



Ready-to-Serve Beverage from Spray Dried Pomegranate Juice Powder

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ABSTRACT

The pomegranate juice is considered as the one of the nature's most powerful antioxidants. Excellent flavour, nutritive value and medicinal properties of pomegranate fruit indicates its good potentiality for processing into value added products. In India and other countries of the world the demand of fruit beverages are increasing regularly due to its nutritional, medicinal and calorific properties. Present investigation was undertaken to develop RTS beverage using spray dried pomegranate juice powder with added sugar and citric acid. Spray dried powder of pomegranate (Cv. Bhagwa) juice obtained with 154°C inlet air temperature, 87.5 mL/h feed flow rate and 37 per cent malto dextrine concentration were used to prepare the RTS premix. For standardization, pomegranate RTS was prepared with various levels of powder quantities (6, 8, 10, 12 and 14 g powder per 100 mL RTS), TSS (12, 13, 14, 15 and 16°Brix) and acidity (control, 0.20, 0.25, 0.30 and 0.35 %). The results of sensory score indicated that the RTS developed using 8 g spray dried pomegranate juice powder per 100 mL RTS having 15°Brix total soluble solids and 0.30 per cent acidity was found to be best among all the levels.

Key Words: Pomegranate, Spray dried powder, Ready-to-Serve, Beverages, Sensory analysis

INTRODUCTION

Pomegranate (*Punica granatum* L.) is one of the oldest known edible fruit crops which belong to the family Punicaceae. Among arid and semiarid fruits of India, pomegranate ranks first in area and production of 1.28 lakh ha and 12.86 lakh tonnes, respectively with productivity of 10.04 t/ha (Anonymous, 2016). Among different varieties of pomegranate cultivated in Maharashtra, Bhagawa and Super Bhagawa varieties become popular because of a glossy red coloured fruit with soft seeds and more acceptable TSS-acidity blends.

Fruit is well known for its medicinal properties due to high level of antioxidant activity and high total phenolic content (Bagci, 2014; Vardin and Yasar,

2012 and Horuz *et al*, 2012). Apart from its demand as fresh fruit and juice, the processed products such as anardana, carbonated drinks, syrup, concentrate, wine, candy, frozen, canned and minimally processed arils are also gaining importance in world trade (Dhumal, 2012; Barman *et al*, 2013 and Dak *et al*, 2014). In spite of numerous health benefits, fresh consumption of pomegranate is still not wide spread due to difficulty in extracting arils from the fruit and staining of hands and it is also a time consuming process. Product diversification in the context of increased pomegranate production is the need of time. Therefore, there is great demand for value added products of pomegranate due to their convenience and unique sensory characteristics.

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Drying of fruit juice produces a stable, easy handling form of the juice powder that reconstitute rapidly to a good quality product resembling the original juice as close as possible (Vikram Simha *et al*, 2012). Juice powders are used mainly as convenience foods and have long storage shelf life at ambient temperatures (Horuz *et al*, 2012 and Muzaffar *et al*, 2016). Spray drying has been adopted to manufacture powders due to its ability to generate a product with precise quality specifications in continuous operation. In India and other countries of the world, the demand of fruit beverages is increasing regularly. This increasing trend is mainly due to the higher content of nutritional, medicinal and calorific properties over the non-fruit based beverages. Ready-to-Serve (RTS) is one of the best and commonly acceptable beverages.

The numerous health benefits and huge production provide a solid basis for the development and utilization of pomegranate as both pharmaceuticals and dietary supplement. Therefore, this is very important to standardize the suitable powder quantity, TSS and acidity for the preparation of RTS with good sensory properties. Thus, present investigation was undertaken to develop pomegranate RTS beverage using spray dried pomegranate juice powder with addition of sugar and citric acid.

MATERIALS AND METHODS

Raw materials

Fresh, well matured, uniform size and coloured pomegranate fruits of Cv. Bhagawa were procured from the local market, Rahuri, Ahmednagar, Maharashtra and used for the experimentation.

Extraction of juice

After weighing, fruits were carefully cut at the equatorial zones with sharp knife to minimize damage to arils. The arils were separated manually and defective and damaged arils were discarded. The juice from arils was extracted manually and filtered through four layered muslin cloth.

Preparation of spray dried powder

Spray dried powder of pomegranate juice was produced at 154°C inlet air temperature, 87.5 mL/h feed flow rate and 37 per cent maltodextrine concentration and used to prepare the RTS premix (Roustapour *et al*, 2012; Vardin and Yasar, 2012; Vikram Simha *et al*, 2012).

Standardization of RTS premix from pomegranate juice powder

Powder obtained by spray drying was used to prepare the RTS premix. The RTS normally contain minimum 10 per cent juice, 10°Brix TSS and 0.3 per cent acidity (Malav *et al*, 2014). The RTS premixes were prepared to maintain these standards. Standardization was carried out in three steps *i.e.* standardization of powder quantity, standardization of TSS level and standardization of acidity level. The RTS was standardized on the basis of sensory scores. The independent and dependent parameters for standardization of RTS premix are as given in Table 1.

Table 1. Independent and dependant parameters for standardization of pomegranate RTS premix.

Independent parameters	Powder quantity (6, 8, 10, 12 and 14 g /100 mL RTS) TSS levels (12, 13, 14, 15 and 16°Brix) Acidity level (Control, 0.20, 0.25, 0.30 and 0.35%)
Dependent parameters	Sensory attributes

Standardization of powder quantity

Pomegranate RTS was prepared with five levels of powder *i.e.* 6, 8, 10, 12 and 14 g powder per 100 mL RTS. Sugar and citric acid was added to adjust the 15°Brix TSS and 0.30 per cent acidity of RTS. Premixes were prepared by mixing the required quantities of powder, sugar and citric acid. Sensory evaluation of RTS was done to obtain optimized quantity of pomegranate juice powder.

Standardization of TSS level

Five RTS premixes were prepared from pomegranate juice powder, sugar and citric acid to

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vary the TSS of RTS from 12 to 16°Brix. The RTS was prepared from these premixes. Pomegranate powder quantity as standardized was kept constant for each treatment. Sugar was added in varying proportion to get the required TSS levels of RTS. Acidity of RTS was adjusted to 0.30 per cent with required quantity of citric acid. Sensory evaluation of RTS was done to obtain best TSS level.

Standardization of acidity level

Five premixes were prepared to adjust the acidity of RTS to 0.20, 0.25, 0.30 and 0.35 per cent with required quantity of citric acid. The control sample was prepared without addition of citric acid. The quantity of pomegranate juice powder and TSS as standardized was used for all the treatments. Sensory evaluation of RTS was done to obtain best acidity level.

Sensory evaluation

The sensory evaluation of pomegranate RTS was carried out by the procedure given by Amerine *et al* (1965) on nine point hedonic scale. The sensory evaluation was performed by a panel of semi trained judges for colour, flavour, taste and overall acceptability.

Statistical analysis

The data obtained on sensory characteristics of the RTS was analyzed to determine the statistical significance of the treatments using method of analysis of variance described by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

Standardization of RTS premix from pomegranate juice powder

The present investigation was an attempt to develop RTS beverage by varying quantity of pomegranate juice powder, TSS and acidity. The premixes were prepared to maintain the RTS standards. The levels of ingredients were finalized on the basis of sensory scores and presented in Table 2 to 7.

Standardization of powder quantity

For standardization of powder quantity, the five premixes were prepared by using different levels of pomegranate juice powder, sugar and citric acid. The ingredients for preparation of RTS premix were finalized by performing several experiments based on a trial-and-error method to maintain the RTS standards i.e. 15°Brix TSS and 0.30 per cent acidity and were given in Table 2. The RTS were prepared by using the premixes, were analyzed for sensory evolution and presented in Table 3.

The data revealed that the sensory scores of RTS varied significantly with increase in the quantity of pomegranate juice powder from 6 to 14 g. The scores for all the sensory parameters were increased up to 8 g powder quantity and afterword decreased. RTS prepared with 8 g pomegranate powder (Tp2) had maximum acceptability (8.33) among the treatments followed by treatment Tp3 (7.50) while minimum acceptability (6.33) was observed in treatment Tp4 and Tp5. Higher sensory score for treatment Tp2 was observed which may be due to the proper blend of sugars and citric acid. Sugars and citric acid had statistically significant effect on sensory parameters of RTS. Thus the acceptable quantity of the pomegranate juice powder was found to be 8 g per 100 mL RTS.

Table 2. Treatment details for standardization of pomegranate juice powder quantity for preparation of RTS premix.

Treatment	Powder quantity (g)	Sugar (g)	Citric acid (mg)
Tp1	6	9.5	255
Tp2	8	8.0	230
Tp3	10	6.5	210
Tp4	12	5.5	190
Tp5	14	4.5	180

Bawne (2000) prepared tamarind RTS from 10, 12 and 14 per cent levels of juice reported that the acceptability of RTS increased significantly with increasing the juice level from 10 to 12 per cent and decreased at 14 per cent.

Table 3. Effect of powder quantity on sensory parameters of pomegranate RTS

Treatment	Col-our	Taste	Flavour	Overall acceptability
Tp1	6.62	7.50	7.87	7.33
Tp2	8.00	8.50	8.50	8.33
Tp3	7.50	7.50	7.50	7.50
Tp4	7.00	6.00	6.00	6.33
Tp5	7.00	6.00	6.00	6.33
SE(m)±	0.087	0.035	0.037	0.045
CD at 5%	0.277	0.113	0.117	0.142
CV (%)	2.077	0.863	0.884	1.079

Standardization of TSS level

The five premixes were prepared by using different concentrations of sugar and citric acid to maintain TSS levels of RTS in between 12 to 16°Brix. The powder quantity of 8 g per 100 mL and acidity of 0.30 per cent was maintained for all prepared RTS. The treatment details for preparation of RTS premixes and their sensory scores with varying TSS levels are presented in Table 4 and 5, respectively.

From Table 5, it was observed that TSS had significant effect on taste, flavour and overall acceptability scores of RTS whereas non-significant effect on colour scores. The sensory scores for pomegranate RTS were increased up to 15°Brix TSS, afterwards sensory scores were decreased with increasing the TSS levels. This may be because of improper TSS-acidity blend with increasing the TSS level. Taste, flavour and overall acceptability scores of pomegranate RTS varied significantly from 5.86 to 8.28, 6.89 to 7.92 and 6.92 to 8.09, respectively with varying levels of TSS whereas colour scores varied non-significantly from 7.73 to 8.06. The treatment Ts4 (15°Brix TSS) received maximum score for colour, taste, flavour and overall acceptability as 8.06, 8.28, 7.92 and 8.09, respectively followed by treatment Ts5 (16°Brix TSS). Thus, the acceptable RTS was prepared with 15°Brix TSS. Similar results were reported by Sandhan *et al* (2009) for carbonated pomegranate

RTS, Akhtar *et al* (2013) for pomegranate juice based drink, Dhumal (2012) for pomegranate RTS and Sree (2012) for sweet orange RTS.

Table 4. Treatment details for standardization of TSS level for preparation of RTS premix

Treat-ment	TSS, °Brix	Powder quantity (g)	Sugar (g)	Citric acid (mg)
Ts1	12	8	4.8	215
Ts2	13	8	5.9	220
Ts3	14	8	7.0	225
Ts4	15	8	8.1	230
Ts5	16	8	9.2	235

Table 5. Effect of TSS levels on sensory parameters of pomegranate RTS.

Treatments	Colour	Taste	Flavour	Overall acceptability
Ts1	7.81	5.86	7.10	6.92
Ts2	7.73	6.36	7.33	7.14
Ts3	7.75	7.00	7.47	7.41
Ts4	8.06	8.28	7.92	8.09
Ts5	8.00	7.50	6.89	7.46
SE(m)±	0.1	0.142	0.040	0.099
CD at 5%	N/A	0.454	0.129	0.317
CV (%)	2.2	3.518	0.950	2.324

Standardization of acidity level

For preparing RTS with varying acidity levels, the powder quantity and sugar quantity were kept constant at 8 and 8.1 g per 100 mL RTS, respectively as per previous results. The quantities of ingredients used for preparing RTS premixes with varying acidity level are as shown in Table 6. The results for sensory score are presented in Table 7.

The data shown in Table 7 depicts that acidity levels had statistically significant effect on the sensory parameters of pomegranate RTS. The score for all the sensory parameters of pomegranate RTS except colour were increased with increased acidity levels up to 0.30 per cent and afterward decreased. At constant powder quantity and TSS level, prepared RTS with lowest acidity content had sweeter taste which was disliked by most of

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the panelist. Higher score for overall acceptability was recorded for treatment Ta3 i.e. for RTS with 0.30 per cent acidity due to proper blend of sugar and citric acid. Thus 0.30 per cent acidity (Ta3) was selected as the optimum acidity level for preparation of pomegranate RTS.

Similar findings were observed by Sandhan *et al* (2009) for carbonated pomegranate RTS, Maheswarlu *et al* (2010) for whey based pomegranate beverage, Sree (2012) for sweet orange RTS, Rejeti (2012) for sapota RTS blended with papaya, pineapple, grape, carrot and beetroot in different proportions

Table 6. Treatment details for standardization of acidity level for preparation of RTS premix.

Treatment	Acidity (%)	Powder quantity (g)	Sugar (g)	Citric acid (mg)
Control	0.12	8	8.1	-
Ta1	0.20	8	8.1	185
Ta2	0.25	8	8.1	205
Ta3	0.30	8	8.1	230
Ta4	0.35	8	8.1	260

Table 7. Effect of acidity levels on sensory parameters of pomegranate RTS.

Treatments	Colour	Taste	Flavour	Overall acceptability
Control	5.50	5.50	6.00	5.67
Ta1	6.90	6.80	6.80	6.83
Ta2	7.50	7.30	7.30	7.37
Ta3	8.20	8.00	7.90	8.03
Ta4	8.40	7.10	7.20	7.57
SE(m)±	0.026	0.041	0.046	0.027
CD at 5%	0.082	0.132	0.147	0.086
CV (%)	0.612	1.035	1.13	0.657

CONCLUSION

It was concluded that sensory properties of pomegranate RTS were significantly influenced by powder quantity, TSS and acidity levels. The acceptable quality RTS can be prepared using 8 g spray dried pomegranate juice powder per 100 mL

by adding sugar and citric acid to maintain 15°Brix total soluble solids and 0.30 per cent acidity, respectively.

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