

Development of Blended RTS (Ready to Serve) Drink from Pomegranate and Plum Fruits

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ABSTRACT

Fruit drinks, known as functional food, are required for a healthy life and diversify the consumer choice. Pomegranate and plum juice could be blended to produce nutritious RTS (ready-to-serve) drinks. The present study was done to develop blended RTS drinks from pomegranate and plum juice. The fruits were blended in 10 varying ratios, totaling 20 percent of the total volume of plum and pomegranate juice with and without kokum water with sugar added to 13-degree brix. The developed product was tested for biochemical and sensory properties. The pH and titratable acidity range were 3.29 to 3.46 and 0.22 to 0.51, respectively. The blend with 20 percent plum juice and 80 percent kokum water had the most antioxidant and ascorbic acid content. The 10:10 percent pomegranate and plum juice blend with 80 percent kokum water was the most acceptable by a sensory panel, with an average score of 8.21 on a 9-point hedonic scale. We concluded that the 10:10 pomegranate and plum juice blend with kokum water RTS drink could be commercialized as nutritious.

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Introduction

Humans have consumed pomegranate as a precious fruit since ancient times. The fruit's name is derived from *pomus* and *granum*, which means seeded and granular apple (Labbe *et al.*, 2016). Afghanistan is known as a country of pomegranates due to its excellent quality and cultivars thrive (Finetto, 2011). Pomegranate fruits contain 48-53 percent arils, 78 percent juice, and 22 percent seed (Dhumal *et al.*, 2014). Improper postharvest management of pomegranate fruits results in high product loss (20-40%), which leads in reducing market cost and consumer acceptability (10-15%) of pomegranate fruits (Dhinesh and Ramasamy, 2016). Fresh pomegranate arils could produce highly valuable beverages (Sahebkar *et al.*, 2017).

Plum (*Prunus domestica*) contains vitamins, minerals, fibers and other phytochemical compounds that promote a healthy life. Few of the 2000 plum varieties have commercial

importance (Birwal *et al.*, 2017). The plum (drinks and canned fruits) processed products are available on the market. The beverage obtained from plum fruit could be the best source of phenolic compounds (Chang *et al.*, 1994). Among all stone fruits, plums are known for their poor volatile compounds (Lozano *et al.*, 2009). Kokum is an Indian native tree scientifically named *Garcinia indica* C. and classified under the Clusiaceae family. Its fruits provide dietary vitamins and minerals (B complex, Ca, K, Mg). It has many health-promoting properties, including maintaining heart rate, hypertension, stroke protection, and prevention of coronary diseases (Milind and Isha, 2013). Total anthocyanin pigment content from kokum rind (Fresh, dry, and sugar rind) varied from 79.93, 85.03, and 7.83 mg/100g in fresh, dry, and sugar rind samples respectively (Vasundhara *et al.*, 2016).

Blending pomegranate and kokum juice in a ratio of 80:20 provided good TSS, acidity, and anthocyanin. This combination scored the highest organoleptic score (Wasker, 2000). The blending of pomegranate juice with coconut water at the ratio of 6.54 percent pomegranate juice and 6.97 percent coconut water was reported best on an organoleptic basis (Chauhan *et al.*, 2008). The fruits like aonla, plum, watermelon, etc., which are individually not utilized for beverage making, could be used to prepare beverages after blending with some other fruits in appropriate proportions (Bidyut *et al.*, 2002). Squash drinks could be prepared by blending plum and orange in ratios of 50:50, with the highest sensory scores value (Joseph and Shukla, 2015).

Soft drinks, mainly used for their quenching nature, are essential to the human diet. It has recently been popularized among people (children, adults, and older people). Substituting fruit juices with synthetic compounds can improve the nutritional and sensory properties of the beverages and fruit drinks consumed during festivals for enjoying the celebration and social gatherings, as well as their health-promoting properties. Blending fruit juices could be an easy and safe way to improve the nutritional properties (vitamins, minerals, and phenolic compounds) and sensory properties (taste, color, aroma) of drinks (De Carvalho *et al.*, 2007). Along with the mentioned advantages, blending fruit juices can conceal undesirable properties.

Pomegranates and plums are the major fruits produced in Afghanistan. Commonly, fresh fruits are supplied to the local market or for export during the harvest season at a low cost. A few processed products of pomegranate and plum fruits are available. Producing processed products from the fruits could prevent postharvest losses and maintain fruit costs during harvesting. This research was carried out to develop a blended RTS drink from pomegranate and plum and find the best ratio of blends with good nutritional properties and high sensory scores.

Methods and Material

Raw Materials

- a) Bhagwa cultivar of pomegranate fruit directly procured from a farmer close to Devanahalli, Bangalore.

- b) Indian fresh plum fruits were procured from a wholesale market, KR Market, Bengaluru. The fruits were checked for their uniformity and color.
- c) Dried Kokum rind (am sol)- Dehydrated kokum shell procured from domestic farmers living in Vanalli village, Uttara Kannada, Karnataka.

Location

The experiment was conducted at the Department of Postharvest Technology, College of Horticulture, University of Horticultural Sciences Campus, GKVK (Post), Bengaluru, India-560065, during 2017-18.

Extraction of juice

Pomegranate arils were separated manually from the washed fruits, and a juice extractor was used to extract fruit juice. The extracted juice was centrifuged at 5000 rpm for 5 minutes to obtain clear juice.

Plum fruits were washed, carefully cut into halves, and manually removed pits. The fruit pulp was extracted using an Electric fruit pulper, and coarse particles were removed by passing through muslin cloth; subsequently, the pulp was treated with 0.1 percent pectinase enzyme and incubated for 2 hours at 45°C in a water bath. Enzyme-treated pulp was filtered through muslin cloth and centrifuged at 5000 rpm for 5 minutes to obtain clear juice.

Kokum extract was prepared by soaking 100 gr of ground dehydrated kokum rind overnight with 500 ml of water. Kokum water is prepared by adding 1.5 percent of kokum extract.

The desired amount of RTS drink was prepared by blending different amounts of pomegranate and plum juice (Table 1). Kokum water was added based on treatment requirements. Irrespective of the treatments, the required amount of sugar was added to the beverage to maintain total soluble solids (TSS) for 13°Brix. The developed beverage was filled in a 0.2-liter capacity glass bottle, which was pre-sterilized. Later, biochemical and sensory attributes of the devoted beverage were tested.

Methods employed for physicochemical assessment

the blended drink's pH was measured using a digital pH meter (model number BP3001). To ensure accurate reading, the beverage temperature was kept stable during sample observations. A visual titration method was performed to determine titratable acidity (%) in blended beverages. The 2, 6-dichlorophenol indophenol sodium salt method was applied to quantify the ascorbic acid content of the developed beverage. (AOAC, 2006). The pH differential method determined the total monomeric anthocyanin content (Giusti and Wrolstad, 2001). FRAP method was performed to quantify the total anthocyanin content of the blended beverage. The nine-point Hedonic scale judged the sensory evaluation (color, odour, taste, body/texture, after taste and overall acceptability) of the developed beverage. The experimental design was performed using Completely Randomized Design (CRD), and results were analyzed based on the design.

Table 1. Treatments details

Treatment/Composition	Pomegranate Juice (%)	Plum Juice (%)	Kokum Water (%)
T ₁	20.00	0.00	80.00
T ₂	15.00	5.00	80.00
T ₃	10.00	10.00	80.00
T ₄	5.00	15.00	80.00
T ₅	0.00	20.00	80.00
T ₆	20.00	0.00	0.00
T ₇	15.00	5.00	0.00
T ₈	10.00	10.00	0.00
T ₉	5.00	15.00	0.00
T ₁₀	0.00	20.00	0.00

Kokum water contains 1.5 percent Kokum extract.

Result and Discussion

Physico-chemical properties of pomegranate, plum, and kokum fruit and juice.

The values for physico-chemical properties of pomegranate, plum, and kokum fruits are presented in Table 2. The obtained data are comparable with those reported by Sandhan and Kushare (2009).

Table 2: Physico-chemical properties of pomegranate and plum fruits/juice and kokum extract

Parameters	Juice/Extracts		
	Pomegranate	Plum	Kokum
TSS (°B)	13.27	10.63	6.9
pH	3.59	3.25	2.62
Acidity (%)	0.83	2.17	5.67
Ascorbic acid (mg 100 ml ⁻¹)	12.08	15.46	227.76
Antioxidants (mg AEAC 100 ml ⁻¹)	56.87	76.22	2161.53
Anthocyanin (mg 100 ml ⁻¹)	14.93	0.32	146.67
Reducing sugars (%)	8.61	5.86	3.57
Total sugars (%)	11.14	8.84	5.91
Moisture content (%)	79.06	88.27	7.97
Length (mm)	76.35	40.77	-
Width (mm)	78.89	40.53	-
Weight (gram)	306.86	57.56	-
Color			
<i>L</i> [*]	50.76	43.14	-
<i>a</i> [*]	42.71	30.52	-
<i>b</i> [*]	37.52	26.54	-

The biochemical composition of the RTS drink is prepared by blending pomegranate and plum juice with and without kokum water

pH

pH of all the treatments was significantly different (Table 3). As plum and kokum extract concentrations increased, the pH value decreased. The acidic nature of plum and kokum might cause variation in the blended beverage's pH and lower the drink's pH. Similar findings were reported by Zaman *et al.* (2016) in pineapple and mango fresh juice blends and Khan *et al.* (2017) in tamarind and plum blended squash.

Table 3: Biochemical composition of pomegranate and plum blended RTS drink

Treatments	pH	Acidity (%)	Ascorbic acid (mg 100 ml ⁻¹)	Antioxidant activity (mg AEAC 100ml ⁻¹)	Anthocyanin (mg 100 ml ⁻¹)
T ₁	3.41 ^c	0.26 ^e	4.90 ^c	34.02 ^c	2.69 ^a
T ₂	3.33 ^{fg}	0.36 ^d	4.93 ^c	35.62 ^{bc}	2.10 ^c
T ₃	3.30 ^{gh}	0.43 ^c	5.20 ^b	36.47 ^b	1.54 ^e
T ₄	3.30 ^{gh}	0.45 ^{bc}	5.22 ^b	36.44 ^b	0.95 ^g
T ₅	3.29 ^h	0.51 ^a	5.53 ^a	38.80 ^a	0.36 ⁱ
T ₆	3.68 ^a	0.22 ^f	2.60 ^g	10.18 ^g	2.44 ^b
T ₇	3.46 ^b	0.29 ^e	2.71 ^f	10.44 ^g	1.80 ^d
T ₈	3.39 ^{cd}	0.38 ^d	2.78 ^{ef}	12.30 ^f	1.09 ^f
T ₉	3.36 ^{de}	0.44 ^{bc}	2.85 ^e	14.20 ^e	0.64 ^h
T ₁₀	3.34 ^{ef}	0.47 ^b	3.01 ^d	16.33 ^d	0.06 ^j
Mean	3.39	0.38	3.97	24.48	1.37
S. Em ±	0.01	0.01	0.03	0.57	0.03
CD @ 5%	0.03	0.03	0.10	1.69	0.08
F-test	*	*	*	*	*

Note: * - Significant at 5 percent level

Similar alphabets in the superscript (column) are not significantly different ($P \geq 0.05$)

Titrateable acidity (%)

Table 3 above shows the acidity of blended RTS drinks. The observation revealed that acidity increased as the amount of plum juice and kokum extract increased. The high amount of organic acid in plum and kokum extract might be a reason for increasing the acidity of blended RTS drinks. These results corroborate the findings of Byanna and Gowda (2013) in developing blended RTS beverages from sweet orange and kokum and Sarkar and Bulu (2017) in Blending Guava Pulp with Pineapple Juice.

Ascorbic acid (mg 100 ml⁻¹)

Significant differences were recorded for the ascorbic acid content of all treatments, as presented in Table 3. Slightly increases in the ascorbic acid content of RTS blended beverages

were recorded in treatments containing higher amounts of plum juice and kokum extract. The finding is supported by the development of blended drinks from orange and pineapple by Islam *et al.* (2014) and Khan *et al.* (2017) in Tamarind and Plum blended Squash.

Antioxidant activity (mg AEAC 100 ml⁻¹)

The antioxidant content of the RTS blended drink is significantly different according to the treatments (Table 3). Maximum antioxidant activity was recorded in T₅ (20% plum juice with 80% kokum water). Treatments containing kokum water recorded higher amounts of antioxidants than those without kokum water. Higher antioxidant activity in kokum and plum juice might be a reason for the increasing antioxidant activity of blended RTS drinks. A similar report was recorded on developing blended carrot and pineapple drinks by Owolade *et al.* (2017).

Anthocyanin (mg 100 ml⁻¹)

The anthocyanin content showed significant differences among treatments (Table 3). The treatments containing kokum water recorded higher anthocyanin content than those with the same concentration of pomegranate and plum juice without kokum water. This might be due to more anthocyanin content in kokum and pomegranate juice. The present finding is supported by the developing of grape juice with kokum by Siddharth and Ajaykumar (2013) and by Pangotra (2016) in developing phalsa blended beverages.

Sensory evaluation of RTS drink prepared by blending pomegranate and plum juice with and without kokum water

Treatment with 80 percent of kokum water and 10 per cent each of pomegranate and plum juice scored higher sensory colour scores than other treatments (Figure 1).

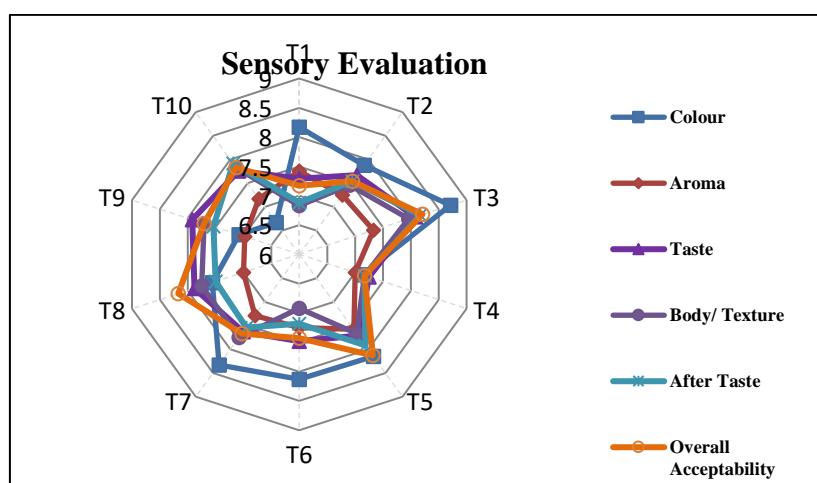


Figure 1. Sensory scores of pomegranates and plum blended RTS drink

This may be due to the optimum concentration of anthocyanin pigment from pomegranate juice and kokum extract, which gave a bright red color to the product. The highest sensory scores were recorded by T₃ (10% pomegranate and 10% plum juice with 80% kokum water) for its taste, aftertaste, and body /texture, which was in the range of “Like very much.” It might be because of the balance between the sourness imparted by plum and kokum and the

sweetness of pomegranate. The characteristic sour and sweet taste might have positively influenced the sensory scores of the panelists. Odor scores were observed highest in the RTS drink prepared with a high level of plum juice (20% plum juice with 80% kokum water). This may be due to numerous volatile compounds in plum and the pungent aroma of kokum, which increase the sensory odor score of blended drinks. The result is supported by the volatile compounds profiling study conducted by Pino and Quijano (2012). The highest sensory score (8.21) was observed for overall acceptability in T₃ (10% pomegranate juice and 10% plum juice with 80% kokum water), which was in the range of "Like very much." This may be due to a combination of all fruits at an optimum level, thereby giving a pleasing taste with good overall acceptability.

Conclusion

Pomegranate and plum blended RTS could be prepared by mixing 10 percent pomegranate juice and 10 percent plum juice with 80 percent kokum water with high sensory scores and good biochemical composition, including ascorbic acid and antioxidant activity. Blending pomegranate and plum juices at a ratio of 10:10 percent with adding 80 percent kokum water is highly recommended for commercialization.

Conflict of Interests: The author(s) declared no conflict of interest.

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