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## Preparation and evaluation of pomegranate jelly and comparative study at different concentration of pectin and sugar

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### Abstract

The present investigation aimed to optimize the formulation of pomegranate jelly using the 'Sendri' variety of pomegranate by evaluating the influence of varying sugar (35% and 45%) and pectin (1.5%, 2.0%, and 2.5%) concentrations on physicochemical, sensory, and economic attributes. The study employed a completely randomized design with six treatment combinations. The physicochemical parameters including total soluble solids (TSS), acidity, pH, and moisture content were analyzed using standard methods, while sensory evaluation was conducted using a 9-point hedonic scale. Results revealed that TSS ranged from 69.8 to 72.8 °Brix, acidity from 0.76% to 0.85%, pH from 2.37 to 2.75, and moisture content from 50.77% to 58.40%. The treatment comprising 45% sugar and 2.0% pectin exhibited superior organoleptic acceptability (score 7.8) with balanced physicochemical properties (Moisture content (53.30%), TSS (71.70Brix), acidity (0.80%) and pH (2.52)) and moderate production cost (Rs. 247 per kg). The findings indicate that optimization of sugar and pectin levels significantly enhances product quality and consumer acceptability.

**Keywords:** Pomegranate jelly, Quality, Overall acceptability, Sensory evaluation, Food processing

### Introduction

Pomegranate (*Punica granatum L.*; Family: *Lythraceae*) is an important fruit crop known for its nutritional, medicinal, and economic value. India is the leading producer (8.07 lakh tones) in the world, with Maharashtra contributing a major share. Due to its high antioxidant content and health benefits, pomegranate is widely utilized for fresh consumption and processed products.

A processed product that has been recently studied is pomegranate jelly. In this case, the percentage of sugar added is smaller than that of jams and marmalades, and addition of jellying agents (pectins, agar, etc.) is necessary for the preparation of jellies, that generally maintain the colour characteristics of the original juice very well. The effect of the pH is essential for pigment stability and the colour of the prepared jellies. Therefore, it has been shown that jellies prepared with juices from sour pomegranates, have better colour and pigment stability than those produced with sweet pomegranates of cultivar 'Mollar' (Melgarejo *et al*, 2000) [4].

In the case of pomegranate juice, it has been shown that both the extraction and clarification process and the pH of the obtained juice (juices added of organic acids to decrease the pH), have marked effects on juice stability. Jelly refers to a product made from fruit juice with a semi-solid or gelatinous consistency (Madrid *et al*, 1994) [3]. The ingredients used in making jellies are: juices and fruit pulp, sweeteners, acids (citric, lactic, tartaric, malic and ascorbic), sulphurous anhydride, benzoic acid or sodium, potassium or calcic benzoate, antifoams, thickeners and natural jellifiers (agar, pectin's, carob gum, alginates and carrageenates, colourings, essences and authorized flavourings) (Codigo *et al.*, 1988) [1].

The food industry uses different types of thickeners and jellifiers, also called hydro soluble gums, hydrocolloids, hydrophilic colloids or simply gums. These products allow some rheological characteristics to be modified and adapted to the taste of the consumer or simply to solve technological manufacturing problems. Processing into value-added products such as jelly enhances shelf life and market value. Jelly is a semi-solid product made from fruit juice, sugar, acid, and gelling agents like pectin.

The quality of jelly depends on the correct balance of these ingredients, particularly sugar and pectin, which influence texture, flavor, and stability.

The present study was conducted with the following objectives:

1. To study physical properties of pomegranate fruit.
2. To standardize the process for preparation of pomegranate jelly.
3. To analyze chemical composition of fruit and jelly.
4. To evaluate organoleptic/sensory properties of jelly.

## Material and Methods

1. **Raw material:** Fresh, mature, and defect-free fruits of the 'Sendri' variety of pomegranate were procured from

the local market. Analytical-grade chemicals including pectin, citric acid, ethanol, potassium hydroxide, and phenolphthalein were utilized.

2. **Extraction of juice:** The fruits were washed, manually peeled, and arils were separated. The arils were homogenized using a mechanical grinder and filtered through muslin cloth to obtain clarified juice.
3. **Preparation of pomegranate jelly:** The extracted juice was heated with sugar. Pectin was added during boiling, and the mixture was cooked until Total Soluble Solids (TSS) reached 68-78°Brix. The jelly was cooled, cut, and packaged under hygienic conditions.

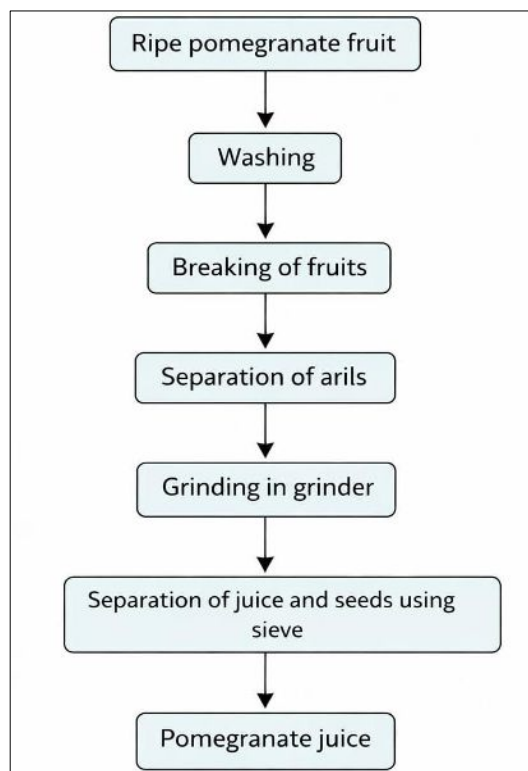


**Fig 1:** Flow chart for extraction of juice

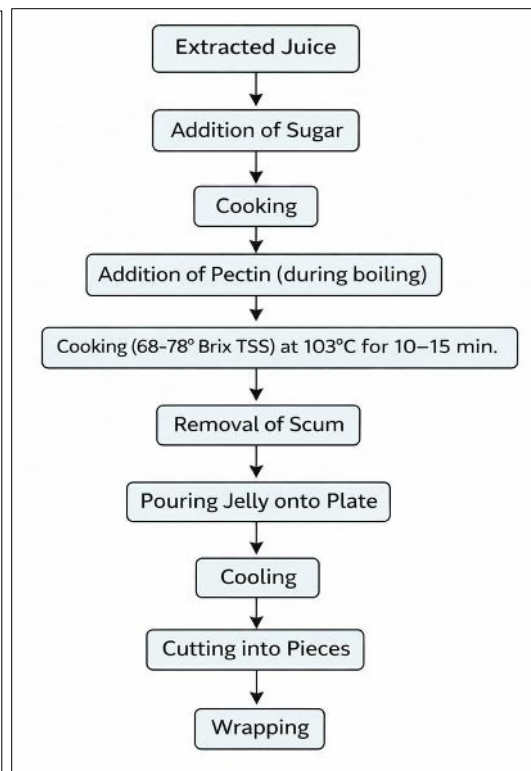


**Fig 2:** Flow chart for preparation of jelly from juice

## 4. Design of experiment

A completely randomized design (CRD) was adopted with six treatment combinations.

|                       |   |                                                                 |
|-----------------------|---|-----------------------------------------------------------------|
| Number of Treatment   | : | 6                                                               |
| Treatment combination | : | i) Sugar - 35%, 45%.<br>ii) Pectin - 1.5 g and 2.0 g and 2.5 g. |

**Table 1:** Design of Experiment

| Varieties | Treatment      | Treatment combination   |
|-----------|----------------|-------------------------|
| Sendri    | T <sub>1</sub> | Sugar 35% +Pectin 1.5 g |
|           | T <sub>2</sub> | Sugar 45% +Pectin 1.5 g |
|           | T <sub>3</sub> | Sugar 35% +Pectin 2.0 g |
|           | T <sub>4</sub> | Sugar 45% +Pectin 2.0 g |
|           | T <sub>5</sub> | Sugar 35% +Pectin 2.5 g |
|           | T <sub>6</sub> | Sugar 45% +Pectin 2.5 g |

**5. Physico-chemical characteristics:** Physical properties such as weight, size, volume of fruit, Diameter, specific gravity, juice percentage, and consumable matter were measured (Stroshine 1988, Shahnawaz and Sheikh, 2011) <sup>[8]</sup>.

<sup>[6]</sup>. Chemical analysis included TSS, acidity, pH, and moisture content.

Moisture content was determined using hot air oven method (AOAC, 1990). TSS was measured using a digital refractometer. Titratable acidity was determined via titration using 0.1 N NaOH and expressed as percentage of malic acid. pH was measured using a calibrated digital pH meter (Siddappa *et al.*, 1986 and Kotecha *et al.*, 2002) <sup>[7, 2]</sup>.

## 6. Sensory/Organoleptic evaluation of pomegranate jelly:

Sensory evaluation of Sendri variety of pomegranate was conducted using a 9-point hedonic scale with 15 judges (Ranganna, 2003) <sup>[7]</sup>. At a time, all samples were kept for organoleptic evaluation. The average scores of judges with different quality characteristics viz. colour, texture, taste and overall acceptability were recorded.

The overall acceptability of the pomegranate jelly was based on the mean scores obtained from all sensory characters. The characters with mean scores of 6 or above out of 9 were considered acceptable.

**Fig 3:** Sendri variety of Pomegranate**Fig 4:** Fresh pomegranate arils**Fig 5:** Boiling of pomegranate Juice**Fig 6:** Jelly being prepared From Pomegranate Juice**Fig 7:** Experimental work in progress**Fig 8:** Samples for sensory evaluation

## Results and Discussion

The present investigation was undertaken to standardize the methodology of juice extraction, physical properties of pomegranate and to standardize procedure for pomegranate jelly making, to evaluate the jelly for chemical and sensory properties.

### 1. Physical properties of fresh pomegranate fruit:

The fresh pomegranate fruits were evaluated for various physical properties. Data shows that average weight of “Sendri” variety of pomegranate fruit was 578.60 g. The per cent consumable matter and per cent peel of “Sendri” fruit was recorded as 56.78% and 42.34%. The percent seed of pomegranate fruit of “Sendri” variety is 26.89%. The percent juice of pomegranate fruit of “Sendri” variety is 43.67%.

**Table 2:** Weight of fruit, Diameter of fruit, Percent consumable matter, Percent of peels, Percent of seeds and Percent juice:

| Treatment      | Wt. of fruit (gm) | Diameter of fruit (cm) | Consumable matter (%) | Peels (%) | Seed (%) | Percent juice (%) |
|----------------|-------------------|------------------------|-----------------------|-----------|----------|-------------------|
| T <sub>1</sub> | 770.09            | 7.8                    | 55.07                 | 43.75     | 28.04    | 41.55             |
| T <sub>2</sub> | 758.43            | 7.9                    | 54.46                 | 42.91     | 29.49    | 42.19             |
| T <sub>3</sub> | 704.61            | 8.1                    | 56.63                 | 43.36     | 26.29    | 41.86             |
| T <sub>4</sub> | 576.2             | 7.6                    | 58.48                 | 40.6      | 27.15    | 46.85             |
| T <sub>5</sub> | 364.64            | 7.1                    | 60.01                 | 41.62     | 31.06    | 45.81             |
| T <sub>6</sub> | 297.67            | 6.7                    | 56.07                 | 41.82     | 19.34    | 43.77             |

## 2. Chemical composition of fresh pomegranate fruits:

Chemical composition of fresh pomegranate fruits which was obtained from pomegranate juice. Average Total

Soluble Solids (TSS), acidity, pH of pomegranate fruit was recorded as 15.5°Brix, 0.84%, 2.79 sample respectively for “Sendri” variety.

**Table 3:** Total Soluble Solids (TSS) (°Brix), Acidity and pH value

| Treatment | TSS (°Brix) | Acidity (%) | pH   |
|-----------|-------------|-------------|------|
| T1        | 14.7        | 0.92        | 2.85 |
| T2        | 14.7        | 0.83        | 2.81 |
| T3        | 15.8        | 0.88        | 2.83 |
| T4        | 15.5        | 0.79        | 2.7  |
| T5        | 16.7        | 0.86        | 2.79 |
| T6        | 15.7        | 0.78        | 2.8  |

## 3. Chemical composition of fresh pomegranate jelly and Cost of production of pomegranate jelly:

The chemical composition of fresh pomegranate jelly prepared by changing sugar percentage (35% and 45%) and pectin (1.5%, 2.0% and 2.5%) level.

**Table 4;** Total Soluble Solids (TSS) (°Brix), Acidity, pH value, Moisture Content (%) and Effect of treatments on cost of production (Rs / kg) of pomegranate jelly

| Treatment | TSS (°Brix) | Acidity (%) | pH   | Moisture (%) | Cost of production (Rs/kg) |
|-----------|-------------|-------------|------|--------------|----------------------------|
| T1        | 72.0        | 0.83        | 2.40 | 53.70        | 250.45                     |
| T2        | 71.7        | 0.78        | 2.48 | 58.40        | 251.34                     |
| T3        | 72.0        | 0.85        | 2.37 | 52.01        | 247.10                     |
| T4        | 72.1        | 0.76        | 2.70 | 51.72        | 248.52                     |
| T5        | 69.8        | 0.80        | 2.44 | 50.77        | 257.08                     |
| T6        | 72.8        | 0.79        | 2.75 | 53.20        | 259.03                     |

The total soluble solids (TSS) of pomegranate jelly ranged from 69.8 to 72.8°Brix across different treatments, indicating that variations in sugar and pectin levels had little influence on the TSS content of finished product. Acidity varied between 0.76% and 0.85%, showing minimal effect of treatment variations on acidity. The pH of jelly samples ranged from 2.37 to 2.75 and moisture content ranged from 50.77% to 58.40%.

The cost of production of pomegranate jelly from the “Sendri” variety varied between Rs. 247 and Rs. 259 per kg, with the highest cost associated with jelly prepared using 45% sugar and 2.5% pectin, and the lowest with 35% sugar and 2.0% pectin. The total production cost included expenses for fruits, pectin, sugar, citric acid, and fuel, with pectin contributing the highest cost followed by fruits, while

sugar, citric acid, and fuel had comparatively lower contributions. The cost of raw materials was estimated at Rs. 80 per kg for fruits, Rs. 500 per 100 g for pectin, and Rs. 42 per kg for sugar. Overall, the production cost translated to approximately Rs. 57 to Rs. 62 per 100 g of jelly.

## 4. Sensory evaluation of fresh pomegranate jelly:

The sensory evaluation of pomegranate jelly was carried out by 15 semi-trained judges. The sensory evaluation was done according to 9 point hedonic scale. The 9 point hedonic scale shows the performance of different samples. The results recorded in Table 5. are obtained by calculating average points given by 15 judges for different properties like colour, taste, flavor, texture and appearance.

**Table 5;** Sensory evaluation of fresh pomegranate jelly

| Sample         | Colour | Taste | Flavor | Texture | Appearance | Overall acceptability |
|----------------|--------|-------|--------|---------|------------|-----------------------|
| T <sub>1</sub> | 6.2    | 5.93  | 6.4    | 6.4     | 5.7        | 6.66                  |
| T <sub>2</sub> | 6.3    | 6.33  | 6.6    | 6.8     | 6.2        | 7.2                   |
| T <sub>3</sub> | 6.53   | 6.86  | 6.4    | 6.6     | 6.3        | 7.06                  |
| T <sub>4</sub> | 7.33   | 6.86  | 6.86   | 6.9     | 6.7        | 7.8                   |
| T <sub>5</sub> | 6.06   | 6.4   | 6.2    | 6.8     | 6.2        | 7                     |
| T <sub>6</sub> | 6.6    | 6.73  | 6.66   | 7.06    | 6.4        | 7.2                   |
| Mean           | 6.50   | 6.51  | 6.52   | 6.76    | 6.25       | 7.15                  |

It was found from the present investigation that the overall acceptability of pomegranate jelly increased by increasing the quantity of pectin as per quantity of sugar or decreasing the quantity of sugar as decreasing quantity of pectin for preparation of products. The comparative evaluation of pomegranate jelly revealed that jelly prepared with 45% sugar and 2.0% pectin were highly acceptable followed by jelly with 45% sugar and 1.5% pectin. Acceptability of pomegranate jelly decreased with increasing percentage of sugar and decreasing quantity of pectin.

## Conclusion

The study concluded that pomegranate juice extracted from arils of the “Sendri” variety contains 14.7-16.7°Brix TSS, with an average titratable acidity of 0.84% in fresh fruit. Jelly prepared from this variety showed that the best quality sample, made with 45% sugar and 2.0% pectin, had a moisture content of 51.72%, while the maximum TSS (72.8°Brix) was observed in jelly with 45% sugar and 2.5% pectin. The highest acidity (0.85%) was recorded in jelly prepared with 35% sugar and 2.0% pectin. Sensory

evaluation indicated that jelly made with 45% sugar and 2.0% pectin achieved the highest overall acceptability score (7.8). Economically, the cost of producing this best-quality jelly was estimated at Rs. 249 per kg, making it both acceptable in quality and feasible for production.

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