



Physicochemical Analysis of Pomegranate of Gilgit Baltistan, Pakistan

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Abstract: Juice can be considered as an important and functional ingredient in food products. The aim of current study was to screen and compare the physico-chemical properties of some indigenous species of pomegranate in Gilgit-Baltistan (GB) Pakistan. Fruits were collected from three tehsil regions of GB i.e. Bagrote, Jalalabad and Heramosh valleys. The fruits were washed, peeled off and arils were separated. Fresh juice was prepared from the arils and physico-chemical properties were evaluated. The pH of juice was found in the range of 2.4 (Sour, Jutial Gilgit) to 3.9 (sweet, Jalalabad). Comparative to other areas, pomegranate species of the Jutial exhibited higher total soluble solids (TSS) as 11.5 (sour) 14.5 (sweet) 14.2 (doom). The proximate reducing sugar analysis showed the higher content of reducing sugars in Sweet >Doom >Sour varieties. Lowest average ash and moisture content was observed in sour and higher was determined in sweet varieties.

Keywords: Physico-Chemical, Gilgit-Baltistan (GB), Pomegranate, Nutrients, Juice, Tehsil, TSS

1. Introduction

Pomegranate (*Punicagranatum* L.) belongs to the Punicaceae family (Hardeet *al.*, 1970). It is one of the important and commercial horticultural fruits which is generally very well adapted to the Mediterranean climate (Biale, 1981). It has been cultivated extensively in Iran, India and some parts in the U.S.A (California), China, Japan and Russia. Pomegranate fruits are consumed fresh or processed as juice, jellies and syrup for industrial production (Hodgson, 1917). Different parts of its tree (leaves, fruits and barks) have been used traditionally for their medicinal properties and for other purposes such as in tanning (Rania and Ne'jib, 2007).

Historical evidence reveals that its primary origin is in Iran where it has been grown in every area, both coastal and mountainous areas. It has now been spread to all other regions

of the world (Kumar, 1990). Turkey was analyzed for the chemical components, some of which was found for nutritional and health. Four samples were found to contain glucose syrup one of which was found to have very high amount of hydroxymethylfurfural (152498 mg/kg). Twelve pomegranate (*Punica granatum* L.) cultivars obtained from different growing regions of Iran were analyzed for their physical and chemical properties. These properties included fruit fresh weight, volume and density, peel thickness, soluble solids (TSS), titratable acidity (TA), EC, pH, vitamin C, ellagic acid content of juice and peel, total antioxidant activity of peel and juice and etc. Fruit weight ranged from 103.38 to 505.00 g and fruit volume from 99.41 to 547.88 cm. Similarly, average fruit density ranged 0.91 g.cm G3 to 1.04 g.cm G3 and peel thickness of the fruit was recorded from 1.60 to 6.01 mm. Reducing sugars (Vahid *et al.*, 2009).

Different parts of its tree (leaves, fruits and bark skin) have

been used traditionally for their medicinal properties and for other purposes such as in tanning (Rania *et al.*, 2007). The edible part of the fruit contains considerable amounts of acids, sugars, vitamins, polysaccharides, polyphenols and important minerals. (Gil, *et al.*, 2000). The pomegranate fruit is widely considered as a "healthy" fruit due to its biological actions, most of them attributed to its phenolic content (Lansky and Newman, 2007). Studies about pomegranate polyphenols have shown prevention of cardiovascular, cancer diseases and neurological damage in humans (Aviram *et al.*, 2002).

2. Materials and Methods

2.1. Study Area

The present study was conducted in the Department of Agriculture and Food Technology, Karakorum International University Gilgit. The present study was carried out during 2010 growing season pomegranate trees grown in different areas of three districts of Gilgit Baltistan. All treatments were carried out in first week of September to last week of October.

2.2. Collection of Sample

Thirty normal size pomegranates were obtained from mature fruits growing in Bagrote, Jalal Abad and Heramoshvallies of district Gilgit. Commercially ripe fresh fruits were harvested during September and October from different mature trees randomly selected to represent the population of the plantation. The fruits were harvested at commercially maturity stage and transported to the Food Technology Laboratory of Karakorum International University Gilgit.

2.3. Separation of Seeds

Fruits were cleaned and washed to remove all foreign matters such as dust, then peeling was done manually by knife and grains or aerals were separated by hands.

2.4. Juice Extraction and Filtration

The pulp was extracted from the seeds of pomegranate varieties. Electric blender of good quality was used to crush seeds. Extracted juice was filtered by means of muslin cloths to separate juice from the pulp, fiber and seed particles.

2.5. Analysis of Physico Chemical Parameters of Pomegranate Juice

Following chemical parameters of juice of different pomegranate varieties was measured.

PH:

The pH values of samples were measured by using pH meter (Inolab) according to AOAC (1990) method No.981-12.

Principle:

The basic principle of electrometric pH meter is determination of the activity of hydrogen ions by potentiometer measurement using a standard hydrogen electrode and reference electrode. The glass electrode is

commonly used. The pH value of an aqueous solution is defined by the equation:

$$\text{pH} = -\log_{10} \text{AH}^+$$

Where, AH^+ = the activity of hydrogen ions in the solution in g-moles/l. The electromotive force (emf) produced in the glass electrode system varies linearly with pH. This linear relationship is described by plotting the measured emf against the pH of different buffers. Sample pH was determined by extrapolation.

2.6. Materials

PH meter, conical flask, Balance, Funnel, Shaker, Distilled water, soft tissue paper, Samples, Buffer Solutions (pH 4.0, 10.0 and pH 7.0.)

2.7. Procedure

The pH meter is standardized with standard buffers of pH 4, and 7 respectively. Before taking each reading electrode is washed with distilled water and then dried with soft tissue paper. The electrode is simply dipped in sample till the pH meter gives final reading that is considered being the pH value of sample.

2.8. Total Soluble Solids

Total soluble solids content expressed as Brix was determined by using refracto meter, (Atago 3810-Japan) as described by AOAC (1984) at temperature (20 C). Refractometer, Distilled water, Spatula, Soft tissue paper and Samples were used. Refractometer gives rapid and accurate ratio of TSS present in sample. TSS is expressed in terms of Brix. The representative sample is placed on dry refractometer prism and refractometer is calibrated and readings were taken directly. Refractometer prism is washed with distilled water and dried with soft tissue paper after each reading.

2.9. Total Titratable Acidity

Total titratable acidity of samples was determined by following standard AOAC (1984) method by titrating against strong alkali solution. Burette stand, 50ml Burette, Conical flasks, volumetric flasks, Filter cloth, Distilled water, Funnel, Graduated cylinder, 10-ml sample were used. NaOH (0.1 N) 2-g pellets of NaOH are dissolved in 1000 ml distilled water, The resulting solution will be 0.1 N NaOH normal solution (Base) were used during analysis. 0.1g phenolphthaleine is dissolved in 50ml distilled water and 50ml alcohol to prepare Phenolphthaleine indicator. 5g sample is taken in volumetric flask and the volume is made with distilled water up to 100ml. Filter the sample if needed. The diluted sample (10ml) is taken in a conical flask and 2-3 drops of phenolphthaleine indicator and titrated against 0.1N NaOH solution which is filled in a burette. Continue titration till the solution persists pink color. Appearance of pink color is the end point and the color is persisted for 15-20 seconds. Finally the ml of 0.1N NaOH used is recorded for all the samples and acidity is calculated by

using the following formula,

$$\text{Acidity} = F \times T \times 0.1N \text{ NaOH} \times 100 \times 100 / L \times M$$

Where, F is factor of acid (citric acid) which is equal to 0.0064.

2.10. Reducing Sugars

AOAC (1984) recommends following procedure for the determination of reducing sugars present in samples. 50ml Burette, Stand, conical flask, volumetric flask, distilled water, filter cloth, 100ml-graduated cylinder, test tube holder, funnel, and 5g sample was used. Fehling Solution A: 34g $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ is dissolved in 500ml of distilled water. Fehling solution B: 173g Sodium Potassium Tartrate and 50g of NaOH is dissolved in 500ml distilled water and as Indicator: Methylene Blue. Fruit grounded sample (5g) is taken and diluted up to 100ml with distilled water. The burette is filled with this solution. 5ml fehling A and 5ml fehling B with 10ml of distilled water is taken in conical flask and boiled, On boiling it was titrated against the sample solution from the burette till color changes to dark brown or red. 2-3 drops of methylene blue is added as indicator till dark brown or red color persisted. The ml of sample is then recorded and reducing sugar percentage is calculated by using the following formula.

$$\text{Xml of sample solution} = 0.05\text{g of reducing sugar}$$

$$100\text{ml of sample solution contains} = 100 \times 0.05 / \text{Xml} = \text{Yg of reducing sugar}$$

This 100ml of sample solution was prepared from 5g sample
So,

$$5\text{g sample contains} = \text{Yg of reducing sugar}$$

$$\% \text{ Reducing sugar in sample} = \text{Yg} \times 100 / 5$$

2.11. Ash Content

Ash is the inorganic residue remaining after the complete oxidation of organic matter in foodstuff. AOAC (1990) recommends following procedure for determination of ash content. Balance precision, china dishes, electrical muffle furnace, oven, spatula, desiccator, test tube holder, and 10-g sample was used during chemical analysis of samples. China dishes were taken and weighted properly and weight is noted down. 10-gm of sample is added in china dish. Then charred the sample or dry in oven at 70°C for 2-4 hours. In temperature up to 100°C and left it for 24 hours. After 24 hours dry matter is obtained. The sample must be dried in oven till it gives constant weight of sample. After drying the sample 1-gm dry sample is taken in china dish and incinerated in muffle furnace at 550°C for 12-18 hours. Turn off the muffle furnace after the required time and wait till the temperature inside furnace dropped to at least 250°C . Door of muffle furnace is opened carefully to avoid losing ash that may be fluffy. Ash obtained is transferred in desiccator for cooling. After cooling ash is

weighted and calculated on the basis of following formula:

$$\% \text{ Ash} = \frac{\text{Initial Weight} - \text{Final weight}}{\text{Initial weight}} \times 100$$

2.12. Moisture Content

Sample was dried in the oven provided with opening for ventilation and maintained at 130°C for 60 minutes. The loss in sample weight is expressed as percentage moisture. China dish, Desiccators, Silica granules, Rubber gloves were used. Perten laboratory mill 3100, Analytical Balance, Accuracy $\pm 0.0001\text{g}$, Hot air oven was used. Clean moisture dishes were taken and dried in oven at 130°C for 30 minutes. Moisture dishes were taken out and placed in desiccators and weighed soon after they reach at room temperature. 10g of well-mixed sample was added to the each moisture dish and recorded the weight. Removed from scale and covered with lid.

Placed the moisture dish in oven uncovered for 60 minutes (60 minutes dry period Begin when oven temperature is usually 130°C . Afterward removed the sample from oven and covered with lid. Place the sample in desiccators for cooling. Gloves were used for sample transfer room oven to the desiccators.

Weighted the sample till after reached at room temperature.

$$\% \text{ moisture} = \frac{\text{wt of original sample} - \text{wt of dried sample}}{\text{Wt of original sample}} \times 100$$

3. Result

3.1. Physico Chemical Analysis of Pomegranate

Table 1. Total Soluble Solid Of Pomegranate.

Varieties	Jalalabad	Bagrote	Jutal	Mean
Sour	11	11	11.5	11.1
Sweet	14	14	14.5	14.1
Doom	14.1	14.1	14.2	14.1

3.2. Above Readings Is Mean of Three Replication

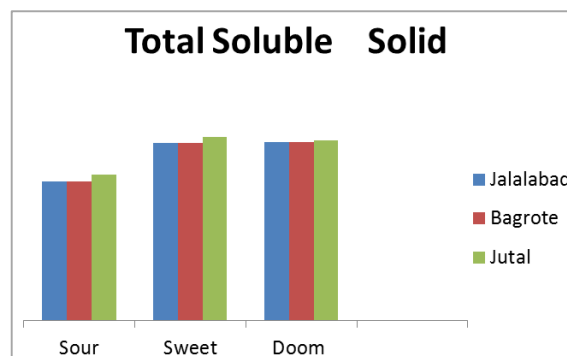


Figure 1. Total Soluble Solid of Pomegranate.

Table 2. pH of pomegranate.

Varieties	Jalalabad	Bagrote	Jutal	Mean
Sour	2.5	2.6	2.4	2.5
Sweet	3.9	3.6	3.86	3.78
Doom	3.2	3.2	3.1	3.1

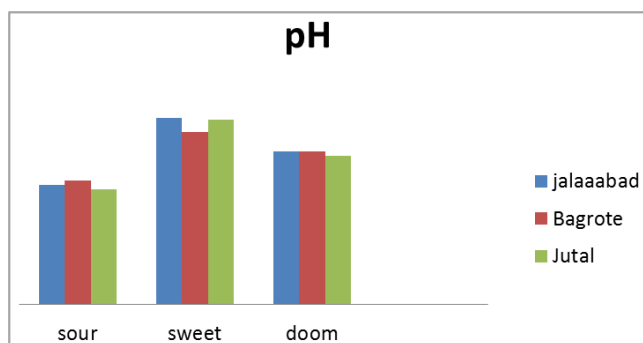


Figure 2. pH of pomegranate.

Table 3. Titratable Acidity in pomegranate.

Varieties	Jalalabad	Bagrote	Jutal	Mean
Sour	0.867	0.879	0.885	0.876
Sweet	0.362	0.382	0.399	0.381
Doom	0.645	0.654	0.665	0.654

3.3. Above Readings Is Mean of Three Replication

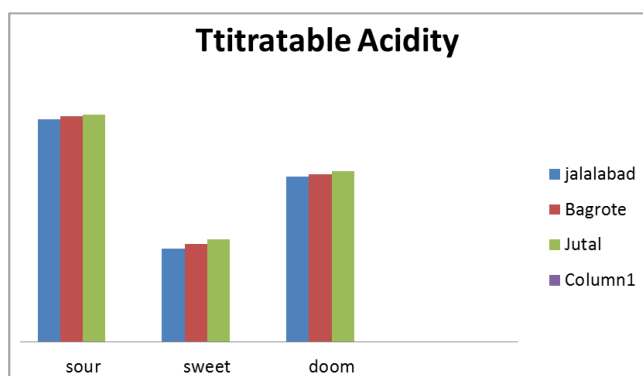


Figure 3. Titratable Acidity in pomegranate.

Table 4. Reducing sugar in Pomegranate Fruit.

Varieties	Jalalabad	Bagrote	Jutal	Mean
Sour	07.00	7.18	7.27	7.15
Sweet	11.99	12.25	12.65	12.29
Doom	10.05	10.08	10.2	10.11

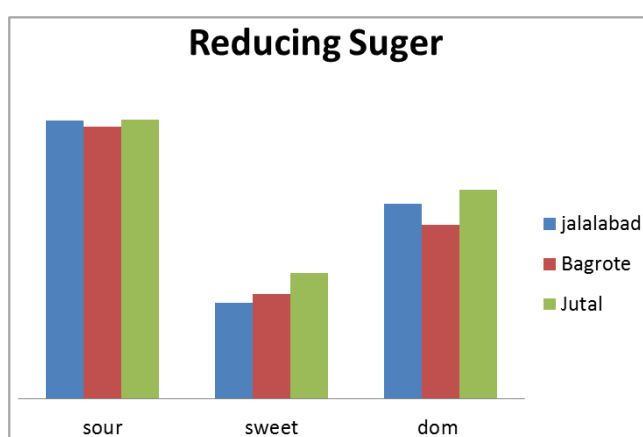


Figure 4. Reducing sugar in pomegranate fruit.

Table 5. Moisture in Pomegranate Fruit.

Varieties	Jalalabad	Bagrote	Jutal	Mean
Sour	73.82	72.24	73.1	73.05
Sweet	77.5	76.3	77.2	77
Doom	75.3	74.6	74.2	74.83

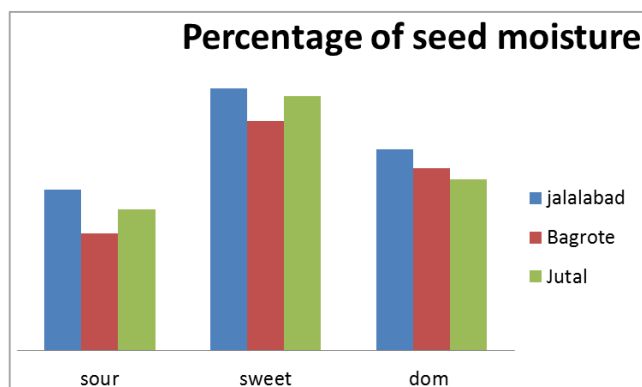


Figure 5. Percentage of seed moisture in pomegranate.

Table 6. Percentage of seed Ash in pomegranate.

varieties	Jalalabad	Bagrote	Jutal	Mean
sour	0.59	0.56	0.52	0.556
sweet	0.64	0.6	0.69	0.64
Doom	0.55	0.59	0.55	0.56

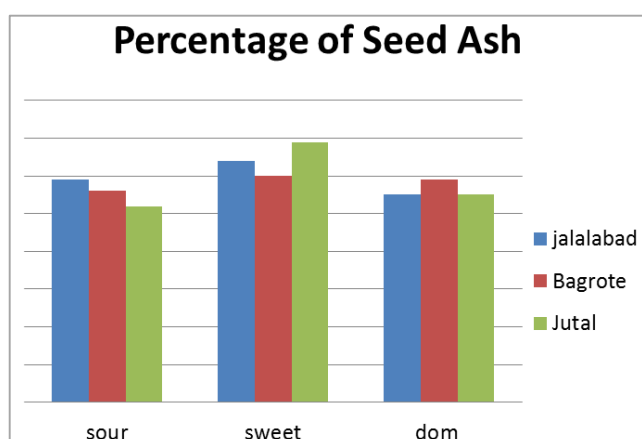


Figure 6. Percentage of seed ash in pomegranate.

4. Discussion

4.1. Physico Chemical Analysis of Pomegranate

The chemical composition of fruit differs depending on the cultivar, growing region, climate, maturity, cultural practice and storage conditions (Melgarejo *et al.*, 2000; Nanda *et al.*, 2001; Barzegar *et al.*, 2004; Miguel *et al.*, 2004b; Fadavi *et al.*, 2005).

The results for total soluble solids, pH, titratable acidity, and maturity index of the pomegranate from the different Localities.

Total soluble solids%: In Jalalabad valley the highest total soluble solids content in 14 °Brix (Sweet), 14.1°Brix (Doom), 11.0°Brix (Sour). In Bagrote valley the highest total soluble solids content in 14.00°Brix (Sweet), 14.1°Brix (Doom), 11.0

°Brix (Sour). In Jutal valley the highest total soluble solids content in 14.5 °Brix (Sweet), 14.2 °Brix (Doom), and 11.5°Brix (Sour). Over all the Total soluble solid is high in Jutal because due to the clay soil as shown in Table 1. While our results were in agreement with values (10–16.5 °Brix) reported by (Fadavi *et al.*, 2005).

The total soluble solids observed in the present study were found to be in typical range as reported by other researchers (Radunić, Mira, *et al.* 2015).

Acidity%:

Data in Table 3 show that, pomegranate cultivars Titratable Acidity % in Jalalabad valley the highest are 0.36% (sweet), 0.64 % (Doom), 0.86 % (Sour). Acidity % in Bagrote valley is highest 0.382%in (sweet), 0.654% in (Doom), and 0.87% in (Sour). Acidity % in Jutal valley is highest 0.399% in (sweet), 0.665% in (Doom), and 0.885% in (Sour).

The minimum acidity of pomegranate juice is 0.35% which was reported by (Mustafa Ozgen *et al.*, 2008).The titratable acidity content varied from 0.33, similar results were also reported by Fadavi *et al.* (2005).

According to (Melgarejo, 1993), the predominant acid of this fruit is malic acid. In studies carried out with the Mollar variety quantities of malic and citric acid. The content of malic acid ranged between 0.143% and 0.249% and the citric acid between 0.147% and 0.4 % (Sharms *et al.*, 1997).

Reducing sugar: Data in Table 4: show that, in Jalalabad pomegranate juice reducing sugar content are 11.99% (sweet), 10.05 % (Doom), 7.7 % (Sour) and, in Bagrote pomegranate cultivars reducing sugar content are 12.25 % (sweet), 10.08 % (Doom), 7.18 % (Sour).In Jutal pomegranate cultivars reducing sugar content are 12.65 % (sweet), 10.20% (Doom), 7.27 % (Sour).

Reducing sugar ranged 13.89 % this finding is (Al-Kahtani and Saxena *et al.*, 1987)

Our results are in agreement with findings of a study carried out in Egypt (I.E. Abd El-Rhman, 2010).

pH: Data in Table.2 show that, in Jalalabad pomegranate cultivars pH are 3.92 in (sweet), 3.2 in (Doom), and 2.5 in (Sour). In Bagrote pomegranate cultivars pH are 3.68 in (sweet), 3.22 in (Doom), 2.6 in (Sour). InJutal pomegranate cultivars pH are 3.86 in (sweet), 3.11 in (Doom), and 2.45 in (Sour).

The pH ranged from 2.75 to 4.14, the findings of this research are more than average (3.34) reported by Mustafa *et al.*, 2008.

The pH values ranged between 3.16 and 4.09 the pH values obtained in the current study are greater than those reported by Cam *et al.* (2009) on pomegranate cultivars grown in Turkey.

The pH range (2.75–4.14) is appeared as representative range as reported in different studies and the pH values recorded in the current study were also observed in the same range (Radunić, Mira, *et al.* 2015).

4.2. Physical Analysis of Pomegranate Fruit

Seed Ash%:

Data in Table 9: show that, in Jalalabad pomegranate cultivars seed Ash % are 0.64% in (sweet), 0.55 % in (Doom),

and 0.59% in (Sour). In Bagrote pomegranate cultivars seed Ash % are 0.60 % in (sweet), 0.59% in (Doom), and 0.56% in (Sour). In Jutal pomegranate cultivars seed Ash % are 0.69% in (sweet), 0.55% in (Doom), and 0.52% in (Sour).

Seed moisture %:

Table 5: the seed moisture percentage of the studied in Jalalabad pomegranate cultivars 77.5% (Sweet), 75.3% (Doom), 73.82% (Sour).The seed moisture percentage of the studied in Bagrote pomegranate cultivars 76.3% (Sweet), 74.6% (Doom), 72.24% (Sour). The seed moisture percentage in Jutal pomegranate varieties 77.2% (Sweet), 74.3% (Doom) and 73.11% (Sour).

The moisture content of the seeds up to 81.53% was reported by Amit Parasahar (2010). Evaluations of various important components are also reported previously to highlight the important pomegranate characteristics (Zaouay Faten *et al.*, 2012).

5. Conclusion

In the current study physico-chemical properties of pomegranate indigenous to Gilgit-baltistan were determined. The evaluated parameter includes the total soluble solids, acidity, reducing sugars, pH, seed ash and seed moisture. Significant difference in the physicochemical properties such as sugars, soluble solids, seed moisture and pH were observed. This study is important in exploring the knowledge of indigenous plants and also increases the information of pomegranate associated properties in specified study region. Whereas, difference in physico-chemical characteristics of the indigenous pomegranate varieties showing the genetically diversity among the species of this Gilgit-baltistan (Rajasekar, Dhivyalakshmi, *et al.* 2102). Furthermore, such studies may help to the producers or companies for selecting the better indigenous pomegranate specie having better composition.

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