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Physico-chemical properties of pomegranate fruits

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Abstract
Physical and chemical properties of pomegranate fruits are very important for understanding the behavior necessary for design of equipment's for harvesting, processing, transportation, separating and packing. Keeping all above facts in view, the present project work was planned to study the physical properties of pomegranate and to study the chemical properties of pomegranate In this study some physical and chemical properties such as moisture content, weight of fruit, weight of arils and peels, volume of fruit, specific gravity, overall dimensions (length, width and thickness), consumable matter, inconsumable matter and TSS, pH value, ascorbic acid etc. was determined and results are78.95%, 204.54 gm, 129.12 gm and 75.38 gm, 242 cm^3, 0.844 gm/cm^3,7.07 cm, 6.79 cm and 6.75 cm, 63.10%, 38.8%, 15.7° Brix, 3.5, 11.4 respectively.

Keywords: Bhagava, properties, equipment, etc.

Introduction
Pomegranate (*Punica granatum* L.) is a highly valued crop and is widely cultivated in Mediterranean countries. It is an ideal crop for the sustainability of small holdings, as pomegranate is well suited to the topography and agro-climate of arid and semi-arid regions. Pomegranate fruits are important for human health because of their high antioxidant capacity and a high polyphenols and anthocyanin content (Gil *et al*, 2000) [7]. Pomegranate fruit maturity status is commonly assessed based on external (skin) colour, aril and juice colour and acidity of juice. Whenever the consumers and manufacturers accept it or not will depend on the combination of several quality attributes that are related to the physico-chemical properties including size, skin color, sugar content, acidity and flavor.

Due to ever-increasing consumers' awareness of the direct relationship between food intake and good health - especially from natural foods such as fruits and vegetables - the demand for this fruit is expected to increase in future (Eccles, 2009) [5].

The consumption of pomegranate has been associated with beneficial health effects, such as prevention of oxidation of both low and high density lipoprotein, blood pressure, inflammatory, atherosclerosis, prostate cancer, heart disease, and HIV-1 (Aviram *et al*, 2000, 2004; Malik *et al*, 2005; Neurath *et al*, 2005) [2, 9, 12]. These beneficial effects have been attributed to the high levels of antioxidant activity (Gil *et al*, 2000) due to the high content of polyphenols such as gallic acid, ellagitannins, gallotannins, chlorogenic acid, caffeic acid, ferulic acid, coumaric acids, and catechin and anthocyanins (Gil *et al*, 2000; Seeram *et al*, 2008) [7, 18] reported that pomegranate juice has greater antioxidant capacity than other fruit juices and beverages. (Tehranifer *et al.*, 2010) [19].

The physical properties such as size, shape, surface area, volume, density, porosity, colour, and appearances are important in designing a particular equipment or determining the behaviour of the product for its handling.

Material and Methods
Raw material
Average sized healthy fruits of pomegranate of "Bhagava" variety as shown in plate no. 1 were purchased from local market.

Properties of fruit
Physical and chemical properties of pomegranate fruits, were analyzed for the following physical-chemical characteristics

Plate 1: Bhagava variety of pomegranate

1 Physical properties

The moisture content was determined by AOAC method (2000). The sample was kept in oven at 110 ^{0}C for 24 hrs.

$$M = \frac{W1-W2}{W1} \times 100 \quad (1)$$

Where,
M –Moisture content in %
W_1 – Initial weight of sample, gm
W_2 – Final weight of sample, gm

The weight of fruits was taken on top electronic balance and average weight per fruit was calculated and expressed in grams. The volume of pomegranate was determined through measuring volume of displaced water directly in measuring jar. By using the equation as follows,

$$\text{Volume of fruit} = \frac{B-A}{N} \quad (2)$$

Where,
A= Initial volume of water
B= final volume of water
N= number of fruit
Specific gravity of pomegranate fruit was determined as follows

$$\text{Specific gravity} = \frac{W}{V} \quad (3)$$

Where, W = Weight of fruit
V = Volume of fruit

To determine the average size of the pomegranate, a sample of 5 randomly selected pomegranate was drawn and their three principal dimensions were measured using a vernier caliper to an accuracy of 0.02 mm. The geometric mean diameter *Dm* of the fruit was calculated by using the following relationship:

$$D_m = (LBT)^{\frac{1}{3}} \quad (4)$$

Where, L, B and T are the length, width and thickness of the fruit
The sphericity of fruits was calculated using the formula (Mohsenin, 1970) [10]:

$$\phi = \frac{(LBT)^{\frac{1}{3}}}{L} \quad (5)$$

Where, ϕ is degree of sphericity.
Percent consumable matter was calculated by using following equation

$$\text{Consumable matter (\%)} = \frac{WCM}{W} \times 100 \quad (6)$$

Where, WCM = Weight of Consumable Matter
W = Weight of whole fruits
Peel (%) was calculated by using following equation

$$\text{Peel (\%)} = \frac{WP}{W} \times 100 \quad (7)$$

Where, WP = Weight of Peels
W = Weight of whole fruits

2 Chemical properties

Total Soluble Solids were estimated at ambient temperature by Abbe's Refractometer (60-95^0 Brix & 30-60^0 Brix) and hand refractometer (0-32^0 Brix) (Erma, Japan) and the values were expressed as ^{0}Brix at room temperature. The pH of pomegranate seed juice was estimated by CL 54 digital pH meter (Toshniwal Instruments Mfg. Pvt. Ltd., India).
For determination of vitamin C (ascorbic acid) dye was prepared. This was blue in color. It was prepared as follows.
50 ml Sodium salt of 2, 6-dichlorophenol-indophenol was dissolved in approx 15 ml hot glass distilled water containing 42 mg of sodium bicarbonate. It was then cooled diluted with glass distilled water to 200 ml. It was stored in refrigerator.
Calculation of dye factor
5ml of standard ascorbic acid solution was taken & 5ml of HPO_3 solution was added to it. Microburret was filled with dye. It was titrated with dye sol^{n}upto a pink colour which was persist for 15 sec. Dye factor was calculated by the formula

$$\text{Dye factor} = \frac{0.5}{\text{Titre}}$$

Procedure of calculating Ascorbic acid
2 ml of juice sample was taken & 5 ml of MPA sol^n was added to it. Then it was titrated against dye. It is calculated by

$$\text{Ascorbic acid} = \frac{\text{Dye factor X Titre X Volume made up}}{\text{Weight of sample X Aliquote (test sample)}}$$

Results and discussion

The results of physical properties of pomegranate cv. *Bhagawa* are presented in Table 1. Using this procedure the moisture content was calculated. The value of moisture content was found in the range of 76.72 to 80.6 percent (wb) with an average of 79.06 percent (wb).

Physical properties of fresh pomegranate fruit

The weight of fruits was taken on top electronic balance and average weight per fruit was calculated and expressed in grams. The value of weight of fruit was found in the range of 193.3 to 214 mm. The average value of was weight of pomegranate fruits found 204.54 gm.

Weight of Aril and Peels

The weight of aril and peels were taken on top electronic balance and total weight per fruit was calculated and expressed in grams. The weight of aril and peel was found in the range of 124.2 to 139.2 and 69.1 to 78.8 gm respectively. The average values of weight of arils and peels were found 129.12 gm and 75.38 gm, respectively. Hence averagely each fruit was having 63.10% of weight of arils and 36.8% of weight of peels. The arils in this variety were bold in size and the weight of non-edible portion of fruit which consisted of peel and the seed was medium in the variety Bhagwa (Shiva Prasad *et al.*2013) [17].

Volume

The volume of pomegranate fruit was determined through measuring volume of displaced water directly in measuring jar. The volume of pomogrenate fruit was found in the range of 230 to 250 cm^3.The average value of volume of pomegranate fruits was found 242 cm^3.

Specific Gravity

The specific gravity of pomogrenate fruit was found in between 0.84 to 0.856. The average value of specific gravity of pomegranate fruits was found 0.844.

Overall Dimensions

The length, width and thickness of pomegranate fruit were found in the range of 6.65-7.51, 6.52-7.2 and 6.5-6.9 cm, respectively. The average values of length, width and thickness of pomegranate fruit were found 7.07 cm, 6.79 cm and 6.75 cm respectively. Similar results for length, width and thickness of pomegranate fruits has also been reported by Riyahi *et al*. (2011) [16] and Patel *et al.* (2018) [14].

Geometric Mean Diameter

The geometric mean diameter of the pomogrante fruit was in between 6.53-7.19 cm and the average geometric mean diameter of pomegranate fruit was found 6.86 cm. Celik and Ercisli (2009) [4] reported that the average value of the geometric mean diameter was calculated as 70.1 mm for cv. Eksinar.

Sphericity

The sphericity of the pomogrante fruit was in between 0.95-0.97. The average sphericity of pomegranate fruit was found 0.96. Similar result found by Jithender *et al.* (2017) [8] for the same variety.

Consumable matter (%)

The consumable matter was calculated on the basis of aril and peel present in the fruit. The consumable matter in current study was found in the range of 61.44 to 65.04 percent. The average percent consumable matter of pomegranate fruit was found 63.10 percent.

Percent of Peel

The peel percent was found between 34.9-38.5 percent with average 36.8 percent.

Chemical properties of pomegranate fruit

Total Soluble Solid

Using refractometer, the values of TSS was found in range of 15.3 -15.9 with the average of 15.7 ^oBrix. Various researchers noticed highest TSS in both multiple hybrids as wellas selections of pomegranate. Shiva Prasad *et al.* (2013) [17] reported TSS of 14.74^{0}Brix for Ganesh varieties and Bhagwa variety 14.52^{0}Brix. (Nataraja (2002) [11] was of the opinion that multiple hybrids 30/2 and 7/2 had 15.4 and 14.73^{0}Brix TSS.

pH Value

The pH was found in the range of 3.3-3.7. The average pH value of pomegranate seed juice was found 3.5. Ghadge and Jadhav (2015) [6] reported pH value for arakta 3.59 and for Ganesh 3.54.

Ascorbic acid

The average amount ascorbic acid of pomegranate fruit was found 11.4 mg/100ml.Ghadge and Jadhav (2015) [6] reported that the Vitamin C content in Ganesh cultivar was 8.5-9 mg/100g and in Arakta cultivar 9.2-9.5mg/100g.

Table 1: Some Physical and Chemical Properties of Pomegranate cv. *Bhagwa*

Properties	Min	Max	Mean	SD*
Moisture content (wb)%	76.72	80.60	79.06	1.49
Weight (gm)	193.30	214.00	204.54	7.45
Weight of Arils (gm)	124.20	139.20	129.12	6.11
Weight of peels (gm)	69.10	78.80	75.38	3.83
Volume of fruit (cm^3)	230.00	250.00	242.00	7.58
Specific Gravity(gm/cm^3)	0.83	0.86	0.84	0.01
Length (cm)	6.65	7.51	7.08	0.31
Width (cm)	6.52	7.20	6.85	0.25
Thickness (cm)	6.50	6.94	6.72	0.20
GMD (cm)	6.53	7.19	6.86	0.24
Spericity	0.95	0.97	0.96	0.01
Percent of consumable matter (%)	61.44	65.04	63.12	1.54
Percent of Peel (%)	34.90	38.55	36.82	1.54
TSS (Total Soluble Solid) ^oBrix	15.30	15.90	15.70	0.23
pH	3.30	3.70	3.52	0.15
Ascorbic Acid (mg/100ml)	10.90	11.90	11.40	0.40

*SD=Standard Deviation

Conclusion

The following conclusions were drawn from the study. The average moisture content of pomegranate fruit 78.95%

- Average weight, weight of arils and peels, volume of pomegranate fruit 204.54 gm, 129.12 gm and 75.38 gm and 242 cm^3 respectively.
- Average specific gravity of pomegranate fruit 0.844.
- Average length, width and thickness, GMD, sphericity of pomegranate fruit 7.07 cm, 6.79 cm and 6.75 cm, 6.86 cm and 0.96 respectively.
- Average consumable matter and percent of peel of pomegranate fruit 63.10%, 36.8%.
- Average Total Soluble Solid(TSS) of pomegranate fruit 15.7 ^oBrix, pH and ascorbic acid content was 3.5 and 11.4 mg/100 ml. respectively

References

1. AOAC, Official methods of analysis of the Association of Official Analytical Chemists, 17th edition. 2000;920:151.
2. Aviram M, Dornfeld L, Rosenblat M, Volkova N, Kaplan M, Coleman R, *et al*. Pomegranate juice consumption reduces oxidative stress, atherogenic modifications to LDL, and platelet aggregation: studies in humans and in

atherosclerotic apolipoprotein E-deficient mice. The American Journal of Clinical Nutrition. 2000;71(5):1062-1076.
3. Aviram M, Rosenblat M, Gaitini D, Nitecki S, Hoffman A, Dornfeld L. Pomegranate juice consumption for 3 years by patients with carotid artery stenosis reduces common carotid intima-media thickness, blood pressure and LDL oxidation. Clinical Nutrition. 2004;23(3):423-433.
4. Celik A, Ercisli S. Some physical properties of pomegranate cv. Eksinar. International Agrophysics. 2009;23:295-298
5. Eccles J. An R & D strategy for the Australian pomegranate industry. Rural Industries Research and Development Corporation of Australian Government. 2009. Retrieved from www.rirdc.gov.au on 19.04.2010.
6. Ghadge KS, Jadhav BD. Physico-chemical properties, estimation of total sugars and vitamin C content of pomegranate cultivars Arakta and Gansesh: A comparative investigation. Journal of Chemical and Pharmaceutical Research. 2015;7(8):670-675
7. Gil MI, Tomas-Barberan FA, Hess-Pierce B, Holcroft DM, Kader AA. Antioxidant activity of pomegranate juice and its relationship with phenolic composition and processing. Journal of Agriculture and Food Chemistry. 2000;48:4581-4589.
8. Jithender B, Vyas DM, Abhisha S, Rathod PJ. Determination of Physical and Mechanical Properties of Pomegranate (Var. bhagwa) Fruit and Aril. Int. J Curr. Microbiol. App. Sci. 2017;6(10):879-885.
9. Malik A, Afaq F, Sarfaraz S, Adhami VM, Syed DN, Mukhtar H. Pomegranate fruit juice for chemoprevention and chemotherapy of prostate cancer. Proceedings of the National Academy of Sciences of the United States of America. 2005;102(41):14813-14818
10. Mohsenin NN. Physical properties of plant and animal materials Forden and Breach Science Pub. London. 1970.
11. Nataraja KH. Evaluation of multiple hybrids of pomegranate (*Punica granatum* L.) in Southern Dry Region of Karnataka. M.Sc.(Hort.) Thesis, University of Agricultural Sciences, Bengaluru, KARNATAKA (INDIA). 2002.
12. Neurath AR, Strick N, Li YY, Debnath AK. *Punica granatum* (pomegranate) juice provides an HIV-1 entry inhibitor and candidate topical microbicide. Annals of the New York Academy of Sciences. 2005;1056:311-327.
13. Nishant Kumar, Neeraj, Shiv Kumar. Functional Properties of Pomegranate (*Punica granatum* L.). The Pharma Innovation Journal. 2018;7(10):71-81
14. Patel MB, Alok Nath, Mayani JM. A study on physical properties of pomegranate (*Punica granatum* L., Punicaceae) fruits. International Journal of Chemical Studies. 2018;6(5):1460-1463
15. Ranganna S. Sugar estimation. In S. Ranganna (Ed.), Handbook of analysis and quality control for fruit and vegetable products, New Delhi: Tata McGraw-Hill. 20012:12-17.
16. Riyahi R, Rafiee S, Dalvand MJ, Keyhani A. Some physical characteristics of pomegranate, seeds and arils. Journal of Agricultural Technology. 2011;7(6):1523-1537.
17. Shiv Prasad KR, Mukunda GK, Mohankumar AB, Yathiraj K. Bhagwa a promising variety of pomegranate for dry regions of Karnataka. Internat. J agric. Sci. 2013;9(1):84-87.
18. Seeram NP, Aviram M, Zhang Y, Henning, S, Feng L, Dreher M. Comparison of antioxidant potency of commonly consumed polyphenol-rich beverages in the United States. Journal of Agricultural and Food Chemistry. 2008;56:1415-1422.
19. Tehranifar A, Zarei M, Esfandiyari B, Nemati Z. Physicochemical Properties and Antioxidant Activities of Pomegranate Fruit (*Punica granatum*) of Different Cultivars Grown in Iran. Center of Pomegranate Research, Department of Horticultural Science, Ferdowsi University of Mashhad, Mashhad, Iran. Hort. Environ. Biotechnol. 2010;51(6):573-579.