



Quality Evaluation of *Rhododendron arboreum* Flowers of Different Regions of Himachal Pradesh for Standardization of Juice Extraction Technique

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Abstract: The present study was carried out in the department of Food Science, Nutrition and Technology, CSK Himachal Pradesh Agricultural University Palampur with the objective to explore the nutritional quality of *Rhododendron* flowers of different regions of Himachal Pradesh and to standardize juice extraction technique. The samples of flowers used in the present investigation were obtained from district Kangra, Kullu and Shimla. *Rhododendron* flower were assessed for chemical and functional parameters and juice/pulp extraction technique was standardized. Results of the study showed that the flowers were found to contain valuable nutrients. The chemical analysis revealed mean values of total soluble solids as 4.47 ± 0.41 °B, pH as 3.69 ± 0.47 and acidity $2.10 \pm 0.39\%$. The total, reducing sugars, non-reducing sugars and ascorbic acid were in the range of 5.70 to 6.17, 2.90 to 3.33, 2.64 to 2.91 % and 243.55 to 249.11 mg/100g, respectively. The highest anthocyanin content in flower was recorded as 212.27 mg/100g. Blanching method was standardized as the best for juice extraction from with the maximum per cent juice recovery of i.e. 70 % with attractive red colour.

Keywords: *Rhododendron arboreum*; chemical composition; functional parameters; juice recovery; blanching

1. Introduction

Rhododendrons are wildy grown flowers in Himachal Pradesh at high altitude. The genus *Rhododendron* belongs to the family, Ericaceae. It is commonly known as “burans”, is amongst highly valued wild edible flower growing between 1500 and 2400 m above mean sea level. The flower of *Rhododendron* exhibits many nutritional, medicinal and aromatic properties and has a number of uses in folk medicine. Flowers are reported to possess therapeutic and stimulating properties and have a number of uses in folk medicine.

Traditionally, the petals of the *Rhododendron arboreum* flowers are commonly used in the preparation of chutney by the hill people. Flowers contain anthocyanins and flavonols as the major pigments (Krishna *et al.*, 2010) and the hot water extract of flowers can be used as natural food colouring agent. Flowers are sourish-sweet in taste eaten



raw, in Himachal Pradesh it is used for making chutneys, cold drinks and squash; also form an important constituent of local wine, 'sur'(Kharwal & Rawat, 2013) which helps in preventing high-altitude sickness. At home scale, small quantities of juice extracted from flower is used for preparing jelly and squash and syrup.

The flower of *Rhododendron* exhibits many nutritional, medicinal and aromatic properties. It has a special place in the cultural and economic life of the people of Himachal Pradesh. However, it has remained neglected and its nutritional qualities and value added products have hardly received any attention so far. Considering the nutritive value and other beneficial effects of *Rhododendron* flower the study was carried out to assess the nutritional profile of *Rhododendron* flowers of different regions of Himachal Pradesh and to standardize the technique for juice extraction to enhance the utility of this valuable flower which otherwise invariably goes waste.

2. Materials and Methods

2.1 Collection of Sample: The samples of *Rhododendron arboreum* flowers used in this study were procured from different areas of Himachal Pradesh *viz.* Kangra, Kullu and Shimla.

2.2 Chemical and functional characteristics of Rhododendron Flowers: The flowers were cleaned and graded according to size and colour and after removing the sexual organs, calyx and stalk; the petals were washed under running tap water to obtain the edible portion. This edible portion (petals) was used for further analysis. All the analysis were done in triplicate.

Chemical analysis: Total soluble solids were determined by using Hand Refractometer and pH of was determined with the help of pH meter (Ranganna, 2007). Acidity, Ascorbic acid and Sugars were estimated by the standard methods of AOAC, 1990

Functional parameters: β -carotene in the sample was estimated by the method of Srivastava & Kumar, 2003. For the estimation of Total Anthocyanins extraction was done by the method of Jang & Xu, 2009 and total anthocyanin content was determined by the method of Giusti & Wrolstad, 2001. Flavonoids were determined by the method of Boham & Kocipia, 1994. Acid detergent fibre (ADF) was estimated by the method of Van Soest & Wine, 1967. Lignin was determined by the method of Van Soest & Robertson, 1985.

2.3 Standardization of extraction techniques for juice: The *Rhododendron arboreum* flowers were procured, graded and sorted according to size and colour and washed under running tap water. The flowers were subjected to different juice extraction techniques in the laboratory. Three techniques for juice extraction *viz.* blanching, steaming and manual were standardized with 100 g of petals. From the 100g petals pulp was extracted and homogenized. Fibrous material was separated with the help of muslin cloth for juice extraction. The homogenized juice was treated with sodium benzoate @ 0.5 g/ litre of juice. The treated juice was filled in pre-sterilized glass bottles. After filling, heating at $80\pm 5^{\circ}\text{C}$ for 30 minutes was carried out for all the treatments. The best technique was selected on the basis of the maximum per cent juice yield, good taste and colour retention. The method for extraction of juice is illustrated in Figure 1. The different pulp extraction techniques followed for flowers are discussed below:

Blanching: The flowers were sorted and washed properly. The petals of flowers were blanched in boiling water for one to two minutes. After treatment, the flowers were immediately immersed in cold water.

Steaming: The flowers were sorted and washed properly. After washing, the flowers were subjected to steaming in pressure cooker by adding sufficient amount of water.



Manual: The flowers were sorted and washed properly. The petals of flower were put in mixer grinder and converted into pulp with the help of appropriate water to facilitate grinding process.

Juice recovery (%): The inedible portion was removed from flower and sample of 100 g petals was taken. After washing of petals, the juice was collected by using extraction techniques, weighed and recorded in terms of per cent juice recovery.

$$\text{Juice recovery (\%)} = \frac{\text{Juice (ml)}}{\text{Wt. of flowers (g)}} \times 100$$

Colour: Colour of juice samples was observed with visual appearance.

2.4 Statistical Analysis: The data obtained from various parameters were subjected to statistical analysis with the help of computer using CRD design. The data were analyzed using analysis of variance. The level of significance was deliberated at $p \leq 0.05$. (Gupta, 2000)

3. Results and Discussion

The study was performed to assess the nutritional profile of *Rhododendron* flowers of different regions, to standardize technique for extraction of juice.

3.1 Chemical composition of Rhododendron flowers: Data pertaining to chemical parameters *viz.* TSS, pH, acidity, total sugars, reducing, non-reducing sugars and brix/ acid ratios of *Rhododendron* flowers are presented in Table 1. It has been observed that the difference in TSS was non-significant for *Rhododendron* from Kangra and Kullu (4.67°B). Whereas, 4.07°B TSS was observed for *Rhododendron* of Shimla. Solanki *et al.*, 2013 reported 8.50°B TSS. The pH and acidity contents varied in *Rhododendron* from different areas and the ranged from 3.10 to 4.14 and 1.75 to 2.50 per cent with mean values 3.69 and 2.10, respectively. The results found in conformity with the results given by Gupta, 2008 and Mishra, 2008.

Besides, Table 1 depicts the per cent total, reducing and non-reducing sugars in *Rhododendron* flower as well. The per cent total, reducing and non-reducing sugars with average range recorded as 5.70 to 6.17, 2.90 to 3.33 and 2.64 to 62.91 per cent, respectively. The difference in total, reducing and non-reducing sugars were found non-significant with the mean values 5.99, 3.11 and 2.74 per cent, respectively. Almost similar findings have been reported by Gupta, 2008. The brix/ acid ratio was found maximum in flowers of Kangra (2.71) followed by Kullu (2.31) and Shimla (1.63) with the mean value 2.27.

3.2 Functional parameters of Rhododendron flowers: Table 2. depicts the data related to ascorbic acid content, β -carotene, vitamin A content anthocyanins, flavonoid and lignin content. A critical look on data revealed that the maximum vitamin C content was observed in *Rhododendron* of Shimla (249.11 mg/100 g) followed by Kullu (247.54 mg/100 g) and Kangra (243.55 mg/100 g). Alike results of present investigation was also reported by Solanki *et al.*, 2013. The highest mean value for β -carotene and vitamin A was recorded for *Rhododendron* of Kullu (0.54 mg/100 g and 0.90 I.U) followed by Kangra (0.47 mg/100 g and 0.79 I.U) and Shimla (0.44 mg/100 g and 0.74 I.U). The highest anthocyanin content was found in *Rhododendron* of Kangra (212.27 mg/100 g), followed by Kullu (211.51 mg/100g) and Shimla (208.18 mg/100 g).



Solanki *et al.*, 2013 reported 214.35 mg/110 g anthocyanins in *Rhododendron* petals.

The mean values found significantly different for flavanoids and lignin content when compared with each other. Maximum and minimum values of per cent flavanoids were recorded for *Rhododendron* of Kullu (14.49%) and Shimla (13.80%). Attri *et al.* (2014) reported the total flavonoids content in *Rhododendron* flower as 1276.5 mg/100 ml. Lignin content also varied significantly in *Rhododendron* of Kangra, Kullu and Shimla areas. *Rhododendron* flowers of Kangra had highest lignin content (1.52%), followed by Kullu (1.49%) and Shimla (1.45%).

3.3 Standardization techniques for Juice/ pulp extraction: Data presented in Table 3 represents standardization of extraction techniques for preparing *Rhododendron* juice *viz.* steaming, blanching and manual from *Rhododendron* flowers for maximum juice recovery and best color. The percent recovery of juice was same (70.00%) in steaming and blanching methods while percent juice recovery was only 55.60% by manual. Best and attractive red colour and maximum juice recovery was noticed by blanching method. Though the acceptable colour of juice was also observed in manual method but it was more tedious and also could not recover the maximum. Waskar & Garnade, 1999 reported 64.00 per cent juice recovery in fruits by blanching methods.

4. Conclusion

The study conclusively indicated that nutritional *Rhododendron* flower from all the selected regions of Himachal Pradesh *i.e.* Kangra, Kullu and Shimla are rich in valuable nutrients with slight variations in TSS, pH and acidity values. The observations recorded on the functional parameters of *Rhododendron* in the present study indicate that this flower is not only beautiful but also contain good amount of health imparting constituents like **ascorbic acid, anthocyanins** and **flavonoids**. Blanching is best treatment for juice extraction from *Rhododendron* petals and this juice can be used to develop various value added products like ready to serve beverages squash, appetizers, etc.

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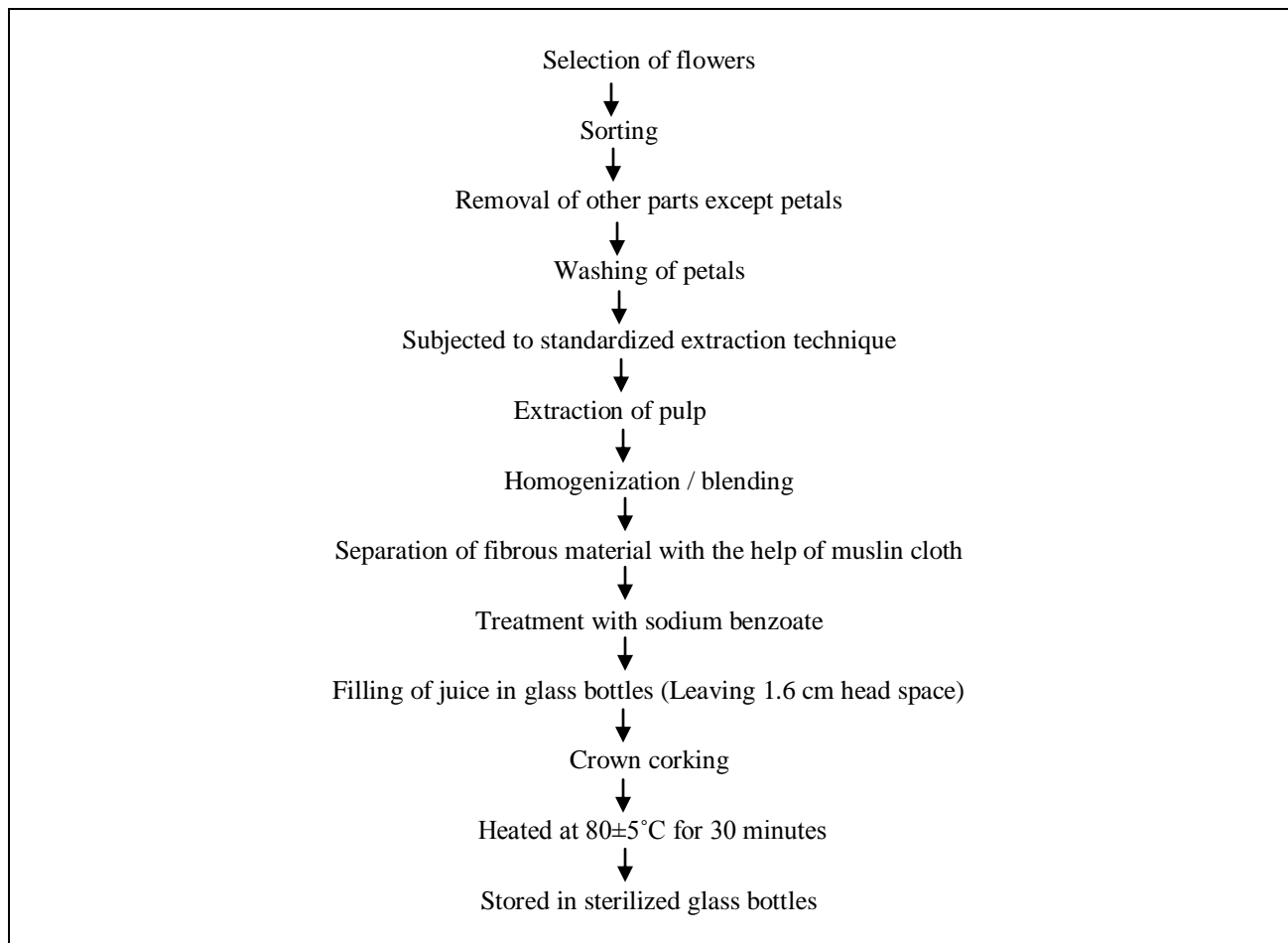


Figure 1: Flow chart for preparation of juice/pulp from *Rhododendron* flowers



Table 1: Chemical composition of *Rhododendron* flowers

Parameters	Location				
	Kangra	Kullu	Shimla	Mean	C.D.
					(P≤0.05)
TSS (°B)	4.67	4.67	4.07	4.47±0.35	0.51
pH	4.14	3.84	3.10	3.69±0.54	0.23
Acidity (% Citric Acid)	1.75	2.04	2.50	2.10±0.38	0.38
Total sugars (%)	6.11	6.17	5.70	5.99±0.25	NS
Reducing sugars (%)	3.33	3.10	2.90	3.11±0.22	NS
Non- Reducing sugars (%)	2.64	2.91	2.66	2.74±0.15	NS
Brix/ Acid Ratio	2.71	2.31	1.63	2.22±0.54	1.19

Table 2: Functional parameters of *Rhododendron* flowers

Parameters	Location				
	Kangra	Kullu	Shimla	Mean	C.D.
					(P≤0.05)
Ascorbic acid (mg/100g)	243.55	247.54	249.11	246.73±2.87	1.45
β- Carotene (mg/100g)	0.47	0.54	0.44	0.49±0.05	0.01
Vitamin A (IU)	0.79	0.90	0.74	0.81±0.08	0.02
Anthocyanins (mg/100g)	212.27	211.51	208.18	210.66±2.18	2.59
Flavonoids (%)	14.16	14.49	13.80	14.15±0.35	0.22
Lignin (%)	1.52	1.49	1.45	1.49±0.03	0.02



Table 3: Effect of extraction techniques on the juice recovery from petals of *Rhododendron* flowers

Parameters/Techniques	Steaming	Blanching	Manual
Juice (%)	70.00	70.00	55.60
Pomace (%)	30.00	30.00	44.40
Colour of juice	Violet unattractive	Intense Red attractive	Red attractive