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Effect of different drying techniques on minerals and phytochemical composition of Lali gurans (*Rhododendron arboreum)* flowers

Netravati Hiremath*[1], Manjula Sheshagiri[2], Nutan Lepcha[3] and Yangshi Doma Bhutia[3]

[1,3]Department of Nutrition and Dietetics, JSS Academy of Higher Education and Research, Mysuru 570 004, Karnataka, India, Contact
[2]Department of Home Science, Maharani's Science College for Women (Autonomous) Mysuru 570 005, Karnataka, India

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ABSTRACT

Rhododendron arboreum flowers are considered to be rich in phyto chemicals and secondary metabolites like polyphenolic compounds, alkaloids, saponins *etc.*, *Rhododendron* plant is commonly known for its aesthetic, sacred as well as for its medicinal value. In the present study, minerals and phytochemical composition were assessed by using Association of Official Agricultural Chemists protocols and other standard protocols. *Rhododendron arboretum* flowers dried by using the different drying techniques and further their minerals and phytochemical composition were assessed. Results revealed that in 100 g of sample, sun dried petals had the maximum calcium (651 ± 8.54 mg), iron (9 ± 2.0 mg) and phosphorous (121 ± 2.65 mg) content compared to that of hot air and microwave oven dried samples. Hot air oven dried petals had maximum content of polyphenols (290 ± 2.91mg GAE/100 g). However, sundried sample had shown the highest antioxidant activity of (113 ± 1.59 mg/100 g) as in comparison with other two treatments. Significant variation was observed in the phytochemical composition of *Rhododendron arboreum* flowers dried with three different drying techniques. From the results, it was revealed that different drying techniques has brought the changes in mineral and phytochemical composition in *Rhododendron* flowers.

Key words: *Rhododendron arboretum, Drying, Antioxidant, Polyphenol, Minerals*

Introduction

Rhododendron tree has the immense economic and ecological importance with huge medicinal property. Rhododendron belongs to one of the largest family *Ericaceae* and word 'Rhodo' is Greek word which means rose and 'dendron' indicates tree. In 1873, *Carl Linnaeus* described this for the first time in *Genera Plantarum*. Rhododendron species are widely expanded in Nepal, India, China, Malaysia and Thailand. These regions are considered as major habitats with more than 90 per cent of world's share, while 102 of these species are distributed in India (Panda and Kirtania, 2016). *Rhododendron plant* blooms with a wide range of colored flowers with deep red, pale pink, purple, white and is especially known for its bright visible flowers (Tewari *et al*., 2018). Due to its aesthetical beauty, is considered as Nepal National flower, state flower of Nagaland and Himachal Pradesh and state tree of both Sikkim

([1]Assistant Prof., [2]Assistant Prof., [3]MSc.)

and Uttarakhand (Singh *et al.,* 2013). In Nepal, it is locally called as Lali Guras which means 'rose tree' (Sonar *et al*., 2012). *Rhododendron arboreum* is the most common species in India (Bhattacharyya and Sanjappa, 2008). *Rhododendron* has various health benefitting properties which is being used in treatment of diarrhea, asthma inflammation, constipation, dysentery, bronchitis and detoxification purpose (Nisar *HYPERLINK "https://arccjournals.com/journal/agricultural-reviews/R-2146"et al*HYPERLINK "https://arccjournals.com/journal/agricultural-reviews/R-2146"., 2013). *Rhododendron flower* comprised with several nutritionally important minerals such as iron, zinc, copper, sodium, manganese *etc.*, which are very essential for various physiological functions. It also contains secondary metabolites like tannins, steroids, alkaloids, flavonoids, saponins, *etc.,* (Nisar *HYPERLINK "https://arccjournals.com/journal/agricultural-reviews/R-2146"et al*HYPERLINK "https://arccjournals.com/journal/agricultural-reviews/R-2146"., 2013). Usage of *Rhododendron* flower as natural source in food product development as coloring agent or as nutrient enhancer helps in facilitating the partial fulfillment of nutrients and phytochemicals requirement. Further, effect of different processing techniques on chemical composition guides the food industrialist to choose effective processing techniques to minimize the nutrient loss. Hence, the present study was undertaken with an objective to know the effect of different drying techniques on mineral and phytochemical composition *Rhododendron arboretum* flower.

Materials and Methods

Fresh *Rhododendron arboretum* flowers were collected from the regions of Gangyap, Chakung part of West Sikkim, India. Further, *Rhododendron arboreum* flowers were subjected to three different drying techniques *viz*., sun drying, hot air oven and microwave drying further dried samples were analyzed for minerals content, antioxidant activity and polyphenol content.

Minerals estimation

Minerals such as iron (Fe), calcium (Ca), phosphorus (P), sodium (Na) and potassium (K) were assessed in *Rhododendron arboreum* flowers dried with different drying techniques. For minerals estimation, sun dried, hot air oven dried and microwave oven dried samples were incinerated in Muffle furnace at 550 °C. Mineral solution was prepared by using diluted hydrochloric acid with 1:1 ratio (Aras and Ataman, 2007). Further, minerals content was analyzed in prepared mineral solution. The concentration of each mineral in sample is expressed in mg/100g.

Antioxidant activity of *Rhododendron arboreum*

Antioxidant activity was assessed by using ascorbic acid as standard and 1-diphenyl-2-picryl hydrazyl (DPPH) as free radical scavenger (Kamtekar *et al*., 2014). For extraction, 98 per cent of ethanol was used. The concentration range for ascorbic acid was 24 µg to 192 µg per ml and the absorbance was taken at 593 nm using UV-VIS spectrophotometer (UV-1900i) against the blank, curve developed for antioxidant activity is presented in Figure 1.

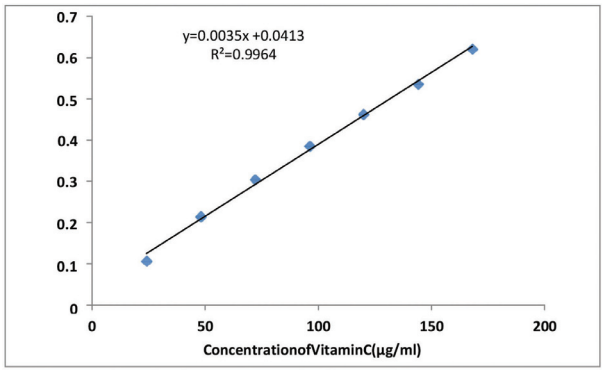

Fig. 1. Standard curve for antioxidant activity

Polyphenol estimation

Total polyphenol content in *Rhododendron arboreum* was assessed by following the protocol of Alvarez *et al*., 2016. Standard curve was developed by using 10 mg per cent solution of gallic acid and the curve developed is presented in Figure 2. Flower samples were extracted with methanol solution in magnetic stirrer for one hour at 500 rpm under the ambient room temperature. The extracted samples were cen-

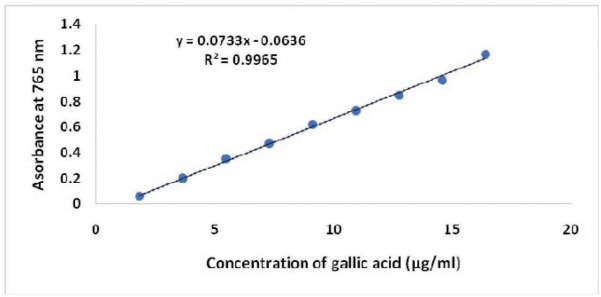

Fig. 2. Standard graph of polyphenols from the Gallicacid

trifuged at 5000 rpm for 20 minutes. The supernatant was analyzed for polyphenol content.

Results and Discussion

To know the impact of any processing technique on nutritional composition, it's very crucial to analyze the moisture content. Constant moisture maintenance for further analysis aids in minimizing the errors. Moisture content in flower was found to be more than 80 per cent and non-significant difference was observed among all three treatments and the result is presented in Table 1.

Table 1. Percent moisture content in *Rhododendron arboreum* dried with different drying techniques

Drying methods	Moisture (%)
Sun dried	87.95
Microwave dried	87.93
Hot air oven dried	88.20
P value (0.05)	0.84^{ns}

Note: ns: Non-significant @ 0.05 %

Effect of the different drying techniques on mineral composition of Rhododendron flowers showed a significant difference in mineral composition and the results are shown in the Table 2. From the results it was revealed that, calcium and iron content was more in sundried sample as 651± 8.54 mg and 9 ± 2.0 mg per 100 g respectively compared to that of microwave dried (619 ± 9.02 mg/100 g) and hot air dried (621 ± 12.58 mg/100 g) sample. Microwave oven dried sample had the highest content of sodium (228.7 ± 6.11 mg/100 g) and potassium (938 ± 9.17 mg/100 g). Microwave oven and hot air-dried sample had the similar phosphorus (150 ± 6.00 mg/100 g) content. Similar report of high mineral composition in sundried sample was also reported by Liman and his coworkers in 2014. Different leafy vegetables like drumstick, spinach was dried by different drying techniques such as sun and oven drying, where sun drying showed the higher retainment of calcium and magnesium content in case of spinach.

The dried samples were analyzed to assess the effect of different drying techniques on the antioxidant activity. Table 3 shows the antioxidant activity in *Rhododendron arboreum* flower samples dried with different drying techniques. Sun dried sample (113 ± 1.59 mg Asc/g) showed the highest antioxidant activity compared to that of the microwave oven (111 ± 0.20 mg Asc/g) and hot air oven (108 ±0.38 mg Asc/g) dried samples and the results are on par with the report of Barola *et al*., 2022. Antioxidant property as well as antimicrobial activity of *Rhododendron* species is also reported by Kashyap *et al.*, (2017). The *Rhododendron arboreum* flower species contains a various health benefit due to the presence of bioactive components. Similar study was done to know the impact of different drying methods on the bioactive compounds and the parameters on the red- fleshed apple slices. Wojdylo *et al*., (2020) report revealed that antioxidant capacity was reduced in the oven drying method compared to other drying methods. Drying is commonly done for the preservation for the commercial purpose but it is being highlighted that the different drying processing techniques significantly affect the nutritional and

Table 3. Effect of Different drying techniques on total antioxidant activity of *Rhododendron arboreum* flowers (mg of Ascorbic acid /g)

Different treatments	Antioxidant Activity (Mean±SD)
Sun Dried	113 ± 1.59
Microwave Dried	111 ± 0.20
Hot air dried	108 ± 0.38
P value (0.05)	0.002*

Note: * Significant @ 0.05 %

Table 2. Different drying techniques effect on mineral content of *Rhododendron arboreum* flowers (mg/100g)

Drying methods	Calcium (Mean±SD)	Iron (Mean±SD)	Sodium (Mean±SD)	Potassium (Mean±SD)	Phosphorus (Mean±SD)
Sun Dried	651 ± 8.54	9 ± 2.0	179.3 ± 7.09	929 ± 8.54	121 ± 2.65
Microwave Dried	619 ± 9.02	6.1 ± 0.36	228.7 ± 6.11	938 ± 9.17	150 ± 4.00
Hot air oven dried	621 ± 12.58	5.8 ± 1.04	223.7 ± 11.93	915 ± 10.41	150 ± 6.00
P value (0.05)	0.016*	0.004*	0.001*	0.028*	0.0002*

Note: * Significant @ 0.05 %

antioxidant property (Sharma *et al*., 2020). A study conducted on *Robinia pseudoacacia* L. flowers by Ji *et al*., 2012 reported the maximum retainment of antioxidant activity and protein content in the oven dried sample. However, shade dried sample showed to retain a high carbohydrates and amino acids level.

Polyphenols content in different dried samples of *Rhododendron arboreum* flower is presented in Table 4. Significant difference was observed in polyphenol content of *Rhododendron arboreum* flower samples dried with different drying techniques. The hot air oven dried sample had the highest polyphenols content (290 ± 2.91mg GAE/100g), whereas the microwave dried sample had 111 ± 2.52mg GAE/100g and sun-dried sample had 152 ± 2.67mg GAE/100g of polyphenolic content. A study was conducted in *Robinia pseudoacacia L*. flowers by Ji *et al.*, 2012 reports revealed that low phenolic content in the sun-dried sample. Another similar study was conducted in *Rhododendron arboreum* where it showed oven drying sample had the maximum polyphenolic content (Barola *et al*., 2022).

Table 4. Different drying techniques effect on total polyphenols content of *Rhododendron arboreum* flowers (mg of GAE/100g)

Different treatments	Polyphenols content (Mean ± SD)
Sun Dried	152 ± 2.67
Microwave Dried	111 ± 2.52
Hot air oven dried	290 ± 2.91
P value (0.05)	<0.001*

Note: * Significant @ 0.05 %

Conclusion

The flowers of *Rhododendron arboreum* contains various bioactive components known to have anti-inflammatory and cardio protective properties. The present study is focused on analyzing the different drying methods effects on the biochemical and antioxidant content. The results confirms that different drying techniques have the impact on changing the mineral and phytochemical constituents, therefore there is a need for minimization of drying loss by selecting the minimal loss drying techniques.

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Conflict of interest

The authors declared that there is no conflict of interest relevant to this article.

References

Álvarez, R., Araya, H., Navarro-Lisboa, R. and Lopez de Dicastillo, C. 2016. Evaluation of polyphenol content and antioxidant capacity of fruits and vegetables using a modified enzymatic extraction. *Food Technology and Biotechnology*. 54(4): 462-467. 10.17113/ftb.54.04.16.4497

AOAC: *Official methods of analysis of the Association of Official Analytical Chemists.* 1995. (16th Ed). Washington DC: Association of Official Analytical Chemists.

Aras, N.K. and Ataman, O.Y. 2007. *Trace Element Analysis of Food and Diet*. Royal Society of Chemistry. 10.1039/9781847552495.

Barola, A., Tewari, A. and Kabdwa, N.C. 2022. Effect of pre-treatments and drying methods on nutritional quality of rhododendron arboreum, west himalaya. *Journal of Advanced Scientific Research*. 13(02): 121-128. https://doi.org/10.55218/JASR.202213216

Bhattacharyya, D. and Sanjappa, M. 2008. Rhododendron habitats in India. *Journal American Rhododendron Society.* Winter. 14-18.

Ji, H.F., Du, A.L., Zhang, L.W., Xu, C.Y., Yang, M.D. and Li, F.F. 2012. Effects of drying methods on antioxidant properties in *Robinia pseudoacacia* L. flowers. *J. Med. Plants Res*. 6(16): 3233-3239. 10.5897/JMPR12.107

Kamtekar, S., Keer, V. and Patil, V. 2014. Estimation of phenolic content, flavonoid content, antioxidant and alpha amylase inhibitory activity of marketed polyherbal formulation. *Journal of Applied Pharmaceutical Science*. 4(9): 061-065.10.7324/JAPS.2014.40911

Kashyap, P., Anand, S. and Thakur, A. 2017. Evaluation of antioxidant and antimicrobial activity of Rhododendron arboreum flowers extract. *International Journal of Food and Fermentation Technology*. 7(1): 123-128.10.5958/2277-9396.2017.00013.7

Liman, M.G., Abdullahi, A.S., Maigoro, A.L. and Umar, K., 2014. Effects of three drying techniques on mineral composition of some leafy garden vegetables. *IOSR J. Applied Chem*. 7(1): 38-42. DOI:10.9790/5736-07123842

Nisar, M., Ali, S. and Qaisar, M. 2013. Antibacterial and cytotoxic activities of the methanolic extracts of Rhododendron arboreum. *J Med Plants Res.* 7(8): 398-403.

Panda, S. and Kirtania, I. 2016. Variation in *Rhododendron arboreum* Sm. complex (Ericaceae): insights from exomorphology, leaf anatomy and pollen morphology. *Modern Phytomorphology*. 9(34): 24-49.

Sharma, A., Bachheti, A., Sharma, P., Bachheti, R.K. and Husen, A. 2020. Phytochemistry, pharmacological activities, nanoparticle fabrication, commercial products and waste utilization of *Carica papaya* L.: A comprehensive review. *Current Research in Biotechnology*. 2 : 145-160. doi.org/10.1016/j.crbiot.2020.11.001

Singh, K.K., Rai, L.K. and Nepal, L.H. 2013. In vitro propagation of *Rhododendron niveum* Hook F (state tree of Sikkim) an endangered rhododendron species of Sikkim Himalaya. *Cibtech J Biotechnol*. 2(1): 53-60.

Sonar, P.K., Singh, R., Khan, S. and Saraf, S.K. 2012. Isolation, characterization and activity of the flowers of *Rhododendron arboreum* (Ericaceae). *Journal of Chemistry*. 9 : 631-636.

Tewari, D., Sah, A.N. and Bawari, S. 2018. Pharmacognostical Evaluation of *Rhododendron arboreum* Sm. from Uttarakhand. *Pharmacognosy Journal*. 10(3): 10.5530/pj.2018.3.86

Wojdylo, A., Lech, K. and Nowicka, P. 2020. Effects of different drying methods on the retention of bioactive compounds, on-line antioxidant capacity and color of the novel snack from red-fleshed apples. *Molecules*. 25(23): 5521. doi.org/10.3390/molecules25235521