*International Journal Of*

**Recent Scientific Research**

**ISSN: 0976-3031**

**Volume: 7(11) November -2015**

# NUTRITIONAL COMPOSITION AND BIOLOGICAL ACTIVITIES OF RASBHARI: AN OVERVIEW

**Kirti Joshi and Ila Joshi**

THE OFFICIAL PUBLICATION OF
INTERNATIONAL JOURNAL OF RECENT SCIENTIFIC RESEARCH (IJRSR)
http://www.recentscientific.com/ recentscientific@gmail.com

ISSN: 0976-3031

Available Online at http://www.recentscientific.com

*International Journal of Recent Scientific Research*
*Vol. 6, Issue, 11, pp. 7508-7512, November, 2015*

*International Journal of Recent Scientific Research*

RESEARCH ARTICLE

# NUTRITIONAL COMPOSITION AND BIOLOGICAL ACTIVITIES OF *RASBHARI*: AN OVERVIEW

**Kirti Joshi[1*] and Ila Joshi[2]**

Department of Home Science, The IIS University, Jaipur

**ARTICLE INFO**

***Article History:***
Received 05th August, 2015
Received in revised form 08th September, 2015
Accepted 10th October, 2015
Published online 28st November, 2015

***Key words:***

Rasbhari; physalis peruviana; Cape gooseberry; biological activity; nutrient content

**ABSTRACT**

Exotic fruits play an important role in nutrition as an excellent base for low calorie and dietetic products. Highly valued for its unique flavour, texture and colour, recent research has shown rasbhari (Physalis peruviana) to be high in many beneficial compounds. With the rapidly growing popularity of this unique fruit it is important to have a comprehensive reference for its nutritional benefits. This review provides a valuable source for current knowledge on nutritional composition and the relation of their physiologically active components with beneficial effects on human health, through scientifically proven information and further development of rasbhari for functional foods as well as nutraceutical and pharmaceutical industries.



## INTRODUCTION

The fruits of rasbhari (Physalis peruviana) are also named as goldenberry, gooseberry, Cape gooseberry, and winter cherry all over the world (Hassanien, 2011; Mericli, 2011). Physalis species are grown naturally and cultured in a wide range of countries including North and South African countries, India, Australia, New Zealand, Ecuador, Venezuela, Colombia, Chile and Peru (Mericli, 2011). Cape gooseberry or goldenberry (Physalis peruviana) is a herbaceous, semi-shrub, upright and perennial plant in subtropical zones. They are golden spheres, the size of marbles, with a pleasing taste. They are protected by papery husks that act as a protecting shield against insects, birds, diseases and adverse climatic situations (Hassanien, 2011; Puente *et al*., 2011). The fruit may contain between 150 and 300 seeds, with a diameter ranging between 12.5 and 25.0 mm and weighing from 4 to 9 g each. The seeds are partially or totally enclosed in a papery husk in the shape of a balloon, known as the calyx (Nutrisilva and Agra, 2005; Avila *et al*., 2006).The fruit is somewhat tomato-like in flavour and appearance and taste (sweet and sour) is much richer with a hint of tropical luxuriance (Ramadan, 2011).

Once unwrap from its husk, it can be consumed as such. In addition to having a potential as fresh fruit, rasbhari can be used in salads as flavouring agent in cooked dishes, desserts and jam. Moreover, rasbhari have been widely used in folk medicine as they have the therapeutic property. They are used for treating diseases like cancer, leukemia, malaria, asthma, hepatitis, dermatitis and rheumatism. Despite the therapeutic properties, rasbhari also has some remarkable bioactivities such as anti-pyretic, anti-inflammatory, anti-allergic, anti-ulcer, anti-microbial, anti-oxidant and hepatoprotective (Ramadan, 2011; Zhang *et al*., 2013; Tammu and Ramana, 2015).The oleaginous fruit by-products may become one of the important oil sources. The oil is rich in essential fatty acids, natural antioxidants and phytosterols (Ramadan and Moersel, 2003). The pulp of rasbhari fruit is nutritious, containing particularly high levels of carotenoids, vitamin C and minerals. Many chemical compounds viz. 28-hydroxywithanolide, withanolides, phygrine, kaempferol and quercetin di and tri-glycosides are reported to be present in rasbhari (Ramadan and Morsel, 2003; Szefer and Nriagu, 2007; Borchani *et al*., 2011).

The commercial attention in this fruit has grown due to its nutritional properties related to high antioxidants, minerals and vitamin content as well as its medicinal properties like anti-pyretic and anti-allergic. In spite of its beneficial abilities, only a small number of studies have been carried out with regard to the nutritional composition and bioactivities of rasbhari. This review provides a supportive source for existing information on nutritional composition, pharmacological properties and development of rasbhari for functional foods as well as nutraceutical and pharmaceutical industries.

**Corresponding author:* **Kirti Joshi**
Department of Home Science, The IIS University, Jaipur

**Table 1** Physicochemical parameters of fresh rasbhari fruit

| Physicochemical parameter | Content | | |
|---|---|---|---|
| | Labarca(2013) | Marin (2009) | Botero (2008) |
| ˚Brix | 15.00 ± 0.06 | 14.30 ± 0.80 | 13.73 ± 0.49 |
| pH | 03.80 ± 0.01 | 03.39 ± 0.06 | 03.67 ± 0.12 |
| Acidity (%) | 01.24 ± 0.18 | 02.05 ± 0.15 | 01.90 ± 0.26 |
| Water activity ($a_w$) | 0.93 ± 0.00 | 00.99 ± 0.00 | 00.99 ± 0.03 |

**Table 2** Proximate nutrient content of rasbhari fruit (per 100 g of fruit)

| Nutrient | Osorio and Roldan (2003) | Carrasco and Zelada (2008) | Rodrigues *et al.* (2009) |
|---|---|---|---|
| Energy (kcal/100g) | 49.00 | 76.80 | 88.72 |
| Moisture (g/100g) | 85.90 | 79.80 | 80.97 |
| Protein (g/100g) | 01.50 | 01.90 | 01.85 |
| Fat (g/100g) | 00.50 | 00.00 | 03.16 |
| Carbohydrate (g/100) | 11.00 | 17.30 | 13.22 |
| Fiber (g/100g) | 00.40 | 03.60 | - |
| Ash (g/100g) | 00.70 | 01.00 | 00.80 |

**Table 3** Vitamin content of rasbhari fruit (per 100 g of pulp)

| Vitamins | Osorio and Roldan (2003) | Ramadan and Morsel (2004) |
|---|---|---|
| Carotene (mg/100g) | 01.04 (1730 IU) | 01.60 |
| Thiamine (mg/100g) | 00.10 | 00.10 |
| Riboflavin (mg/100g) | 00.17 | 00.03 |
| Niacin (mg/100g) | 00.80 | 01.70 |
| Ascorbic acid (mg/100g) | 20.0 | 43.0 |

**Table 4** Mineral content of rasbhari fruit (per 100 g of pulp)

| Minerals | Leterme *et al.* (2006) | Musinguzi *et al.* (2007) | Carrasco and Zelada (2008) |
|---|---|---|---|
| Sodium (mg/100g) | 06.00 | 02.00 | - |
| Potassium (mg/100g) | 467.00 | 210.00 | 292.65 |
| Calcium (mg/100g) | 23.00 | 28.00 | 10.55 |
| Magnesium (mg/100g) | 19.00 | 07.00 | - |
| Phosphorus (mg/100g) | 27.00 | 34.00 | 37.90 |
| Iron (mg/100g) | 00.09 | 00.30 | 01.24 |
| Zinc (mg/100g) | 00.28 | - | 00.40 |

***Physicochemical composition of rasbhari fruit***

According to the study conducted by Labarca (2013), the fresh rasbhari shows physicochemical characteristics with a pH of 3.80±0.01, 15±0.06˚Brix, acidity with a percentage of 1.24±0.18 and water activity of 0.931±0.002. Physicochemical parameters of fresh rasbhari fruit, assessed by various researchers is presented in Table 1.

***Proximate composition of rasbhari fruit***

The protein content of rasbhari ranges from 0.05g/100g (Ramadan and Morsel, 2004) to 2.01g/100g (Labarce *et al.*, 2013). Elsheikha *et al.* (2010) concluded in their research that 31.8% of essential amino acids mainly leucine, lysine and isolucine are present in the fruit. The fat content of rasbhari ranges from 0.0g/100g to 3.16g/100g (Rodrigues *et al.*, 2009). Study conducted by Ramadan and Morsel (2003) concluded that rasbhari contain 2% oil, out of which 1.8% oil content is present in seeds and 0.2% in the pulp and skin of the fruit. Rodrigues *et al.*,(2009) in a study on mineral and essential fatty acids content of the exotic fruit Physalis peruviana found that fatty acid profile consist of higher concentration of linoleic acid (72.42%) and oleic acid content (10.3%). The dietary lipid rich in linoleic acid helps in preventing cardiovascular diseases. Saturated fatty acid content represent 12.87% , with palmitic acid to be 8.62% & 9.00% and steric acid 2.65% & 2.5% as evaluated by Ramadan and Morsel (2003); Rodrigues *et al.*, (2009) respectively.

The carbohydrate content of rasbhari ranges from 11g/100 g (Osorio and Roldan, 2003) to 19.6g/100g (Ramadan and Morsel, 2004). Nova *et al.*, 2006 evaluated three sugars in rasbhari fruit which showed fructose to be present in limited amount, whereas glucose to be the abundant sugar followed by sucrose. In addition rasbhari is an interesting source of fiber ranging from 0.4g/100g (Osorio and Roldan, 2003) to 5.67g/100g which acts as a bulk agent, normalizing intestinal motility and preventing diverticular diseases (Borchani *et al.*, 2011).

***Vitamins***

Vitamins cannot be synthesized in the body and must be supplied through foods to maintain health, growth and the state of well being of a person (Srilakshmi, 2013). Rasbhari fruit is highly nutritious having high levels of vitamins A, B, C and E. The pro-vitamin A (β- carotene) content of rasbhari is also high. Puente *et al.*, (2010) reported β- carotene content in rasbhari to be 1460 mg /100g, whereas Labarca *et al.*, (2013) reported 1074.67 mg/100g. Carotenoids are responsible for the orange colour of rasbhari fruit which are very important in the prevention of certain degenerative diseases viz cancer. The reason that carotenoids prevent cancer is related to its antioxidant activity that deactivates free radicals generated in the tissues (Castro *et al.*, 2008).

Thiamine (vitamin $B_1$) content of rasbhari is 0.1mg/100g as reported by Osorio and Roldan (2003) and Ramadan and Morsel (2004).The niacin (vitamin $B_3$) content of rasbhari fruit ranges from 0.80 mg/100g (Osorio and Roldan, 2003) to 1.70mg/100g (Ramadan and Morsel, 2004). The ascorbic acid content of fresh rasbhari is 26.31mg/100g (Labarca *et al.*, 2013) which is in the range of values previously reported by Ramadan and Morsel (2004) i.e. 43mg/100g. Ascorbic acid is an important dietary antioxidant, since it reduces the adverse effects of reactive oxygen that cause damage to macro molecules related to cardiovascular diseases and cancer (Naidu, 2003).

According to Ramadan *et al.*, (2003) the oil extracted from fruit pulp contains extremely high level of vitamin E. The α tocopherol content is 22.50g/kg of total lipids in the oils extracted from pulp and skin of rasbhari, whereas the β-tocopherol content is 13.10g/kg of total lipids. Alpha-tocopherol is a natural antioxidant that can eliminate reactive oxygen species. The oils extracted from rasbhari fruit were characterizied by high levels of vitamin $K_1$. It comprises 2.12g/kg of total lipids in the pulp and skin oil and 0.12g/kg of total lipids in rasbhari seed oil (Ramadan and Morsel, 2003).

***Minerals***

Minerals play several important roles as cofactors and regulators of bio-chemical reactions (Srilakshmi, 2012). The rasbhari fruit contains iron, phosphorus and potassium. Rodrigues (2009) reported iron content in rasbhari fruit close to 1.47 mg/100g which was 5 to 15 times higher when compared with papaya, apple, orange and strawberry. The rasbhari fruit has exceptionally high phosphorus content i.e., 292.65mg/100g (Carrasco and Zelada, 2008). Musinguzi *et al*., (2007) compared the mineral content of Physalis peruviana and Physalis inima and concluded that Physalis peruviana is rich in potassium with a value close to 210 mg/100g, whereas it is only 2.43 mg/100g in Physalis minima. Carrasco and Zalada (2008) and Rodrigus (2009) indicated the presence of zinc in rasbhari fruit as 0.40 mg/100g. Manganese is found in relatively high quantities i.e., 0.26mg/100g.

***Biological Activities of Rasbhari***

***Hepato -protective activity***

Chang *et al*., (2008) conducted a study to examine the antioxidant activities of rasbhari (Physalis peruvia). The study concludes antioxidant activity and potent hepatoprotective effect against induced liver injury in rat. Using different models of antioxidant assay, namely ferric thiocyanate, 2,2-diphenyl-1-picrylhydrazyl (DPPH), and reducing power, rasbhari extract showed a dose-dependent increase in antioxidant activities, with total antioxidant activity ($IC_{50}$: 0.81 µg/ml). The study concluded that rasbhari possesses antioxidant activity and potent hepatoprotective effect.

***Anti-inflammatory activity***

Franco *et al.,* (2008) determined the pharmacological activity of rasbhari fruit on mice with acute inflammation. In this study the anti-inflammatory activities of the fruit extract, using percolation and different solvents, was investigated. On the basis of Draize test the anti-inflammatory activity against various fruit juice concentrations were evaluated. Conclusion showed that rasbhari fruit was mild anti- inflammatory when compared with methylprednisolone, an anti-inflammatory drug.

***Reno-protective activity***

Ahmad (2014) worked on the reno protective effect of rasbhari extract on acute renal injury in rats. The extracted doses improved kidney histology and reduced the level of thiobarbituric acid reactive substances and improved other antioxidant enzymes in kidney homogenate compared to cisplatin group.

***Anti-hyperglycemia and anti-hypertension Potential***

A study conducted by Rodriguez and Rodriguez (2007) showed anti hyperglycemia and anti-hypertension potential of rasbhari. The results indicated that eating the fruit of rasbhari reduced blood glucose after 90 minutes postprandial in young adults, causing a greater hypoglycemic effect after this period.

***Antioxidants and Superoxide Anion Scavenging***

Rasbhari has been proved to have antioxidant activities (Wu *et al*., 2005). The antioxidant activity of rasbhari juices is not a property of a single phytochemical compound, but the synergistic effect of different antioxidants existing in the juice. The ethanolic extract prepared from different concentrations (20, 40, 60, 80 and 95% ethanolic extract) and hot water extract from the whole plant were evaluated for antioxidant activities. The study concluded that ethanol extracts of rasbhari possess good antioxidant activities. The value for highest antioxidant property was obtained from the 95% ethanolic extract. A direct correlation was found between the antioxidant effectiveness of rasbhari juice and their total fat-soluble bioactive (tocopherols, sterols and carotenoids) content.

***Uses and Medicinal properties of rasbhari***

Epidemiological studies indicate that increased consumption of fruits and vegetables are associated with lower risk of chronic degenerative diseases (Reddy *et al*., 2010). Currently, there are different products processed from the fruit of rasbhari, such as, jams and chocolate-covered candies. It can also be processed for juice (Ramadan and Moersel, 2007), pomace (Ramadan and Moersel, 2009) and other products, sweetened with sugar as a snack. In European markets, it is used as ornaments in meals, salads, desserts and cakes (Cedeno *et al*., 2004). The juice of the ripe fruit of rasbhari is high in pectinase, reducing costs in the preparation of jams and other similar preparations (Corporation Colombian International, 2001).

Many medicinal properties are attributed to rasbhari such as antispasmodic, diuretic, antiseptic, sedative, analgesic, helping to fortify the optic nerve, throat trouble relief, elimination of intestinal parasites and amoeba. So far, there are no studies that indicate possible adverse effects (Rodriguez and Rodriguez, 2007). In different regions of Colombia, some of its medicinal properties are to purify blood of kidneys, decrease albumin, clean the cataract, to calcify and control amoebiasis (Corporation Colombian International, 2001).

In Peruvian traditional medicine the fruit of rasbhari, is used empirically to treat cancer and other diseases like hepatitis, asthma, malaria and dermatitis, however, their properties have not been scientifically proven (Zavala *et al*., 2006).There are studies indicating that eating the fruit of rasbhari reduces blood glucose after 90 minutes postprandial in young adults, causing a greater hypoglycemic effect after this period (Rodriguez and Rodriguez, 2007).

## CONCLUSION

Rasbhari was known for centuries, but the potential of this fruit for intensive cultivation has only just begun to be explored. Because of its unique properties, rasbhari could be a suitable plant for different food applications. The development of adequate agro-technical methods can make this fruit a promising profitable new crop for arid regions. Rasbhari can be a very interesting fruit for the processing of new functional foods and drinks. Its pulp, seed and pomace oil might serve as excellent dietary sources for vitamin K1, α-linoleic acid,

essential fatty acids, tocopherols and carotenoids. In addition to this, rasbhari shows potential evidences for the development of a phytomedicine against many diseases. Thus there is a very wide scope for scientific exploration of rasbhari as a new source of bioactive and functional food.

## References


1. Ahmad, L. 2014. Renoprotective effect of Egyptian cape gooseberry fruit (Physalis peruviana) against acute renal injuries in rats. *The Scientific World Journal*, 10(1):39-48.
2. Avila, J. A., Moreno, P., Fischer, G. and Miranda, D. 2006. Influence of fruit maturity and calyx drying in gooseberry (Physalis peruviana L.), stored at 18˚C. *Acta Agronomica*, 55(4): 29-38.
3. Borchani, C., Besbes, S., Masmoudi, M., Blecker, C., Paquot ,M. and Attia ,M . 2011. Effect of drying methods on physico-chemical and antioxidant properties of date fibre concentrates. Food Chemistry, 125:1194–1201.
4. Castro, A., Rodriguez, L. and Vargas, E. 2008. Dry gooseberry (Physalis peruviana ) with pretreatment of osmotic dehydration. *Journal of the Faculty of Chemistry Pharmaceutical*, 15 (2): 226-231.
5. Carrasco, R., and Zelada, C. 2008. Determination of antioxidant capacity and bioactive compounds in native Peruvian fruits. *Journal of the Chemical Society Peru*, 74 (2):108-124.
6. Corporation Colombia International (CCI) 2001. Uchuva. Product profile Bogota: Market Intelligence System, 33(13):1-12.
7. Cedeno, M. and Montenegro, D. 2004. Exporter, logistics and marketing uchuva the US market for SCI Ltda FRUTEXPO Plan. *Journal of the Faculty of Engineering, Industrial engineer*. : Bogota Javeriana University.
8. Franco, L., Matiz, G., Calle, J., Pinzon, R. and Ospina, L. 2007. Anti-inflammatory activity of Extracts and fractions obtained from Physalis peruviana L. calyces. Biomedica, 27(1):110−115.
9. Hassanien, M. F. R. 2011. Physalis Peruviana: A rich source of bioactive phytochemicals for functional foods and pharmaceutical. *Food Reviews International*, 27(3):259–273.
10. Labarca, V. B., Vicuna, C.G., Alvarez, P.F., Fuentes, I.Q. and Won, M. P. 2013. Extraction of β-carotene, vitamin C and antioxidant compounds from Physalis peruviana (Cape gooseberry) assisted by high hydrostatic pressure. *Journal of Food and Nutrition Science*, 4:109-118.
11. Mericli, F.2011. The strawberry fruit (Physalis peruviana). Fitomed. 20: 18-22.
12. Musinguzi, E., Kikafunda, J. and Kiremire, B. 2007. Promoting indigenous wild edible fruits to complement roots and tuber crops in alleviating vitamin A deficiencies in Uganda. Proceedings of the 13th ISTRC Symposium, 763-769.
13. Naidu, K. 2003. Vitamin C in human health and disease is still a mystery? *An overview. Nutritional Journal*, 2(1): 1-10.
14. Nova, R. H., Bojacá, M., Galvis , J. A. and Fischer, G. 2006. Fruit maturity and calyx drying influence post-harvest behavior of Capegooseberry (Physalis peruviana L.) stored at 12 ºC. Agronomía Colombiana, 24 (1): 77-86.
15. Nutrisilva, K. and Agra, M. F. 2005. Comparative study on Nicandra physalodes pharmocobotanical and Physalis angulata (Solanaceae). Brazilian *Journal of Pharmacognosy*. 15(4): 344-351.
16. Osorio, D. and Roldan, J. 2003. Returning to the field: uchuva manual. *Bogota:* Group Latino LTDA.
17. Puente, L. A., Pinto-Munoz, C. A., Castro, E. S. and Cortes, M. 2011. Physalis peruviana Linnaeus, the multiple properties of a highly functional fruit: *A review. Food Research Intrenational,* 44(7): 1733–1740.
18. Ramadan, M. F. and Morsel, J. 2003. Oil Goldenberry (Physalis peruviana L.).*Journal of Agriculture and Food Chemistry*, 51: 969–974.
19. Ramadan, M. F. and Morsel, J. T. 2004. Goldenberry: *A novel fruit source of fat soluble* bioactives. Inform. 15: 130−131.
20. Ramadan, M. F. and Morsel, J. T. 2007. Impact of enzymatic treatment on chemical composition, physicochemical properties and radical scavenging activity of goldenberry (Physalis peruviana L.) juice. *Journal of the Science of Food and Agriculture*, 87: 452−460.
21. Ramadan, M. F. 2011. Bioactive phytochemicals, nutritional value, and functional properties of capegooseberry (Physalis peruviana*): An overview. Food Research International*, 44: 1830-1836.
22. Reddy, C. V. K., Sreeramulu, D. and Raghunath, M. 2010. Antioxidant activity of fresh and Dry fruits commonly consumed in India. *Food Research International*, 43: 285−288.
23. Rodrigues, E., Rockenbach, I. I., Cataneo, C., Gonzaga, L.V., Chaves, E.S. and Fett, R. 2009. Minerals and essential fatty acids of the exotic fruit Physalis peruviana L. *Journal of Food Science and Technology*, 29(3): 2009.
24. Rodriguez, S. and Rodroguez, E. 2007. Effect of intake of Physalis peruviana (aguaymanto) on postprandial glycemia in young adults. Vallejiana *Jouranal of Medicine,* 4 (1): 43-52.
25. Srilakshmi, B. 2012 .Nutrition Science. New Delhi: *New age International (p) limited*.
26. Szefer, P. and Nriagu, J. 2007. Mineral components in foods. New York: CRC Press.
27. Zavala, D., Mauricio, Q., Pelayo, A., Posso, M., Rojas, J. and Wolach, V. 2006. Citotoxic Effect of Physalis peruviana (capuli) in colon cancer and chronic myeloid leukemia. *Annals of the Faculty of Medicine*, 67(4): 283−289.
28. Zhang, Y. J., Deng, G. F. , Xu, X. R., Wu, S., Li, S. and Li, H.B. 2013. Chemical Components and Bioactivities of Cape Gooseberry (Physalis peruviana). *International Journal of Food Nutrition and Safety*, 3(1): 15-24.
29. Tammu, J. and Ramana, K.V.2015 Pharmacological review on Physalis species: A potential herbal cure-all. *World Journal of Pharmaceutical Research*. 4 (2):247-256.
30. El Sheikha, A.F., Zaki, M.S., Bakr,A.A., El Habasuy, M.M, and Montet,D.2010. Biochemical and sensory quality of *Physalis ( Physalis pubscens L.*) juice. *Journal of Food Processing and Preservation*.34(3):541-555.

**How to cite this article:**
Kirti JoshiKirti Joshi1, Ila Joshi, .Nutritional Composition and Biological Activities of Rasbhari: An Overview. *International Journal of Recent Scientific Research Vol. 6, Issue,11, pp.7508-7512, November, 2015*

*******

ISSN 0976-3031