

DOI No.: <http://doi.org/10.53550/EEC.2022.v28i07s.040>

# Nutritional Quality of Red Cabbage (*Brassica oleracea* var. *Capitata* F. *Rubra*): A Review

Ajay Gandhi\*, Kunal Soga, Vishal Thakur and Dipika Mal

Department of Horticulture,  
Lovely Professional University, School of Agriculture, Phagwara 144 411, Punjab, India

(Received 3 April, 2022; Accepted 10 May, 2022)

## ABSTRACT

Red cabbage (*Brassica oleracea* var. *capitata* f. *rubra*) is a vegetable famous for its rich bioactive compounds. The maximum critical characteristics element of cruciferous vegetable with diagnosed anticancer properties are glucosinolates. Red cabbage is substantially used in meals processing to increase the aesthetic value of food as natural colorant in beverages and health benefits. It has many health benefits over most cancer, diabetes and also boosts immune system. It also support in detoxification of body, weight loss, improves skin reduce irritation has intestine recovery strength, relieves constipation. The antioxidant potential of red cabbage facilitates to save us chronic ailments and management of condition like Alzheimer's, melancholy etc.

**Key words:** *Brassica oleracea* var. *capitata* f. *rubra*, *Glucosinolates*, *Antioxidant* and *anthocyanin*.

## Introduction

Now people are paying more attention to the issue of food nutrition. Farmers must also choose an economically important crop in order to sustain their agricultural practices. Red cabbage is a cool-season green vegetable that belongs to the cole crop family (Brassicaceae family). This crop has been dubbed "the modern multitasker's ideal food" because of the multiple benefits it provides (Das *et al.*, 2014). Brassicaceae vegetables are an important part of people's diets all over the world, and are considered basic food crops in China, Japan, and India, as well as European countries (Rubatzky *et al.*, 2012). The red cabbage is not only functions as an antioxidant but also has a number of health-promoting properties due to its bioactive ingredients (Patras *et al.*, 2011).

Red cabbage is a cruciferous vegetable that thrives in the cooler months of the year. Further-

more, unusual crops such as red cabbage have ten times the amount of vitamin A and double the amount of iron as green cabbage, which is what draws the most customers in terms of nutritional value (Sarkar and Rakshit, 2017). Another advantage of producing red cabbage is that it is affordable to cultivate, the crop produces quickly, and harvesting and storage processes are simple. Red cabbage is a type of cabbage that is widely grown in the Mediterranean region and other parts of the world (Chauhan *et al.*, 2016) Red Cabbage is a dicotyledonous flowering herbaceous biennial plant. It has a short stem with a crown and a red-colored head on top. Purple cabbage or (red cabbage) gets its name from the pigment anthocyanin, which turns the leaves purple or red. The color of the soil varies depending on the PH level. Acidic soil produces reddish leaves, neutral soil produces purple leaves, and alkaline soil produces greenish yellow cabbage (Manasa *et al.*, 2017). The ideal temperature for

growth is 15-18° C. It is less resistant to high temperatures, but it can tolerate them and after preparation red cabbage also known as purple cabbage or red and blue kraut.

The genus *Brassica* is categorized as:

<b>Kingdom</b>	Plantae
<b>Subdivision</b>	Spermatophyta
<b>Class</b>	Angio-spermae
<b>Sub-class</b>	Dicotyledonae
<b>Order</b>	<i>Papaverales</i>
<b>Family</b>	<i>Brassicaceae</i>
<b>Genus</b>	<i>Brassica</i>
<b>Species</b>	<i>Brassica oleracea</i>
<b>Subspecies/var.</b>	<i>Capitata f. rubra</i>

Source: (Pereira *et al.*, 2011)

### Chemical constituents present in red cabbage

*Brassica oleracea* is high in polyphenols, especially flavonoids (Abhishek *et al.*, 2017). It also includes ascorbic acid, vitamin E, amino acids, kaempferol, lutein, quercetin, and glucosinolates, as well as kaempferol, lutein, flavones quercetin, and glucosinolates (Ferguson *et al.*, 2012). Red cabbage has the highest levels of vitamins, anthocyanins, and carotenes (Murador *et al.*, 2016) followed by broccoli and Brussel sprout, which have moderate levels, and cabbage and cauliflower, which have lower levels. Glucosinolates (isothiocyanates), vitamins A, C and K and anthocyanins are the main components of red cabbage (Zayed *et al.*, 2022). Red Cabbage may be able to control and thus maximize its calcium, phosphorus, iron, copper, and manganese concentrations. Palmitic, linoleic, and linolenic acids were the most abundant fatty acids, with a high proportion of unsaturated fatty acids (Hasan *et al.*, 2012).

Food colorant is abundant in red cabbage. Vitamins that function as antioxidants are abundant in cruciferous vegetables, a compound that may protect against too many of degenerative diseases.

The Nutritional value of red cabbage per 100 g of fresh:

Carbohydrates	6.1 g
Proteins	1.4 g
Vitamin A	2 µg
Total fat	0.030 g
Dietary fiber	2.60 g
Vitamin C	57 mg
Beta carotene	20 µg
Sugar	3.32 g

Vitamin K	47.6 µg
Anthocyanin pigment	1.6 g
Potassium	206 mg
Calories	27 kcal
Calcium	51 mg

(Draghici *et al.*, 2013)

### Phytochemical constituents

Red cabbage consist many phytochemical elements i.e. Alkaloids, glycosides, steroids, flavonoids, saponnin, tannin, terpenoids and phytosterols (Waghulde *et al.*, 2018).

### Therapeutic Uses

*Brassica oleracea* is a crop plant that is used for its significant food reserves that are stored in its leaves during the winter time. It's high in vitamins A and C, as well as other basic nutrients (Francisco *et al.*, 2017). In human body, a diet rich in brassicaceae vegetables like broccoli cauliflower and cabbage has been linked to a reduced risk of various cancers (Chauhan *et al.*, 2016).

**Anti-ulcer:** Red cabbage's anti-inflammatory properties can help into the curing stomach ulcers and speed up the healing process. It protects the stomach lining from stomach acid, which may aggravate ulcers. Red cabbage will help your stomach feel better if we eat it in small amounts during the day (Hafidh *et al.*, 2016).

**Skin disorder:** Red cabbage's antioxidant and anti-inflammatory properties make it an excellent cure for skin conditions like eczema (Dzia<sup>3</sup>o *et al.*, 2016). The presence of sulphur in red cabbage adds to these advantages. Sulfur is a mineral that is commonly found in many skin medications.

### Pharmacological Activities

Antiplatelet and Anti-oxidative Activity on Platelet The ability of anthocyanins derived from red cabbage to reduce platelet activation by antioxidative activity was the subject of one of the in-vitro technical study (Saluk *et al.*, 2012). The anti-aggregatory property of anthocyanins in the presence of thrombin was discovered by inhibiting arachidonic acid metabolism, which contributes to malondialdehyde, as well as a significant reduction in oxygen generation. When human blood platelets were exposed to the strong oxidising agent peroxynitrite and hydrogen peroxide in the same sample, the findings

showed that the ATH extract of red cabbage reduced protein oxidation and nitration while also preventing lipid peroxidation in blood platelets. This and other studies show that anthocyanins have antiradical activity by preventing lipid peroxidation, which is one of the ways anthocyanins protect cells from oxidative damage and retain membrane coherence. According to study, red cabbage anthocyanins have antiplatelet and antioxidative activity, which may be beneficial in the treatment of cardiovascular diseases (Cruz *et al.*, 2016).

### Anti cancerous properties

Red cabbage was tested for anticancer activity in human hepatocarcinoma cells (HepG2) and human cervical cancer cells (HeLa) (Morsy *et al.*, 2010). When compared to HepG2, the study's findings showed a selective anticancer effect on HeLa cells. In treated human cancer cells, red cabbage (RC) extract is found to be a potent inducer of apoptosis through caspase based both intrinsic and extrinsic pathways, as well as a caspase independent pathway. Furthermore, the study discovered an increased level of TNF, suggesting that the growth inhibition in (HepG2) and (HeLa) could be due in part to TNF's antitumor effect. As a result of its multimechanism and synergistic anticancer effect, the study concluded that red cabbage extract could be a promising anticancer agent (Hafidh *et al.*, 2013).

#### Anti-Inflammatory, Antipyretic and Analgesic

*Brassica oleracea* contains the anti-oxidant and anti-inflammatory properties. The highest overall anti-oxidant content is found in red heads, followed by savoy. The antioxidant activity of red cabbage was 80.8 mol TE/g fw, which was the highest FRAP (ferric reducing antioxidant power) antioxidant activity (Rameshwar *et al.*, 2016).

### Anthocyanin and ascorbic acid content

Anthocyanin (ATH) is belong to family flavonoids and it is a water-soluble pigment in the plant kingdom. Red cabbage contain high levels of anthocyanin. The composition of anthocyanin in red cabbage is approximate 322 mg /100 g of fresh weights (Saluk *et al.*, 2012) Red cabbage helps to prevent us from cardiovascular disorder. The presence of anthocyanin in red cabbage also help in activation of blood platelet and for investigating the effect of exposing platelet of lipids and protein to the powerful oxidative agents that is peroxy nitrite and hydrogen

peroxide. Activation of blood platelets helps in the development of CVDs (Mattioli *et al.*, 2020). Therefore the properties of anti-platelet which is present in the dietary element of plant, vegetable and fruit are helpful for discover new ingredients inhibiting platelet hyperactivity without any bad effect.

### Conclusion

Red cabbage is the most nutritious brassica vegetable. The antioxidant function of red cabbage is responsible for its health benefits. Red cabbage is a cheap and readily available source of anthocyanin. Despite the fact that preclinical studies have shown that red cabbage is a promising source for its disease-fighting properties, there are some drawbacks, and further clinical trials for its therapeutic usage should be performed.

Red cabbage contains many phytochemicals or compounds that have been shown to minimize the risk of cancer, neurodegenerative disorders, diabetes, and other major diseases. As a result, the nutritional importance of fatty acids, which are responsible for the promotion of human health.

### References

- Abhishek, C., Negi, P. S. and Singh, N. K. 2017. Combining ability for flavonoids, flavonols and total phenols in cabbage (*Brassica oleracea* var. capitata L). *Vegetos* 30: 4. Doi : 10.4172/2229, 4473, 20-39.
- Chauhan, E. S., Tiwari, A. and Singh, A. 2016. Phytochemical screening of red cabbage (*Brassica oleracea*) powder and juice-A comparative study. *Journal of Medicinal Plants Studies*. 4(5): 196-199.
- Cruz, A. B., Pitz, H. D. S., Veber, B., Bini, L. A., Maraschin, M. and Zeni, A. L. B. 2016. Assessment of bioactive metabolites and hypolipidemic effect of polyphenolic-rich red cabbage extract. *Pharmaceutical Biology*. 54(12): 3033-3039.
- Das, R., Thapa, U., Mandal, A. R., Lyngdoh, Y. A., Kulshreshtha, S. K. and Debnath, S. 2014. Response of red cabbage (*Brassica oleracea* var. capitata f. rubra) to the integrated use of chemical fertilizers, biofertilizers and boron. *Applied Biological Research*. 16(1): 110-113.
- Draghici, G. A., Alexandra, L. M., Aurica-Breica, B., Nica, D., Alda, S., Liana, A. and Despina-Maria, B. 2013. Red cabbage, millennium's functional food. *Journal of Horticulture, Forestry, and Biotechnology*. 17(4): 52-55.
- Dzialo, M., Mierziak, J., Korzun, U., Preisner, M., Szopa, J. and Kulma, A. 2016. The potential of plant pheno-

- lics in prevention and therapy of skin disorders. *International Journal of Molecular Sciences*. 17(2): 160.
- Ferguson, L. R. and Schlothauer, R. C. 2012. The potential role of nutritional genomics tools in validating high health foods for cancer control: broccoli as example. *Molecular Nutrition & Food Research*. 56(1): 126-146.
- Francisco, M., Tortosa, M., MartínezBallesta, M. D. C., Velasco, P., GarcíaViguera, C., and Moreno, D. A. 2017. Nutritional and phytochemical value of Brassica crops from the agrifood perspective. *Annals of Applied Biology*. 170(2) : 273-285.
- Hasan, M. R. and Solaiman, A. H. M. 2012. Efficacy of organic and organic fertilizer on the growth of *Brassica oleracea* L.(Cabbage). *International Journal of Agriculture and Crop Sciences*. 4(3): 128-138.
- Hafidh, R. R., Abdulamir, A. S., Bakar, F. A., Jalilian, F. A., Jahanshiri, F., Abas, F., and Sekawi, Z. 2013. Novel anticancer activity and anticancer mechanisms of *Brassica oleracea* L. var. capitata f. rubra. *European Journal of Integrative Medicine*. 5(5): 450-464.
- Manasa, S., Mukunda, L., Sadarunnisa, S. and Rajasekharam, T. 2017. Studies on effect of spacing on yield and yield attributing parameters of red cabbage (*Brassica oleracea* var. capitata f. rubra). *International J. Current Microbiology and Applied Sciences.*, 6(12): 3143-3147.
- Morsy, A. F., Ibrahima, H. S. and Shalabyb, M. A. 2010. Protective effect of broccoli and red cabbage against hepatocellular carcinoma induced by N-nitrosodiethylamine in rats. *J Am Sci*. 6: 1136-44.
- Murador, D. C., Mercadante, A. Z., and de Rosso, V. V. 2016. Cooking techniques improve the levels of bioactive compounds and antioxidant activity in kale and red cabbage. *Food Chemistry*. 196 : 1101-1107.
- Mattioli, R., Francioso, A., Mosca, L. and Silva, P. 2020. Anthocyanins: A comprehensive review of their chemical properties and health effects on cardiovascular and neurodegenerative diseases. *Molecules*. 25(17): 3809.
- Patras, A., Brunton, N. P., Downey, G., Rawson, A., Warriner, K. and Gernigon, G. 2011. Application of principal component and hierarchical cluster analysis to classify fruits and vegetables commonly consumed in Ireland based on in vitro antioxidant activity. *Journal of Food Composition and Analysis*. 24(2): 250-256.
- Pereira, D. M., Ferreres, F., Valentão, P. and Andrade, P. B. 2011. Brassica Seeds: Metabolomics and Biological Potential. In: *Nuts and Seeds in Health and Disease Prevention*. Academic Press. 83-91.
- Podsèdek, A. 2007. Natural antioxidants and antioxidant capacity of Brassica vegetables: A review. *LWT-Food Science and Technology*. 40(1): 1-11.
- Rubatzky, V. E. and Yamaguchi, M. 2012. *World Vegetables: Principles, Production, and Nutritive Values*. Springer Science & Business Media.
- Saluk, J., Bijak, M., Ko<sup>3</sup>odziejczyk-Czepas, J., Posmyk, M., Janas, K. and Wachowicz, B. 2012. Anthocyanins from red cabbage extract—evidence of protective effects on blood platelets. *Open Life Sciences*. 7(4): 655-663.
- Sudha Rameshwari, K. and Ayshwarya, M. 2016. Anti-Inflammatory and Antipyretic Activity of Methanolic Extracts of *Brassica oleraceae* Var. CapitataRubra. *IJCR*; 8(3) : 27299-27302.
- Sarkar, D. and Rakshit, A. 2017. Red cabbage as potential functional food in the present perspective. *International Journal of Bioresource Science*. 4(1): 7-8.
- Waghulde, S., Khan, N. A., Gorde, N., Kale, M., Naik, P., and Yewale, R. P. 2018. Comparative antimicrobial activity study of *Brassica oleceracea*. In: *Multidisciplinary Digital Publishing Institute Proceedings* 9(1): 64.
- Zayed, A., Sheashea, M., Kassem, I. A. and Farag, M. A. 2022. Red and white cabbages: An updated comparative review of bioactives, extraction methods, processing practices, and health benefits. *Critical Reviews in Food Science and Nutrition*. 1-18.