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## Neutraceutical potential of some rare fruits & vegetables: A Review

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#### Abstract

Vegetables are considered essential for well-balanced diets since they supply vitamins, minerals, dietary fiber, and phytochemicals. Each vegetable group contains a unique combination and amount of these phyto-nutraceuticals, which distinguishes them from other groups and vegetables within their own group. In the daily diet, rare vegetables can add more nutrition as well as play significant role in preventing various chronic diseases. Rare fruits and vegetables mainly include Broccoli, Purple Cabbage, Kiwi, Fig, Pomelo, Star fruit and many more. All of these are rich source of vitamins, minerals and carbohydrate with low fat content. Mainly they are preventive against different cancer and tumors that lead to cancer. The promotion of healthy rare vegetable products has coincided with a surging consumer interested in the healthy functionality of food.

**Keywords:** Rare fruits and vegetables, cancer, antioxidants, phytochemicals, and phyto-nutraceuticals

#### Introduction

The term vegetable refers to edible part(s) of a plant consumed raw or cooked, generally with a main dish, in a mixed dish, as an appetizer or in a salad. Vegetables include edible stems and stalks, roots, tubers, bulbs, leaves, flowers, some fruits, pulses (mature beans and peas), fungi (mushrooms, truffles), algae (seaweed) and sweet corn and hominy (cereal grains used as vegetables). Vegetables help to meet up major portion of the diet of humans through worldwide and play a significant role in human nutrition, especially as sources of phytonutraceuticals: vitamins (C, A, B1, B6, B9, E), minerals, dietary fiber and phytochemicals (Quebedeaux *et al.* 1990-1999) [18]. Some phytochemicals of vegetables act as strong antioxidants and plays significant role to reduce the risk of chronic disease by protecting against free-radical damage, by modifying metabolic activation and detoxification of carcinogens, or even influencing processes that alter the course of tumor cells (Southon *et al.*, 2000-2009) [23]. According to the 2007 World Health Report unbalanced diets with low vegetable intake and low consumption of complex carbohydrates and dietary fiber are estimated to cause some 2.7 million deaths each year, and were among the top 10 risk factors contributing to mortality (Dias, 2011) [5]. Especially, rare vegetables contributes significantly overall good health, improvement of gastrointestinal health and vision, reduced risk for some forms of cancer, heart disease, stroke, diabetes, anemia, gastric ulcer, rheumatoid arthritis, and other chronic diseases. Some rare vegetables are as follows: Broccoli, Purple Cabbage, Kiwi, Fig, Pomelo, Star fruit. Cruciferous vegetables (Brassicaceae or Cruciferae family) which include, cabbage, broccoli, cauliflower, Brussels sprouts, kales, kailan, chinese cabbage, turnip, rutabaga, radish, horseradish, rocket, watercress, mustards, among other vegetables, provide the richest sources of glucosinolates in the human diet.

#### Different Rare Vegetables

**1. Broccoli:** *Broccoli* ("*Brassica oleracea var. italica*") is a Cruciferous green leaf Cole vegetable. This plant is native of Italy, but can be successfully grown in India also. It is a rich source of valuable nutrients Vitamin A, C & riboflavin. It contains high amount of Iron and Calcium and is a non-fattening food and possesses various medicinal properties as well (Mishra and Mukherjee, 2012) [15]. Broccoli grows best in temperature ranging between 18 °C and 23° C. Sprouting broccoli has a larger number of heads with many thin stalks. It is planted in May to be harvested during the winter in areas with temperate climates. Romanesco broccoli has a distinctive fractal appearance of its heads, and is yellow-green in color. It is technically the *Botrytis* (Cauliflower) cultivar group. Purple cauliflower is a type of broccoli

grown in Southern Italy, Spain and the United Kingdom. It has head shaped like cauliflower, but consisting of tiny flower buds. It sometimes, but not always, has a purple cast to the tips of the flower buds. Chinese broccoli (Alboglabra Group) is also a cultivar of *Brassica oleracea*. Broccoli contains multiple nutrients with potent anti-cancer properties, such as Di-indolylmethane and small amounts of Selenium. The 3, 3-di-indolylmethane found in broccoli is a potent modulator of the innate immune response system with- Anti-viral, Anti-bacterial, and Anti-cancer activity. Broccoli has a chemical component called “indole-3- carbinol” that can combat breast cancer by converting a cancer-promoting estrogen into a more protective variety (Phillip, 2011). Broccoli, especially sprouts, also have the phytochemical sulforaphane, a product of glucoraphanin- believed to aid in preventing some types of cancer, like colon and rectal cancer (Benson, 2011).

**2. Cranberry:** Cranberries are a group of evergreen dwarf shrubs or trailing vines in the subgenus *Oxycoccus* of the genus *Vaccinium*. Cranberries have a long history of use by Native Americans--not only as food, but also as a treasured medicine to treat and ward off a variety of conditions, including infections. The pilgrims were introduced to the berry by Native Americans, and we've had the pleasure of enjoying them ever since. The cranberry is one of only three commercially grown fruits native to North America. Cranberries are thought to provide health benefits due to their flavonoid and phytonutrient content (Howell *et al.*, 2002) [12]. A specific type of flavonoid, proanthocyanidins (PAC), in cranberries provide urinary tract benefits by interfering with the ability of pathogenic P-fimbriated *Escherichia coli* (*E. coli*) to cause infections in the urinary tract (Sobota *et al.*, 1984-2009) [22]. Cranberries provide numerous cardiovascular benefits. They have been shown to reduce low-density lipoprotein (LDL)-oxidation, maintain or improve high-density lipoprotein (HDL) levels, reducing platelet aggregation and improve vascular function (McKay *et al.*, 2007) [13].

**3. Fig:** *Ficus* is one of the largest genera of angiosperms from the mulberry family with more than 800 species of trees, shrubs, hemi epiphytes, climbers and creepers in the tropical and subtropical region all over the world (Frodin, 2004) [8]. Major producers of figs are Turkey, Egypt, Morocco, Spain, Greece, California, Italy, Brazil, and other countries with hot dry summers and mild winters (Tous, 1996) [24]. So figs are an important harvest throughout the world and consumed both in dried and in a fresh state. minerals, vitamins, organic acids and phenolic compound (Veberic *et al.*, 2001-2008) [25]. Both fresh and dried figs have high amounts of fiber and polyphenols. Figs are found to be a rich source of amino acids. They are also free of fat and cholesterol (Guarrera, 2005) [20]. As per USDA data for the Mission variety of figs, dried figs are an excellent source of fiber, Vitamin K and minerals like copper, manganese, magnesium, potassium, calcium relative to human needs (Vinson, 1996). The phytochemistry of *F. carica* shows that it is a potent source of flavonoids and polyphenols and various other compounds like arabinose, b-amyriins, b- carotines, glycosides, b-setosterols and xanthotoxol (Ross *et al.*, 2002) [19]. Alkaloids, flavonoids, coumarins, saponins and terpenes have also been reported in aqueous extract of the ripe dried fruit of *Ficus carica*. *Ficus carica* has also been found to have antidiabetic, hypolipidemic, hepatoprotective, antispasmodic, antipyretic, antibacterial, antifungal, scavenging activity and immune

response. Dried fig was found to be a very good source of minerals like Sr, Ca, Mg, P and Fe.

**4. Kiwi:** *Actinidia chinensis* L., (syn. *A. deliciosa*) is a commercial crop in New Zealand and other countries such as Chile, China and Italy (Ferguson and Huang 2007; Nishiyama 2007) [16]. In India, the area under this fruit is very less, due to its exotic introduction. With extensive research and developmental support, its commercial cultivation in India has been extended to the mid-hills of Himachal Pradesh, Jammu-Kashmir and Arunachal Pradesh. Kiwifruits are normally consumed as fresh fruit, because fresh peel of fruit is having a wide range of compounds leading to distinct flavors in the fruit (Atkinson and Macrae 2007) [1]. Healthful attributes of kiwifruit are high ascorbic acid levels (Ferguson and Huang 2007), polyphenols (Sheng *et al.* 2005) [20], and the presence of flavonoids (Atkinson and Macrae 2007) [1]. Kiwifruits are used for the treatment of many different types of cancers, e.g., stomach, lung, and liver cancer (Yang 1981) [26] in traditional medicine. Some studies have shown that the extracts of kiwi fruits inhibit cancer cell growth (Song 1984) and exhibit cell protection against oxidative DNA damage *in vitro* (Collins *et al.* 2001) [3].

**5. Purple Cabbage:** Red cabbage (*Brassica oleracea* L. var. *capitata* f. *rubra*) is native to southern Europe. At present, it is grown all over Europe. This variety is plentiful year round, but tastes the best when grown in cooler climates. It is a fall/winter vegetable that has crunchy; mildly peppery-sweet leaves. Red cabbage is more unique among the cruciferous vegetables in providing a big quantity of anthocyanins, which qualify not only as antioxidant nutrients, but also as anti-inflammatory nutrients. The antioxidant richness of cabbage is partly responsible for its cancer prevention benefits. Red cabbage is a fantastic source of antioxidants and phytochemicals and potassium, manganese, iron, and magnesium

**6. Pomelo:** Pomelo [*Citrus grandis* (L.) Osbeck] is one of the tropical fruit which native to Southeast Asia (Morton, 1987). In Malaysia, the fruit is called as limau abong, limau betawi, limau bali, limau besar, limau bol, limau jambua or Bali lemon. It is a large citrus fruit with a common name of pomelo or shaddock that belongs to the family of Rutaceae (Morton, 1987; Scora, 1975). The peel of citrus fruit contained higher amount of antioxidant as compared to its pulp as the peel is to protect the antioxidants in the fruit from oxidation. Hence, it is recommended to consume fruit together with its peel rather than the flesh alone (Guo *et al.*, 2003; Abeyasinghe *et al.*, 2007) [9, 2].

**7. Star Fruit:** *Averrhoa carambola*, a multipurpose, drought resistant evergreen tree commonly known as “kamrakh” belonging to family Oxalidaceae, is gaining lot of importance for its therapeutic potentials. Various part of tree has been used in traditional folkloric medicine. *Averrhoa carambola* is a also a good source of potassium, copper, as well as folate and panthothenic acid. The Ascorbic acid levels of the star fruit is believed to be responsible for its sweet or sour taste. For a sweet fruit, the ascorbic acid level is around 10.40 mg per 100ml of juice. For a sour fruit, the ascorbic acid lever is about 15.4 mg per 100ml of juice (Gaurav *et al.*, 2012). It can enhance the potency of antioxidant in scavenging oxidative stress in human body and thereby

reduce the risk of having some chronic diseases (Chakraborty *et al*, 2009 and Kedare & Singh, 2011).

**Nutritional Content:** Rare vegetables are good sources

various nutrients such as vitamins, minerals and most importantly components which have cancer preventing effects. The nutritional values of those vegetables are listed as follows:

**Table 1:** Nutritional Content of Rare Vegetables

Vegetables	Energy (kcal)	Carbohydrates (gm)	Protein (gm)	Fat (gm)	Vitamin C (mg)	Minerals (mg)	Source
Broccoli	34	6.64	2.82	0.37	89.2	72	Mishra and Mukherjee, 2012
Cranberry	46	12.2	0.4	0.1	13.3	-	-
Fig	74	12.3	0.3	0.2	2.0	190.25	-
Kiwi	60	25.9	2.0	0.9	99.05	620.80	-
Purple Cabbage	29	6.5	1.4	0.2	34.4	270	Draghici <i>et al.</i> ,2013
Pomelo	38	9.62	0.76	0.04	61.0	230.01	
Star fruit	31	6.73	1.04	0.33	34.4	135.07	Gaurav <i>et al.</i> , 2012

**Anticancer Components of Different Rare Vegetables:** Rare vegetables contain different type of anticancer

component that can prevent different type of cancer. These components are listed below:

**Table 2:** Different Rare vegetables with their Anticancer Components

Rare vegetables	Parts Used	Anticancer Component	Prevention	Source
Broccoli	Whole	indole-3- carbinol	Breast cancer	Benson, 2011
Sprouts		sulforaphane	colon and rectal cancer	
Cranberry	Whole fruit	Flavonoids (Especially flavonols and proanthocyanins)	Breast, colon, prostate, lung, Bladder cancer	Neto <i>et al.</i> , 2008
Fig	Whole fruit and leaves	lavone, rutin and quercetin, amino acids and inorganic elements	Spleen cancer, Liver Cancer and Lung Cancer, Prostate Cancer	Lianju <i>et al.</i> 2003
Kiwi	whole	Hydroxycinnamic acid (Especially Cholerogetic acid[CGA])	Lung Cancer, Prostate Cancer, Colon Cancer	Rocha <i>et al.</i> , 2012
Purple Cabbage	Whole	Anthocyanins, Polyphenols, Lupeol, sinigrin, and sulforaphane,	Breast cancer, colon and rectal cancer	Draghici <i>et al.</i> , 2013
Pomelo	Pulp	Flavonoids	Any type of Cancer	Lin <i>et al.</i> ,2014
Star fruit	Fruit, Leaves and stem	Proanthocyanidins, epicatechin, Gallic acid in Gallotannin, Anisaldehyde,5hydroxymethyl-2-furfur-al,	Any type of tumors that can lead to cancer	Kumar <i>et al.</i> ,2016

**Conclusion**

Regular intake of rare vegetable rich diet or their extract fortified rich diet plays an important role in human nutrition. They have undeniable positive effects on health since phytonutriceuticals of rare vegetables can protect the human body from several types of chronic diseases. The mechanism by which vegetables decrease risk of disease is complex and largely unknown. Various components of the whole food are likely to contribute to the overall health benefit. Various phytonutriceuticals with antioxidant properties may work directly by quenching free radicals or indirectly by participating in cell signaling pathways sensitive to redox balance. Finally, increasing vegetables in the diet may reduce the intake of saturated fats, trans fats, and foods with higher caloric density, all of which may be related to a healthier overall diet. Because each vegetable contains a unique combination of phytonutriceuticals (vitamins, minerals, dietary fiber and phytochemicals), a great diversity of vegetables should be eaten to ensure that individual’s diet includes a combination of phytonutriceuticals and to *get all* the health benefits.

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