

# ***INTRODUCTION***

---

## 1. INTRODUCTION

The red beetroot (*Beta vulgaris L.*) is a traditional and popular vegetable in many parts of the world (Kugler *et al.*, 2007). Originally, the beet is a plant in the Chenodiaceae family which is now included in Amaranthaceae family. Beetroot is a herbaceous biennial or rarely, perennial plant with leafy stems growing to 1-2m tall. The leaves are heart shaped, 5-20cm long on wild plants.

The flowers are produced in dense spikes, each flower is very small, 3-5mm diameter, green or tinged reddish, with five petals and they are wind pollinated. The fruit is a cluster of hard nut lets. The roots are most commonly deep red-purple in colour, but come in a wide variety of other shades, including golden yellow and red and white striped (Zeldes, 2011).

The garden beet is a round root vegetable, has leafy green tops, which are also edible and highly nutritious. While the most common colour for beets (called “beetroots” in the British Isles) is garnet red, they can range in colour from deep red to purple and from yellow to white, allowing these vegetables to create a distinctively vibrant presentation. They are available year round, but the youngest, most tender beets are found from June through October.

Even though beets have high sugar content, they are low in calories and supply a variety of nutrients. Fresh beets can add great colour, flavour, texture and nutritional quality to a variety of dishes. Beets are an excellent source of folate. Beets are good source of potassium, vitamin C and fibre but low in calories. As a vegetable, beets are fat and cholesterol free.

Beetroot ingestion can be a useful means to prevent development and progression of cancer. Extracts of beetroot also showed some antimicrobial activity on *Staphylococcus aureus* and on *Escherichia coli*. An antiviral effect has also been observed.

Beetroot contains the compounds betanin and methionine that support liver detoxification. Without this function, toxins can accumulate both in the liver and the body's fatty tissues, preventing weight loss and contributing to sluggishness, mood swings and more serious illnesses. The high volume of soluble fibre found in beetroot also feeds the good bacteria in our gut, helping to lower harmful LDL cholesterol levels (Winkler *et al.*, 2005).

The main food pigments found in the common red beet (*Beta vulgaris*) are the betalains, the water soluble pigments. Two main groups of betalains are red-violet betacyanins and the yellow betaxanthins. Betaxanthins are relatively stable and do not have antioxidant properties. The most important betacyanin in red beet is betanin, which is a betanidin 5-O-glucoside (C<sub>24</sub>H<sub>27</sub>N<sub>2</sub>O<sub>13</sub>). Betanin makes up 75–95% of the total colouring matter found in the beet root, therefore it is used as a natural food colouring agent (Azeredo *et al.*, 2007). This pigment, like other betacyanins, is highly susceptible to changes induced by both pH and temperature (Ma Pedreno *et al.*, 2001).

As a powerful antioxidant pigment, betanin may provide protection and reduce risk of cardiovascular disease and cancer (Rakin *et al.*, 2007). High antioxidant activity of betanin is associated with phenolic and cyclic amine groups, both of which are very good electron donors, acting as antioxidants (Gliszczynska-Swigło *et al.*, 2006).

Antioxidant compounds of *Beta vulgaris* has similar antioxidant effects as caused by anti-inflammatory cytokines, green and black tea, with extracts of *Uncaria tomentosa* and with potent antioxidant resveratrol.

Betalain pigments have specifically been shown to possess various antioxidant functions. Comparing 22 vegetable extracts revealed that the beet after beans contains the highest total phenol content per fresh weight and is among the 10 most potent antioxidant vegetables.

The increased production of oxidants and free radicals during inflammatory disorders has become widely recognised as integral component of cell and tissue injury. All inflammatory processes include oxygen-activating processes where reactive oxygen species (ROS) are produced. Thus, ingredients of beetroot, like phenols and ascorbic acid may detoxify ROS acting as chemical antioxidants and also reduce the formation of ROS (Kalt, 2005).

It is generally assumed that climate, soil types, cultivar, fertilizers, irrigation practices, uses of pesticides and herbicides, maturity at harvest and postharvest handling are the most important variables that affect the nutrition and quality of fruits and vegetables (Nunez- Delicado *et al.*, 2005).

A greater number of studies were done mainly on cabbage, carrots, tomatoes, and potatoes (Lairon, 2010). Little information is available about the internal quality, mineral content and composition of the red beetroot. The red beetroot is regarded as a good potential source of antioxidants and phenols (Mattila and Pradhan *et al.*, 2010).

Beetroot can be eaten in a variety of ways raw, steamed, boiled or baked. The part of the beet used medicinally is the root. Beetroot contains anti-tumour, emollient, nutritive, rejuvenative, stimulating, resistance-enhancing properties. Beetroot helps to normalize the pH balance of the body and build the blood. It also increases the uptake of oxygen. Beetroot has been used as a supportive therapy in diseases of the liver and fatty liver. It supports and stimulates the liver, gallbladder, kidney and spleen and increases the flow of bile.

Beets have been used successfully in conditions of acne, anemia, cancer, diverticulitis, dysmenorrhea, hepatitis, jaundice, nausea, hypoglycemia, leukemia, poor circulation, diarrhoea, constipation, haemorrhoids and dysentery (Bavec *et al.*, 2010).

Beetroot helps to combat acidosis and aids the natural process of elimination and detoxification. The beet juice, being an excellent solvent for inorganic calcium deposits, is valuable in the treatment of hypertension, arteriosclerosis, heart trouble and varicose veins.

The roots and leaves of the beet have been used in folk medicine to treat a wide variety of ailments (Grubben *et al.*, 2004). Ancient Romans used beetroot as a treatment for fevers and constipation, amongst other ailments. All parts of the beet plant contain oxalic acid. Beet green and Swiss chard are both considered high oxalate foods which have been implicated on the formation of kidney stones.

### **Varieties of Beets**

Beets are also known as “beetroots”. There are so many varieties of beetroot present in our world. Some of the common varieties of the garden beet include detroit dark red beets, yellow beets, white beets, orange or golden beets and chioggia beets. Beet sizes range from large marbles to cylinders to the size of baseballs. Younger beets are more tender than regular beets and require less time to cook.

### **Detroit dark red beets**

Detroit dark red beets are commonly used in Tamilnadu. Red beets are the most common, having a deep red stalk and meaty root. Large leaves from red beets are often sold as “red chard” in the market. Basically red beets are sweet and earthy. Detroit dark red beets are considered as one of the most outstanding beet varieties, and for more than hundred years it served as a standard by which all other beets were judged. It will produce well formed, almost round, blood-red, 8cm diameter, nutritious roots. Growers regard it as one of the most dependable root crops to grow for taste and keeping quality. It

grows well in almost all soil types and is heat and cold tolerant, has a good tolerance to bolting and is resistant to a number of diseases.

Detroit Dark red is an all-round best for canning, freezing and using fresh. Young leaves make an excellent and colourful addition to salads and the mature greens can be cooked like chard or spinach. It contains a number of nutrients including iron, calcium, folic acid and vitamins A, B and C. It is also a source of good anti-oxidant that can help to fight cancer. They have highest sugar contents of all the vegetables, but are low in calories (Kujala *et al.*, 2000).

### **Ooty beets**

The Ooty beetroot is having a beautiful colour and plenty of nutrients. Many like to eat this especially for its colour. This variety has fine red colour. Since the carbohydrates in the beetroot are in the form of sugar particles, this quickly digested and mixes in our blood.

Beetroot is a good purifier apart from its ability to remove unwanted impurities accumulated in kidneys and gall-bladder. The iron found in beetroot helps our body to make new blood corpuscles. If the blood does not increase in spite of our consuming green vegetables, greens, fruits, dates and figs in large quantities, consuming beetroot for four days in a week gives us a good result. Apart from cooked beetroot, we can also consume uncooked beetroot (Kugler *et al.*, 2007).

Beetroot is a good tonic also for liver problems. For those who frequently vomit due to increase of pitha, beetroot is a good tonic. If beetroot leaves are cooked like other greens and consumed, diseases like ulcer and jaundice will be cured.

Those who suffer for many months by constipation and piles should consume half a tumbler of beetroot juice diluted with water before going

to bed in the night. We can prevent formation of kidney stones by frequently taking beetroot in our food.

For the itching and burning of skin by applying two parts beetroot juice mixed with one part water we can get relief. Patients who suffer from cancer will prevent the spread of cancer if they consume a tumbler of Ooty beetroot juice daily. It is to be noted that this also has the power to prevent cancer (<http://hubpages.com/hub/health-benefits>).

Hence a study has been carried out to analyse the enzymic (catalase, superoxide dismutase, peroxidase, glutathione-S-transferase, glutathione peroxidase, glutathione reductase, polyphenol oxidase) and non enzymic (ascorbic acid,  $\alpha$ -tocopherol, glutathione, polyphenol, total carotenoids and lycopene) antioxidant contents of the two beet root varieties, namely detroit dark red and Ooty variety.