

Beetroot: The Salubrious Root For Dietary Miscellany

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Introduction: Beet root (*Beta vulgaris L.*), also called as beet or chukandar in India is renowned for its sweetness due to its higher sugar content but is low in calories and come in a variety of hues ranging from yellow to red in bulb. It is classified botanically as a herbaceous biennial of Chenopodiaceae family and referred to as cool-season vegetable crop that is produced all over globe. It is an alkaline food that grows in temperate climates. Beetroot and its juice are often eaten due to its delicious flavor, nutritional value and flavour content. It is rich in antioxidants and minerals like potassium magnesium, sodium, betalaine and vitamin C.

Today, beetroot is grown in many countries worldwide, regularly consumed as part of the normal diet and commonly used in manufacturing as a food colouring agent E162. It offers a natural strategy to support cardiovascular health, combat oxidative stress and reduce inflammation. Its growing popularity in both clinical research and everyday diets reflects a renewed appreciation of therapeutic potential.

Brief history of beetroot: Beetroot (*Beta vulgaris*) has a rich and colorful history that spans centuries and continents. Its wild ancestor, *Beta vulgaris ssp. maritima*, was native to coastal regions of Europe and North Africa. Through selective cultivation and hybridization—especially with *Beta patula*—modern beetroot varieties emerged.

Originally, beets were grown primarily for its leafy greens. Ancient civilizations like the Egyptians, Greeks and Romans valued beet leaves for their medicinal and culinary uses. It was not until the Roman era that the fleshy root gained popularity as a food source. By the Middle Ages, beetroot was widely used to treat digestive and blood-related ailments. Beet root juice was interestingly used to colour wines in the 19th century demonstrating its role as a natural pigment long before synthetic dyes became common. Today, beetroot is recognized not only for its culinary versatility but also for its functional health benefits and as a food pigment.

Cultivation: Beetroot is a hardy and adaptable root crop that grows best in cool climates. From the moment seeds germinate, it typically takes 55 to 65 days for the roots to reach harvest. The ideal temperature for growing them ranges from 15-18°C though the plant can tolerate very low temperatures of 5°C and highs up to 24°C provided the soil remained moist. Despite being a cool-season crop, beetroot showed surprising resilience to warmer conditions and moderate frost. However, excessive frost can hinder root development. The sowing schedules varied by region like in cold zones with heavy frost, sowing is done from August to March. In moderate climates, beetroot can be grown year-round. In hot and frost-free areas, sowing is best from February to September. Its roots range in color from bright red to deep purple often displaying beautiful concentric rings when sliced. These richly pigmented varieties are commonly consumed as boiled, roasted or raw either on their own or mixed into vibrant salads. Golden-yellow beets are less common and typically grown for home use due to their milder flavor and lower pigment content.

Processing and culinary uses of beetroot: A substantial portion of commercially processed beetroot is

prepared through boiling, sterilization, or pickling, reflecting its widespread culinary versatility. In Eastern European cuisine, beetroot features prominently in traditional dishes such as borscht which is a vibrant and hearty soup. In Indian cooking, beetroot is often served as a spiced side dish where it is chopped, cooked and seasoned. The green leafy tops of the beets are also edible with young leaves typically being consumed raw in salads for their tender texture and mild flavor while mature leaves are commonly boiled or steamed offering a spinach-like consistency. Beetroot can be enjoyed in various forms as boiled or steamed and served warm with or without butter, pickled and eaten cold as a condiment or peeled, shredded or sliced raw for use in salads. Pickled beetroot remains a traditional food in many cultures worldwide cherished for its tangy taste and extended shelf life.

Nutritional value of beetroot: Beetroot is nutritionally valuable offering a modest yet significant composition of macronutrients and micronutrients. Each 100g beetroot has 88.0% moisture and provides approximately 1.70g of protein, 9.56g of carbohydrates, 6.76g of sugars, 2.80g of dietary fiber, and minimal fat content of 0.17 g providing energy of 43.0 Kcal making it a low-calorie food along with 200.0 mg of calcium, 55.0 mg of phosphorus and 88.0 mg of vitamin C notably. The green leafy tops are equally nutritious particularly rich in iron 3.1 mg, vitamin A 2100 IU, thiamine 110 µg and ascorbic acid 50 mg for 100 g fresh leaf sample making both the root and leaves valuable components of salubrious diets.

Health benefits of beetroot: Beetroot offers numerous health benefits like lowering blood pressure and improving heart health due to its high nitrate content. It can enhance athletic performance by increasing oxygen delivery, improve brain function and provide powerful antioxidant and anti-inflammatory effects. Additionally, it is rich in fiber, supports liver function, aiding digestion and gut health.

Betalains are the pigments in beetroot that give it a red and purple color. These water-soluble pigments are divided into two groups as betacyanins which are red-violet and betaxanthins which are yellow-orange. Betalains are known for their antioxidant, anti-inflammatory and anti-carcinogenic properties.

Antioxidant power: Beetroot's betanin and polyphenols help neutralize free radicals, reduce LDL oxidation and protect DNA from damage. They activate antioxidant enzymes like glutathione and HO-1 supporting cellular defense against oxidative and nitritative stress. Beetroot retains its antioxidant potency even after processing.

Anticancer potential: Betanin in beetroot inhibits cancer cell growth, reduces tumor angiogenesis by promoting apoptosis and autophagy. It enhances the effectiveness of chemotherapy drugs like doxorubicin with minimal toxicity to normal cells with studies showing promising results in lung, liver, colon and breast cancers.

Cardiovascular and performance benefits: Beetroot's natural nitrates improved blood flow, lower blood pressure and support heart health. The athletes use beetroot juice to boost endurance and reduce muscle soreness. It may also help regulate blood glucose and lipid levels aiding in chronic disease management.

Anti-inflammatory effects: Betalains suppress inflammation by downregulating key inflammatory markers such as COX-2, iNOS, TNF- α , IL-6, and IL-8. They inhibit NF- κ B signaling and reduce ROS and reactive

nitrogen species (RNS), thereby limiting tissue damage. These effects have been demonstrated in models of intestinal inflammation, cardiac injury, and inflammatory pain.

Antihypertensive benefits: Beetroot's cardiovascular effects stem from its high nitrate content and betalains' ability to reduce oxidative stress and inflammation. These compounds support endothelial function, inhibit angiotensin-converting enzyme ACE and prevents LDL oxidation. The clinical trials show that betalain-rich supplements can lower blood pressure and improve vascular health.

Hypolipidemic properties: Betalains help regulate lipid profiles by lowering total cholesterol, triglycerides and LDL, while increasing HDL levels. These effects are linked to reduced fatty acid synthesis and enhanced lipid mobilization making beetroot a valuable dietary supplement for managing dyslipidemia and reducing cardiovascular risk.

Antidiabetic potential: Beetroot's bioactive compounds particularly betalains have shown promise in improving insulin sensitivity and reducing blood glucose levels. They help modulate oxidative stress and inflammation which are the two key contributors to insulin resistance and may protect pancreatic β -cells offering potential support in managing type 2 diabetes.

Conclusion: Beetroot stands out as a vibrant, nutrient-rich vegetable with remarkable culinary versatility and therapeutic potential. From its historical roots to modern-day applications, it continues to be valued for its antioxidant, anti-inflammatory and cardiovascular benefits. Its natural pigments and bioactive compounds offer promising assistance in managing life style diseases like hypertension, diabetes and dyslipidemia. Its rich profile of dietary fiber, essential vitamins like vitamin C and folate, minerals like iron, calcium and potassium as well as natural antioxidants makes it a valuable addition to everyday diets. Consumed raw, cooked or juiced, beetroot contributes meaningfully to both traditional diets and functional food innovations. As research deepens, beetroot's role in promoting health and wellness is gaining well-deserved global recognition.



Purple beetroot



Yellow beetroot



Beetroot ragi punch



Beetroot fry



Beetroot carrot salad



Beetroot halwa