Popular Article

Trends in Agriculutre Science

Vol.2, Issue 1, January, 2023, Page: 57-62

Roselle (Hibiscus sabdariffa L.): The untapped multipurpose plant for future

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https://doi.org/10.5281/zenodo.7572567

Abstract

There are many medicinal plants in nature that have not been scientifically investigated and roselle (*Hibiscus sabdariffa* L.) belonging to the family Malvaceae, is one among them. The unique feature of roselle is that it has some potential use for all the parts such as leaves, stems, flower buds, calyces, roots, and seeds. Various plant parts have been used in folk medicine as a diuretic, mild laxative, and treatment for cardiac and nerve diseases. Other medicinal properties attributed to roselle include antiseptic, antibacterial, aphrodisiac, astringent, cholagogue, demulcent, digestive, purgative, emollient, antiscorbutic, anticancer, antipyretic, etc. It is a natural antioxidant supplement due to its high vitamin C and organic acid content. The young leaves and stems of roselle are consumed as leafy vegetables and the calyces are used in the preparation of hot and cold beverages, jam, jelly, beverage, ice cream, butter, sauces, marmalade, candy, pickles, curry, condiment, vinegar, tea, etc as they are rich in calcium, phosphorous and iron. Roselle is a natural colourant for food, beverages, and pharmaceutical products due to its water-soluble anthocyanin pigments. The stems and branches are extensively used for the production of bast fibers, which are just next to jute fibers. Seeds are pounded into meals, added to cereals, or roasted as a coffee replacement and the seed oil is edible and an ingredient in paints. Roselle is an attractive ornamental plant too, used for its decorative red stalks with ripe red fruits. Thus, roselle is a future plant with many nutraceuticals, cosmeceuticals, pharmaceuticals, and industrial applications, but still, it is an underutilized plant in India. Most studies in India concentrated on fiber yield and quality. It would be prudent to investigate the uses of this untapped multipurpose plant in the future.

Introduction

There are over 300 *Hibiscus* species in tropical and sub-tropical parts of the world. *Hibiscus sabdariffa* L. is a unique species of the Malvaceae family, commonly called Roselle or Jamaican sorrel and locally known as "Mesta" in the Indian Subcontinent. Roselle is a plant with beautiful flowers, and people are still divided about where it came from; some say it came from India, while others say it came from Africa. This crop is said to have been introduced from Sudan to India and South America in the 17th century as a vegetable, and it was later cultivated in Asia to produce fiber. All of the parts, including

the leaves, stems, flower buds, calyces, roots, and seeds, have possible uses, which makes this plant special. Roselle is mainly cultivated for its calyx, which is of three types: green, red, and dark red. The red calyces are the most common and are characterized by their anthocyanin concentration. It performs well in the warm and humid tropical climate, making it an excellent choice for low-rainfall areas since it is drought-tolerant.

Mesta or roselle is more than just a fiber crop or a vegetable. There is evidence that this plant has been utilized in traditional Ayurveda in many countries. The flowers, which have a sour taste, are used to make cold and hot beverages and a natural food colorant. Roselle is already gaining the attention of food and beverage producers as well as pharmaceutical companies, which believe it may have lucrative potential as a natural food product for herbal medicine and as a colorant to replace some synthetic dyes.

Fig 1: Roselle plant with leaves, flowers, and fruits

Nutritional benefits of roselle

Due to its high vitamin C concentration, which is three times that of black currants and nine times that of citrus, roselle is a natural antioxidant supplement. Fresh calyces are abundant in riboflavin, ascorbic acid, niacin, carotene, calcium, and iron, while red calyces include antioxidants such as flavonoids, gossypetine, hibiscetine, and sabdaretine. Several researchers have analyzed the micronutrient composition of roselle and reported that the calyces are high in malic acid, anthocyanins,

ascorbic acid, and minerals, especially Ca and Fe, but low in glucose. Red calyces are rich in polyphenolic acids such as protocatechuic and gallic acid and flavonoids. The plant is shown to be abundant in vitamins (ascorbic acid, niacin, pyridoxine), magnesium, and potassium. Nutritional analysis by proximate method showed higher carbohydrate, crude fibre, and ash. Plants have the ability to produce secondary metabolites, such as proteins, steroids, alkaloids, and other compounds that will improve their nutritional value. Seeds are high in protein. The micronutrient composition of roselle varies due to different ecotypes, genetic factors, environment, and harvest conditions.

Table 1. Nutritional information from different parts of Roselle (Solang *et al.*, 2017)

Nutrients	Flowers (100g)	Red calyces (100g)	Green calyces (100g)	Seed (100g)
Ash (g)	9.75±0.59	12.24	6.83	6.89
Fat (g)	0.59±0.06	2.01	2.17	21.60
Crude Fiber (g)	33.9±3.59	4.69	6.75	4.12
Protein (g)	9.87±0.28	4.71	6.45	31.02
Moisture (g)	4.38±0.05	9.25	-	-
Carbohydrate (g)	4.38 ±0.05	68.75	71.56	36.37
Sodium (mg)	ND	96.66	48.1	ND
Potassium (mg)	ND	49.35	49.59	ND
Calcium (mg)	ND	12.65	21.58	6.6
Magnesium (mg)	ND	38.65	47.54	ND
Iron (mg)	ND	3.22	3.37	ND
Zinc (mg)	ND	12.22	16.28	ND
Manganese (mg)	ND	2.39	5.61	ND
Nickel (mg)	ND	1.78	3.57	ND
Phosphorus (mg)	ND	36.30	15.05	6.8
Ascorbic acid (mg)	ND	16.67	12.50	ND
ND: Non-determinate				

Medicinal uses of roselle

Roselle is used in traditional medicine in several countries. Extracts of this plant have been used to treat colds, toothaches, and urinary tract infections. The calyces are shown to have anti-inflammatory activity, cancer prevention, and liver protection activities due to the high content of anthocyanins. In Senegal, West Africa, there are reports of the juice of the leaves of this plant being used for treating conjunctivitis. Mesta leaves are mostly used as an antiscorbutic to cure scurvy, but they have also been used as a sedative and to treat skin conditions including, sores and ulcers in some regions. A decoction

made from its root is also known to treat scurvy. Seed oil is employed in the beverage, folk medicine, and pharmaceutical industries because it has antihypertensive characteristics.

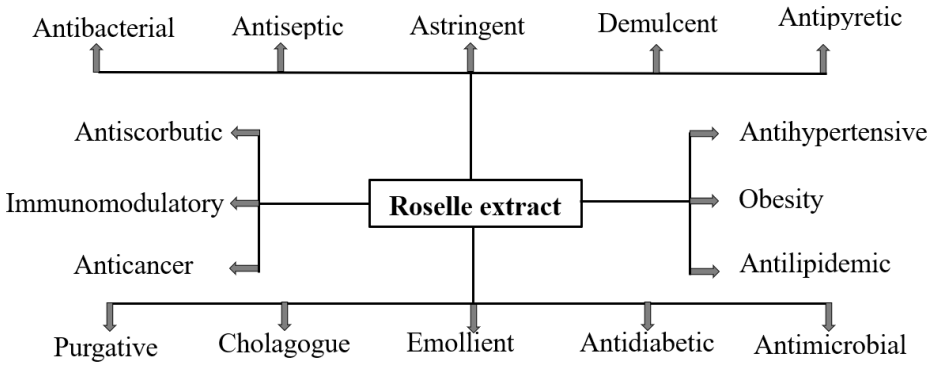

Fig 2: Pharmacological properties of roselle

Roselle in food industries

Every part of the roselle plant is used in food, including the leaves, fruits, roots, and seeds. The young leaves of roselle are consumed as a leafy vegetable and the dried calyces are used as hot and cold beverages, rich in calcium, phosphorous, and iron. The calyces are also used in the preparation of jam, marmalade, candy, pickles, curry condiment, vinegar, ice creams, etc. It is a valuable food product due to its distinctive flavor and brilliant red color. Products like jam and jelly made from red calyces are of acceptable sensory qualities. Jam made from dried calyces has less ascorbic acid content than that made from fresh calyces. Yogurt with roselle flavor is gaining popularity. Roselle calyces are used to make bakery and confectionery items. A chocolate cake made with roselle calyces is an effective source of fiber, calcium, and iron. Caffeine-free herbal tea from roselle is becoming increasingly popular around the world and is used to treat hypertension. The seeds are utilized as fish and domestic animal feed. The edible oil is used in cakes or soup as a substitute for castor oil. Flowers are frequently used as sweet herbal tea, while seeds are substituted for coffee.

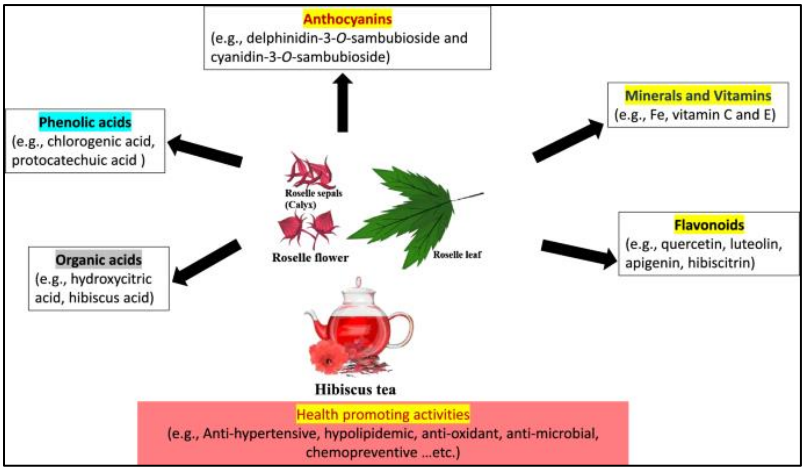

Fig 3: Graphical abstract of phytoconstituents of roselle (Salem *et al*., 2022)

Roselle fiber

The stems and branches are extensively employed in the production of bast fibers, similar to jute fibers in burlap. The properties of roselle fiber are similar to those of other well-established natural fibers, such as jute. Roselle is mostly farmed in Asia, like Thailand, India, and, China for its fibers.

Natural colorant from roselle

Roselle appears to be a good and promising source of natural red colorants due to its water-soluble anthocyanin pigments. Delphinidin-3-sambubioside (Dp-3-sam), which makes about 70% of the anthocyanins in Hibiscus, and cyanidin-3-sambubioside (Cyn-3-sam) are the two main pigments. According to reports, it can be used as a natural colourant for food, beverages, and medicinal products.

Other uses

- Seed oil of roselle is an ingredient in paints.
- Roselle can be intercropped with sorghum and maize or planted along field margins as a border crop.
- Roselle is an attractive ornamental plant used for its decorative red stalks with ripe red fruits in Africa, Iran, Saudi Arabia, and, North Eastern and Southern India.

Conclusion

A versatile plant with a lot of untapped potential for both industrial and medical usage is *Hibiscus sabdariffa* or Roselle. As a functional food, it provides health benefits to consumers. Calyx juice is marketed as a beverage that enhances health due to its high vitamin content. Both the domestic and international markets for dried calyces have significant market potential. It can greatly boost the income of farmers, suppliers, and processors. Roselle is drought-hardy and needs less care and attention once it

is established. However, in order to produce and market roselle products, the food industry must first be able to back them up with scientific data demonstrating how these functional foods based on Roselle calyces and their extracts affect the health of customers.

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