

FLOWERS AS FOOD AND MEDICINE: TRADITION MEETS NUTRACEUTICAL SCIENCE

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ABSTRACT



Nutraceuticals—foods or components offering medical and health benefits—are gaining prominence in disease prevention and wellness. Edible flowers are emerging as rich sources of nutraceutical compounds such as carotenoids, flavonoids, anthocyanins, phenolic acids, vitamins, and essential oils. These bioactives offer antioxidant, anti-inflammatory, antimicrobial, anticancer, and neuroprotective effects. Flowers like marigold, rose, chrysanthemum, and Viola have long-standing medicinal and culinary uses. As health awareness rises, India's nutraceutical market is projected to reach USD 28 billion by 2025. Driven by sustainability, innovation, and shifting regulations, edible flowers hold strong potential in the global nutraceutical industry as natural, functional ingredients for personalized nutrition.

KEYWORDS: Edible flowers, Health, Nutraceuticals, Phytochemicals

INTRODUCTION

Nutraceutical is any substance that may be considered as a food or a part of the food and provides medical or health benefits, encompassing prevention and treatment of diseases. Floral chemicals responsible for these are carotenoids, flavonoids, anthocyanins, simple phenolic acids and also vitamins and essential oils (Mlcek and Rop, 2011). The mineral content of flowers is significant both in terms of macronutrients (phosphorus, potassium, calcium and magnesium) and micronutrients (iron, manganese, copper and zinc). Flowers belonging to the genus *Chrysanthemum*, *Dianthus* and *Viola* are rich in these substances, especially in terms of potassium (Rop *et al.*, 2012). Flowers like Marigold, Chrysanthemum, Portulaca, Daylilies, Rose, Bougainvillea, Viola and some tree flowers have been reported to possess medicinal properties for diseases/disorders such as hypoglycemic, antimicrobial, anti-Alzheimer, the prevention of liver injury, analgesic, anti-obesity, visual health, neuroprotective, anti-bacterial and diuretic properties.

In the modern era, edible flowers are gaining more attention due to their extra-ordinary nutraceutical potential. Flowers are good source of nutritional and phytochemical compounds. The most representative phytochemical compounds found in flowers are phenolic acids, carotenoids, flavonoids, including anthocyanins which are well known for health benefits. Flowers possess strong medicinal properties, viz., antidiabetic, anti-cancer, anti-anxiety, anti-inflammatory, antimicrobial, hepatoprotective, neuroprotective etc.

HISTORY

The Greek Physician Hippocrates, often known as father of medicine said "Let food be your medicine and medicine be your food". The philosophy behind is Focus on Prevention. In ancient Rome, for example, flowers of various species of roses (*Rosa spp.*) were used when cooking various kinds of puree. In medieval France, the flowers of calendula (*Calendula officinalis*) were used when preparing various salads. The term "Nutraceutical" was coined by combining the terms "Nutrition" and "Pharmaceutical" in 1989 by Dr. Stephen DeFelice, Chairman of the Foundation for Innovation in Medicine. Nutraceutical is any substance that may be considered a food or part of a food and provides medical or health benefits, encompassing, prevention, and treatment of diseases.

NUTRACEUTICALS MARKET STATUS IN INDIA

India's nutraceuticals market is getting ready to be a global leader at USD 4-5 billion. It is expected to grow approximately USD 28 billion by 2025. The dietary supplements market in India is valued at USD 394.44 million in 2020 and reports say that it will reach USD 10, 198.7 million by 2026 which is a 22% growth rate year by year.

FLORAL COMPONENTS HAVING NUTRACEUTICAL ACTIVITY

The nutraceutical activity is due to the presence of carotenoids, flavonoids, anthocyanins, simple phenolic acids, vitamins and essential oils. The anthocyanins are particularly important since highly pigmented flowers have a high antioxidant activity compared to cultivars of the same species characterized by less pigmented flowers. The phenolic acids and flavonoids are the most common phenolic compounds with nutraceutical activity.

Marigold: Carotenoids (lutein esters) from marigolds are effective in preventing free radical generation, age-related muscular degeneration, cataracts, cancer and coronary heart diseases. Dried marigold petals and concentrates are used as feed to improve the pigmentation of the poultry skin and the eggs of yolk sac.

Nasturtium: It is a good source of vitamin C, silanol and oxalic acid. It contains Glucosinolates which have antibiotic and anti-tumor effects.

Chrysanthemum: Chrysanthemum shows marked antimicrobial, anti-inflammatory and anti-cancerous effects due to the presence of triterpenes Arni diol, Fara diol and Heliantriol

Carnation: Terpene caryophyllene is found in Carnation responsible for its anti-inflammatory properties. Flowers are considered to be antispasmodic, cardiotonic, diaphoretic and nerve tonic.

Bougainvillea: *Bougainvillea spectabilis* contains quinones, flavonoids, phenols, sterols, glycosides, tannins, furanoids and small amounts of sugars. The alcoholic extract of the leaf has been used for the management of diabetes. The aqueous extract and decoction of this plant have been used as fertility control among tribal people in many countries. It possesses anticancer, antidiabetic, antihepatotoxic, anti-inflammatory, antimicrobial, and antiulcer properties.

Portulaca: *Portulaca grandiflora* contains alkaloids, glycosides, mucilage, tannins and triterpenoids. It is used in the treatment of hepatitis, swelling and pain in the pharynx. The fresh juice of the leaves and stems is applied externally as a lotion to snake and insect bites, burns, scalds and eczema.

HEALTH BENEFITS OF EDIBLE FLOWERS

- **Anti-cancer** - Marigold, Bauhinia, Hibiscus, etc.
- **Anti-obesity** - Hibiscus, Tropaeolum, Viola, etc.
- **Anti-Inflammatory** - Rosa, Chrysanthemum, Hibiscus, Viola, Hibiscus, Day lily, etc.
- **Neuroprotective effect** - Hibiscus, Marigold, Honeysuckle, etc.
- **Antimicrobial activity** - Calendula, Nasturtium, Rose, Hibiscus, etc.

FUTURE PROSPECTS OF FLORAL NUTRACEUTICALS

Rising Health Awareness: As consumers become more health-conscious, demand for nutraceuticals foods and supplements with health benefits beyond basic nutrition-will increase. Flowers with medicinal properties or those used in herbal supplements might see growth in popularity.

Sustainability: There will be a stronger focus on sustainable and eco-friendly practices in both the production of nutraceuticals and flowers. This includes organic farming and environmentally responsible sourcing.

Technological Advancements: Innovations in agricultural technology and biotechnology could enhance the efficiency of growing and processing flowers and nutraceuticals, leading to better yields and higher-quality products

Global Trade: As markets expand, international trade in nutraceuticals and flowers will likely grow. Countries with favorable climates for growing medicinal plants or those with advanced biotech capabilities could become key players.

Regulatory Changes: Increased regulation and scrutiny of health claims will affect how nutraceuticals are marketed and traded. Compliance with international standards will be crucial.

Consumer Preferences: There will be a growing interest in personalized nutrition and natural remedies, driving demand for specialized nutraceuticals and flowers with specific health benefits. Overall, the trade of nutraceuticals and flowers will be dynamic, driven by technological, environmental, and market forces.

CONCLUSION

Edible flowers are valuable reservoirs of nutraceutical metabolites such as carotenoids, flavonoids, anthocyanins, phenolic acids, vitamins, and volatile oils that exhibit varied health advantages including anti-inflammatory, antioxidant, anti-cancer, antimicrobial, and neuroprotective action. Flowers such as marigold, chrysanthemum, Portulaca, Bougainvillea, and Viola exhibited remarkable medicinal potentials. India's nutraceutical industry is aggressively expanding due to increasing awareness on health. The historical utilization and scientific documentation in favour substantiate their prospect. Future opportunities are fuelled by sustainable practices, technology, international trade growth, regulatory changes, and individualized nutrition trends. Overall, edible flowers have tremendous potential in supporting health and disease prevention through natural and functional nutrition options.

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