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File: ■ Holy Basil (*Ocimum tenuiflorum* syn. *O. sanctum*, Lamiaceae)

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RE: Holy Basil's Rich History, Diverse Health Benefits, and Functional Food Possibilities Outlined in Review

Kumari S, Singh PA, Hazra S, Sindhvani R, Singh S. *Ocimum sanctum*: The journey from sacred herb to functional food. *Recent Adv Food Nutr Agric*. 2024;15(2):83-102. doi: 10.2174/012772574X290140240130101117.

Holy basil (*Ocimum tenuiflorum* syn. *O. sanctum*, Lamiaceae) is an important culinary and medicinal herb used in Ayurvedic and Unani traditional Indian systems of medicine and in Thai, Chinese, and African traditional medicines. It is increasingly viewed as a valuable additive to foods and beverages, creating functional foods with health benefits beyond their nutritional values. Leaves, stems, and seeds of holy basil contain many bioactive compounds with beneficial effects on cardiovascular, endocrine, pulmonary, and central nervous systems, as well as aiding in wound healing. Its importance in many spiritual and medicinal systems is a testament to its value. It was known as early as 1500 BCE and was first mentioned in the *Rig Veda*, a foundational Indian scripture.

In Ayurveda, holy basil leaves embody the characteristics of lightness and aridity, whereas its seeds are oily and slimy with cooling properties. It is considered to be an adaptogen, supporting the stress response and exerting immunomodulatory, antioxidant, and antimicrobial effects. It is used as a general health tonic and for respiratory and digestive disorders. Pharmacologically, it has anti-inflammatory, nootropic, anti-obesity, gastroprotective, antibacterial and hypoglycemic qualities. Its major phytochemicals include eugenol, methyl eugenol, linalool, ursolic acid, apigenin, orientin, luteolin, quercetin, aesculetin, eucalyptol, caryophyllene, rutin, vitexin, aesculin, and isovitexin. Several of these compounds are found in more than one plant part; others, in only one. Leaves have the greatest variety and quantity of most bioactive compounds. A variety of methods are used to estimate levels of these compounds in plant material. Overall, holy basil is richest in polyphenols, flavonoids, and essential oil.

Holy basil is native to India and surrounding countries. It grows well in tropical and subtropical areas at elevations < 900 m above sea level. It is relatively drought and frost resistant. It is propagated by seeds, but subject to heavy cross-pollination, necessitating the use of fresh seeds for new plantings. Cuttings may be made two or three times a year, with yields of ~ five tons per hectare. It was reported that the Indian food industry uses 30,083.39 metric tons of holy basil annually. Baked goods, infusions, and dairy foods with holy basil are widely marketed. The authors provide detailed recipes for holy

basil-infused bread, biscuits, milk, yogurt, and cottage cheese, and methods of preparation for infusions, juices, wines, and ready-to-serve (RTS) beverages.

Many other healthful foods and spices are often used with holy basil, such as fennel (*Foeniculum vulgare*, Apiaceae) and West Indian lemongrass (*Cymbopogon citratus*, Poaceae) oil in basil-infused milk, common mint (*Mentha arvensis*, Lamiaceae) and coriander (*Coriandrum sativum*, Apiaceae) or beet (*Beta vulgaris*, Amaranthaceae) root in yogurt, or, with moringa (*Moringa oleifera*, Moringaceae), in green tea (*Camellia sinensis*, Theaceae). Holy basil leaf infusions are added to fruit juices, and its seeds are used to enrich coconut (*Cocos nucifera*, Arecaceae) water and cocktails. One RTS was developed with holy basil, lime (*Citrus × aurantifolia*, Rutaceae) and other citrus juices, peppermint (*Mentha × piperita*, Lamiaceae), and ginger (*Zingiber officinale*, Zingiberaceae). Wines made variously with oranges (*Citrus × sinensis*, Rutaceae); leftover pineapple (*Ananas comosus*, Bromeliaceae), beetroot, and carrot (*Daucus carota*, Apiaceae) pulp; and pumpkin (*Cucurbita pepo*, Cucurbitaceae) have been tried.

Researchers report the health effects of these functional foods and beverages as well as their superior organoleptic and sensory qualities. For example, bread and biscuits made with whole and ground holy basil seeds or leaves were judged to be softer than control bread and biscuits. Compared to ordinary wheat (*Triticum aestivum*, Poaceae) flour biscuits, those enriched with holy basil leaves had more protein and dietary fiber. Yogurt made with holy basil and beetroot had more riboflavin and folic acid than non-augmented yogurt, while yogurt with holy basil, common mint, and coriander showed notably higher enzymatic activity of β -D-galactosidase. Holy basil-infused foods are reported to exert significantly greater antioxidant effects over non-infused foods, down-regulation of hepatic lipogenesis, enhanced stress adaptation and anxiety reduction, improved memory and cognitive function, and possessed gastroprotective effects, and other health benefits related to its anti-inflammatory and antioxidant qualities. Holy basil flavonoids and essential oils in biscuits made with defatted soy (*Glycine max*, Fabaceae) flour contributed to better insulin sensitivity and glycemic control in patients with type 2 diabetes.

Overall, holy basil's rich phytochemical contents make it an ideal component of functional foods with a variety of health benefits while enhancing foods' flavor, aroma, texture, and shelf life. More research is needed to fully elucidate optimal dosages and formulations and to study long-term effects of holy basil-infused foods and beverages. The authors had no conflicts of interest.

—Mariann Garner-Wizard

The American Botanical Council has chosen not to publish the original article.