

GARCINIA INDICA CHOISY: A REVIEW ON THE BIOLOGICAL ACTIVITIES OF THE UNDERUTILIZED MEDICINAL PLANT OF AYURVEDA

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ABSTRACT

Garcinia indica (commonly known as kokum in India) tree has several applications in the food and medicine industries. Since ancient times, kokum has been used in Ayurvedic medicine to treat a variety of ailments, including as dermatitis, diarrhea, dysentery, ear infections, and digestive problems. Plant parts like leaves, fruit and seeds have anticancer, antiulcer, antioxidant, antiglycation and antitumor properties. Presence of hydroxycitric acid, anthocyanins and garcinol has been found in fruits and seeds. The present review highlights the historical use, nutritional value, phytochemical components and confirmed pharmacological activities of kokum.

KEYWORDS: *Garcinia indica*, Ayurveda, Pharmacological importance, culinary importance.

INTRODUCTION

A HISTORICAL PERSPECTIVE

Herbal medicines are the result of decades of therapeutic experience from generations of aboriginal medical practitioners. *Garcinia indica* Choisy (*G. indica*) Syn the popular plant *Brindonia indica*, also referred to as kokum and a member of the Guttiferae family, is indigenous to specific parts of India. Traditional Ayurvedic medicine has long used the plant because of its amazing healing properties for a broad variety of diseases (1).

Originally confined to the western coast of the peninsula and the Western Ghats, Maharashtra, Karnataka, Goa and Kerala, it has also recently been discovered to grow in the eastern states of West Bengal, Assam and the North Eastern Hill region (2), (3).

Traditional Ayurveda writings describe the unripe fruit of *G. indica* as 'amla' (sour), whereas the ripe fruit is variously described as 'katu' (hot and spicy), 'kashaya' (pungent), 'alpamadhura' (mildly sweet) and 'vranaropaka' (enhanced healing of wounds) are properties of its bark and oil. 3-hydroxy citric acid found in the fruit rind has been shown to have fat-burning effects. Additionally, it acts as an anti-depressant and semen coagulant (4).

The Ayurvedic community has long relied on this

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evergreen tropical plant for the treatment of inflammatory and intestinal conditions like colitis, hemorrhoids and even heart disorders (5). Kokum has the potential to be used in the culinary, pharmaceutical and nutraceutical industries due to its abundance of bioactive compounds. The fruit is beneficial for the skin and also acts as a digestive tonic. The fruit has a lot of untapped potential due to its high nutrient density, medicinal properties and historical use.

The major phytochemicals extracted from kokum fruit with demonstrated physiological functions are hydroxycitric acid, anthocyanins and benzophenone derivatives (6). Other chemicals in the fruit include citric and oxalic acids. Carbohydrates, malic acid, polyphenols and ascorbic acid are the other main constituents. Kokum seed butter is utilized in many different types of moisturizers and cleansers because of its non-greasy moisturizing characteristics. Foot massage with kokum oil are really rejuvenating and relaxing. The fruit is additionally utilized as a spice as well as condiment in many different pickles, chutneys, and curry meals in India. 'Amrutkokum', a sugar syrup-steeped fruit beverage used to treat sunstroke, is a summertime staple (7). The present provides an update on the anticancer, antibacterial, antidiabetic, antiobesity, antidepressant and antiulcer properties of *G. indica*, besides its multiple uses in the culinary and industries.

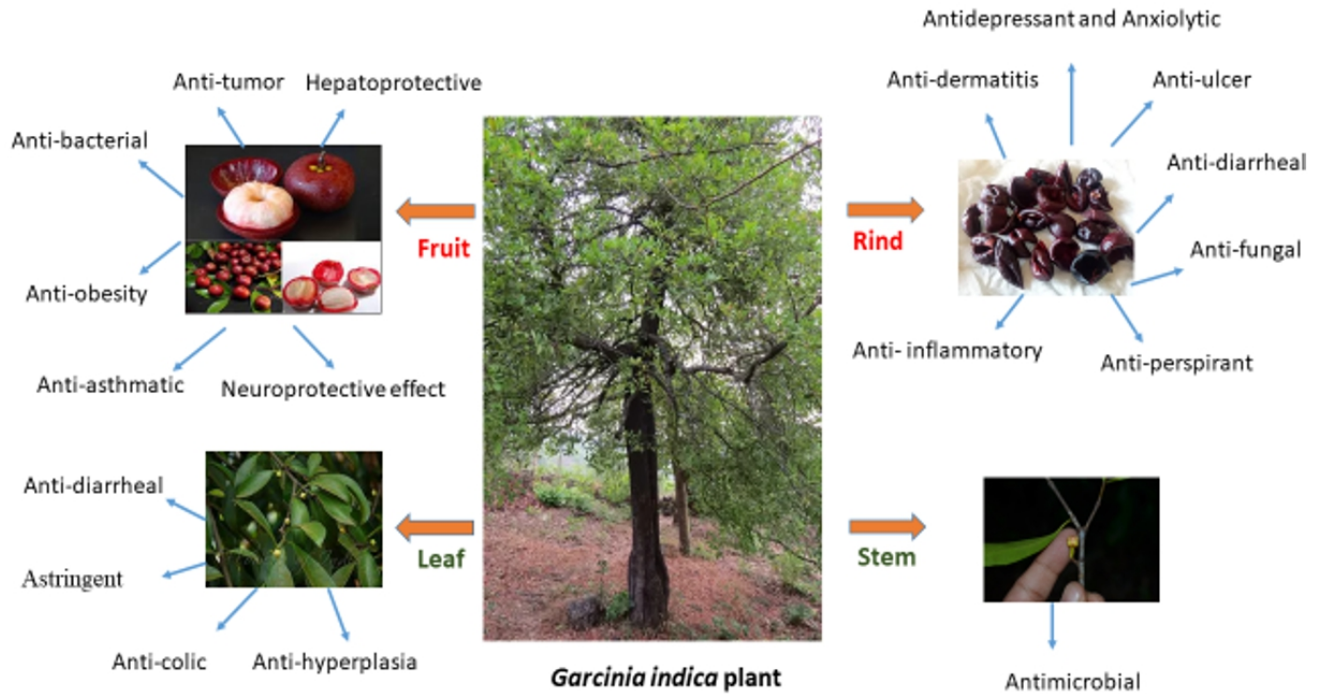


Fig.1.A Various health benefits associated with *G. indica* fruits and its other parts.

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METHODOLOGY

Web of Science, Google Scholar, and PubMed were utilized for literature survey about the history, therapeutic applications as well as pharmaceutical activities of *G. indica* published till 2023. The queries entered were “*Garcinia indica*”, “Kokum”, “Ayurveda”, “Culinary importance”, “pharmacological activity”, “antioxidant”, “antiobesity”, “antidiabetic”, “antimicrobial”, and “antiulcer”.

MEDICINAL PROPERTIES AND THERAPEUTIC RELEVANCE OF *G. INDICA* IN DISEASE PREVENTION AND TREATMENT

ANTIOXIDANT

Garcinol enriched fraction (GEF) from *G. indicafruits* has been found to exhibit antioxidant activity. GEF has been shown to raise reduced glutathione (GSH) levels and improve the antioxidant enzymes catalase (CAT) and superoxide dismutase (SOD) activity. GEF has thus, been found to reduce oxidative stress and protect against damage caused by free radicals(8).

The antioxidant activities of water based extracts of *G. indica* fruit rind have also been tested in a rat model of oxidative stress. The extracts were tested for their ability to inhibit lipid peroxidation and protect against oxidative stress induced by chronic ethanol consumption in rats. The results have shown that the extracts significantly reduced lipid peroxidation and restored the levels of antioxidant enzymes such as SOD, CAT, glutathione peroxidase (GPx) and glutathione reductase (GR). These findings suggest that *G. indica* fruit rind has potent antioxidant activity and can protect against oxidative damage in the liver(9).

ANTIDEPRESSANT

G. indica, has also shown significant antidepressant activity in various animal models. It has been found to reduce the immobility duration in forced swim and tail suspension tests, indicating its potential as an

antidepressant. The fruit rind extract(s) of *G. indica* have been found to inhibit monoamine oxidase (MAO), leading to increased levels of neurotransmitters like serotonin and norepinephrine, which have favorable effects on depression. Additionally, *G. indica* has been found to reverse hypothermia induced by reserpine, a model used to screen potential antidepressant agents. (10)

ANTI-OBESITY

G. indica extract (GIE) of fruits have also been investigated for their anti-obesity activity. Studies on adipogenesis in fibroblast cell line 3T3L1 cells have been conducted *in vitro* and anti-obesity effects have been examined in C57/BL6 mice fed on a high-fat diet. *In vitro* studies have shown that GIE prevented adipogenesis by upregulating uncoupling protein-1 (UCP1) and decreasing endoplasmic reticulum stress in treated cells(11). The polyphenol-rich portion of the *G. indica* fruit berries, in particular helps to reduce oxidative stress and obesity-related problems. The research has moreover indicated the fruit's potential for advancement as a functional and the nutraceutical food(12).

ANTIMICROBIAL

Dried fruit extracts known as kokum have been shown to be active against a number of Gram-positive and Gram-negative bacteria that cause wound infections. For Gram-positive and Gram-negative bacteria, the minimal inhibitory concentration (MIC) of the extracts have been determined to be 15.6-25 µg/mL and 75 µg/mL, respectively. These findings suggest that *G. indica* might serve as a natural herbal antibacterial medication for treating a number of bacterial infections.(13).

ANTICANCER

Garcinol, a major phytochemical isolated from *G. indica* fruits, has been implicated in the recently discovered anticancer potential of *G. indica*. The growth of tumor cells is stalled mainly due to garcinol mediated inhibition of transcription factors NF-κB and JAK/STAT3. *In vitro*, garcinol has demonstrated encouraging outcomes against several cancer cell lines, such as those from the colon, breast, prostate, head and neck, and hepatocellular (14). According to recent studies, garcinol inhibits many proinflammatory signaling pathways, which in turn decreases the development and survival of head and neck cancer. Moreover, research has demonstrated that garcinol can induce pancreatic cancer cells to undergo apoptosis, which will kill the cells. These results point to the potential use of *G. indica* and its active component garcinol as prospective anticancer agent in future(15).

Cardioprotective Activity

In rats with induced heart failure, it has been demonstrated that garcinol therapy can augment ejection fraction, improve heart function, and raise left-ventricular pressure. Additionally, it has been demonstrated that garcinol successfully delays apoptosis in rats suffering from cardiac failure brought on by isoproterenol. In cardiac H9C2 cells, garcinol has been found to diminish inflammatory cell infiltration and lessen interstitial fibrosis (16). Pre-treatment with garcinol has been found to show significant protection against myocardial injury, as evidenced by biochemical markers and histopathological observations(17).

POTENTIAL USES OF G. INDICA IN FOOD AND RELATED INDUSTRIES

Due to the necessity of processing ripe/raw fruits before consumption, adding value to kokum fruits through processing assumes a significant role in economy. Kokum has become an economically significant crop in recent times (18). Kokum fruits have a 4-5 day shelf life at RT and of 28 days if stored at 13°C with 86% humidity—(19). Kokum fruit is used to make the following assortments of goods-

Butter

The oil in kokum seed, which has a nutritional value of 23-26%, is easily extracted by boiling the seed. Kokum butter is the term for the oil that is recovered from the top layer. At RT, it maintains a creamy solid condition and does not melt. According to reports, kokum butter can be found in a wide variety of chocolates and other sweets(20).

Beverages

Kokum fruit extract contains roughly 4% sugars, which when brewed result in a fine red wine. When combined with sugar, kokum fruit extract becomes a versatile ingredient in a wide variety of nutritious drinks and squash substitutes. Homemade nutritional beverages can be made using kokum rinds and sugar in the summer using the crimson syrup that is produced from the ripe fruit(18).

Amsul

The peel of the kokum fruit is the starting point for the production of amsul. For the purpose of imparting a sour flavor, amsul is an excellent component in vegetarian recipes and curries. It is also useful in the treatment of skin boils and irritation(2), (18).

COSMETIC PRODUCTS

The emollient properties of kokum fruit and seed oil make it a useful natural moisturizer for preserving the health and vitality of the skin. A severe lack of

moisture in the skin can lead to ulcers, fissures and other skin damage. Kokum butter has several uses as an astringent and is widely utilized in the production of candles, detergents and lotions as well as in food and pharma industries(18).

CONCLUSION

As knowledge about kokum's purported medicinal properties continues to increase and spread, demand for it in processed forms continues to soar. Several phytochemicals having wide range of pharmacological actions as discussed above are abundantly present in kokum and its various plant parts especially the fruits and seeds. Shedding light further on the biological activities of kokum as a whole and its bioactive phytoconstituents in particular and understanding the mechanism(s) of action thereof would be the focus of research in future. This would deepen our insight about the hitherto relatively unexplored bounties of nature and bolster research in the area.

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