



Kokum (*Garcinia indica*) Fruit: A Review

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10.18805/ajdr.DR-1493

ABSTRACT

Kokum (*Garcinia indica*) is an ancient fruit which is widely consumed in the form of sarbat in a western ghat of India. Kokum is a fruit tree of culinary, pharmaceutical, nutraceutical uses. Kokum has a long history in Ayurvedic medicine as it was traditionally used for treatment of different health related problems like sores, dermatitis, diarrhea, dysentery, ear infection and to facilitate digestion. Kokum seeds are used for oil extraction. Kokum fruit has an antioxidant, acidulant and appetite stimulant properties that helps to fight against cancer, paralysis, ageing, obesity, ulcer etc. Kokum fruit is a good digestive tonic and used to overcome the skin related problems. It is also used for the preparation of the products like Kokum syrup, Sharbat, Butter, Aamsul, beverages. The aim of this paper was to present an overview of the nutritional value, health benefits, traditional uses and its application in food industry.

Key words: Anthocyanin, Garcinol, Hydroxycitric acid (HCA), Kokum (*Garcinia indica*).

Kokum (*Garcinia indica*) belonging to the family *Guttiferae* is an indigenous tree of India (Chandran, 1996; Padhye *et al.*, 2009). It is mostly found in the western peninsular coastal regions and the adjoining Western Ghats in the state of Maharashtra, Goa, Karnataka and Kerala as well as parts of Eastern India in the states of West Bengal, Assam and North Eastern Hill region, but is today found growing in other parts of peninsular India. The tree yields fruits annually in summer season during the month of March to May (Chemexcil, 1992; Chandran, 1996).

Kokum is a slender but very sturdy evergreen tree and does not need elaborate irrigation or use of fertilizers, pesticides or herbicides. Kokum trees are generally found growing in the riversides, forests, wastelands. Plantlets can also be generated by adventitious bud differentiation on mature seeds and by *in vitro* propagation (Nayak *et al.*, 2010). It is an under exploited tree and generally known as Kokum tree, Wild mangosteen and Goa butter tree. Kokum fruit known by different name in different part of India as mentioned in Table 1.

Kokum fruits are round, oblong or oval with pointed tips and, are crowned by the four parted stalk less stigma. Raw kokum fruits are dark to light green in color and crimson red with a yellow tinge to dark violet or purple when fully ripe. The fruits are grow up to the size of a lemon. An average kokum tree bears hundreds of fruits and each fruits weigh around 21–85 g. Kokum fruit contains three to eight large seeds and is covered with whitish pulp which is sweet in taste. The seeds are placed in a pattern similar to that in orange (Nayak *et al.*, 2010). Ripe fruits are sour to taste and have a short shelf life of approximately a week. Seed amounts to nearly a quarter of the total fruit weight and chemical studies have shown that it contains 40-42% oil. Oil remains solid at room temperature and is known as kokum butter which is light gray to yellow in color, greasy in texture and is bland to taste (Nayak *et al.*, 2010). The kokum seeds are first decorticated and the kernels are carefully separated. Kernels are then pressed in expeller to extract oil. Cake left after extraction of the kokum butter may be used as cattle feed as well as organic manure for plantation crops.

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How to cite this article: Manoj R. Chate, Subhash B. Kakade and V.S. Neeha (2019). Kokum (*Garcinia indica*) Fruit: A Review, Asian Journal of Dairy and Food Research. 38(4): 329-332.

Source of support: Nil

Conflict of interest: None

Submitted: 07-11-2019 **Accepted:** 19-12-2019 **Published:** 31-12-2019

Nutritional compositions of kokum fruit

Kokum rind contains three important chemical constituents Garcinol, Hydroxycitric acid and anthocyanin pigment respectively. Garcinol is a fat soluble yellow pigment; Hydroxycitric acid is used as an acidulant and physiologically active compound has been shown to significantly reduce body weight. Anthocyanin pigment is a natural antioxidant present in the kokum. Chemical composition of the kokum fruit is mentioned in Table 2.

Kokum leaves are reported to contain 75% moisture, 2.3 g of protein, 0.5 g of fat, 1.24 g fiber, 17.2 g of carbohydrates, 15.14 mg of iron, 250 mg of calcium, 10 mg of ascorbic acid and 18.10 mg of oxalic acid (Sheela *et al.*, 2004). Seeds of kokum fruit are rich in stearic, oleic and stearic triglycerides (Dushyantha *et al.*, 2010).

Traditional uses of *Garcinia indica*: Kokum (*Garcinia indica*) has got multiple uses and finds various applications among the local population. Summary of the traditional uses of kokum is mentioned in Table 3.

Health Benefits

Kokum (*Garcinia indica*) a medicinal plant mentioned in Ayurveda and it has been used for treatment of different health related problems like liver disorders, dysentery,

sunstroke, cancer and heart diseases (Deore *et al.* 2011).

Anticancer Activity

Garcinia indica is a rich source of bioactive molecules including xanthenes, flavonoids, benzophenones, lactones and phenolic acids. Kokum fruit contains 1.5% of polyisoprenylated benzophenone derivative called Garcinol which is yellow colored, fat soluble pigment found in the rinds of Kokum at level of 2-3% (Yamaguchi *et al.*, 2000). Garcinol obtained from Kokum in tropical regions, is used for its numerous biological effects. Its anti-cancer activity has been suggested but the mechanism of action has not been studied in-detail, especially there is no report on its action against breast cancer cells (Ahmad *et al.* 2010).

Antioxidant activity

Antioxidants are micronutrients that can neutralize free radicals or their actions. Free radicals have been implicated in the etiology of several major human diseases, including cancer, cardiovascular diseases, diabetes and arthritis. Due to the recent trends in nutrition towards development of healthy foods in the form of 'functional foods', one of the important properties in a dietary component is considered to be its antioxidant property (Mishra *et al.* 2006).

Garcinol is a polyisoprenylated benzophenone purified from *Garcinia indica* fruit rind show the antioxidant, anti-cancer and anti-ulcer properties (Yamaguchi *et al.*, 2000). Kokum contains other naturally occurring compounds with potential antioxidant properties such as citric acid, malic acid, polyphenols, carbohydrates, anthocyanin flavonoids and ascorbic acid (Cadenas and Packer, 1996; Peter, 2001; Rastogi and Nayak, 2010; Einbond *et al.* 2004; Yoshikawa, 2000). *Garcinia indica* contains 2 to 3 % of water soluble

red colour pigments. Anthocyanin is major water soluble pigment present in the kokum. Two major anthocyanin pigments cyanidin-3-glucoside and cyanidin-3-sambubioside are usually present in the ratio of 4:1. Kokum contain high concentration of anthocyanins (2.4 g/100 g) compared to other natural sources (Nayak *et al.* 2010). Parthasarathy and Nandakishore, 2016 reported that *Garcinia indica* bark exudates showed its total phenol and xanthone content as 53.43 g/100g and 32.42 g/100g respectively, revealing it as a potential source of natural antioxidants.

Anti Obesity activity

Kokum fruit juice is very acidic with a pH 1.5 to 2.0 and contains large amounts of acids. Major portion of organic acids in kokum is hydroxycitric acid (HCA) (1, 2 dihydroxypropane-1, 2, 3- tricarboxylic acid). Rinds of *Garcinia indica* contain about 20-30% of hydroxycitric acid (HCA) dry basis (Swami *et al.*, 2014). Hydroxycitric acid (HCA) has been patented for use as a hypocholesterolaemic agent because of its anti-obesity activity. Hydroxycitric acid and its derivatives are useful in the treatment of obesity (Jena *et al.*, 2002). It suppresses fatty acid synthesis, lipogenesis and food intake and induces weight loss. Besides hydroxycitric acid (HCA), *Garcinia indica* fruit juice also contains malic acid, citric acid and tartaric acid (Parthasarathy *et al.*, 2012).

Antiulcer activity

Garcinol is a polyisoprenylated benzophenones, has antioxidative, chelating, free radical scavenging, antiglycation, anticancer, anti-inflammatory and antiulcer activities (Lin and Liao, 2005).

Table 1: Name of Kokum Fruit.

Language	Name
English	kokum, Goa butter tree, Kokum butter tree
Sanskrit	Vrikshamia, Vrikshamla, Amlabija, Raktavikshamla, Amlapura, Amlashaka
Hindi	Kokum
Marathi	Bheranda
Tulu	Punarpuli
Tamil	Bhiranda, Murgal, Murgal-mala
Malayalam	Kaattampi
Sinhala	Goraka
Kannada	Murgina, Punarpuli, Devana huli
Oriya	Tintali
Gujarati	Kokum
Kokani	Bhirind

(Chemexcil, 1992 and Chandran, 1996).

Table 2: Chemical Composition of Kokum.

Nutrients	Quantity (%)	Nutrients	Quantity (%)
Moisture	80	Starch	1
Protein (Nx6.25)	1.92	Pigments	2.40
Crude fat	10	Tannin	2.85
Crude fiber	14.28	Pectin	5.71
Total ash	2.57	Ascorbic Acid	0.06
Carbohydrates (by difference)	35	Hydroxyl Citric acid	22.80

(Krishnamurthy *et al.* (1982)

Table 3: Traditional uses of Kokum (*Garcinia indica*).

Traditional uses	Plant parts used	Traditional uses	Plant parts used
Digestive	Fruit	Hepatoprotective	Fruit
Anti-dysentery	Fruit, Rind and leaves	Anti-tumor	Fruit
Antacid	Kokum Rind and leaves	Anti-hyperplasia	Leaves
Anti-diarrheal	Fruit, Rind and leaves	Wound healing	Kokum Butter
Anti-piles	Fruit, Rind and leaves	Analgesic	Rind, Fruit
Anti-ulcer	Rind	Anti-inflammatory	Rind
Anti-colic	Rind and Leaves	Anti-dermatitis	Rind
Anti-obesity (Fruit)	Fruit	Anti-perspirant	Rind
Anthelmintic	Fruit	Astringent	Leaves Fruits and Leaves
Anti-asthmatic	Fruit	Demulcent	Kokum butter
Cardiotonic	Fruit		

(Jagtap *et al.* 2015)**Image: Kokum Fruit (*Garcinia indica*)****Antifungal activity**

Garcinia indica extract has both antifungal and antibacterial properties and has potential for use as a biopreservative in food applications and therapeutic agent in cancer treatment. Study revealed that kokum rind extracts showed antifungal effects against *Candida albicans*, *Penicillium sp.* and *Aspergillus flavus* (Varalakshmi *et al.* 2010).

Anti-Hyaluronidase, Anti-Elastase Activity

During ageing, elasticity of the skin decreases due to elastase enzymes leads to sagging and at the same time hyaluronic acid in the skin also diminishes and skin becomes dry and wrinkled. Hence, there is need to conserve matrix metallo proteins by inhibiting the activity of this matrix metallo proteinases. Garcinol and cambogiol present in the fruit rinds of *Garcinia indica* are good antioxidant due to presence of phenolic group. Along with this various preparations of *Garcinia indica* play a important role in prolonging ageing, we fractionated crude Methanolic Extract (ME) into Ethyl Acetate and Water Fraction (WF) and those fractions were screened for anti-hyaluronidase and anti-elastase activity (Sahasrabudhe and Deodhar, 2010).

Application in Food Industry

The shelf life of kokum fruits under ambient temperature is 4 -5 days and it can be extended up to 28 days if properly stored at 13°C temperature and 86% relative humidity (Tripathi *et al.* 2014). The following types of the products prepared from the Kokum fruit.

Kokum syrup

Kokum fruit juice is sweet and sour in taste and thus liked by many. In traditional method kokum rind is separated by removing fruit pulp and seeds. Equal quantity of sugar mixed with kokum rind in a wide mouth vessel. This mixture of sugar and kokum kept open for sun rays up to eight to ten days. In this process juice comes out from kokum rind and already sugar is mixed with juice. Filter juice and rind with help of a cotton cloth. This clean Kokum Syrup is to be filled in clean glass bottle. For long term preservation these filled bottles again kept on sun light for another ten days without capping. You have to cap the bottles at end of process (Patil *et al.* 2008).

Kokum sarbat

Kokum is widely consumed in the form of sarbat in a western ghat of India. It is prepared by using the kokum syrup. The water is added into kokum syrup at 1:5 proportions and some salt and cumin powder is added (Swami *et al.* 2014).

Kokum aamsul

Aamsul is manufactured from the peel of the Kokum fruit. Aamsul is a fine ingredient in vegetarian dishes and curries for the sour taste.

Kokum butter

Kokum butter is obtained from the seed of kokum. It is a solid, stable hard butter. It is used in preparation of cosmetics, bar soaps and skin lotions (Tripathi *et al.* 2014).

Kokum beverages

Kokum extract is having approximately 4% sugar which can be fermented to produce high quality red wine. The extract from kokum fruit can be converted to many health beverages with addition of sugar (Swami *et al.* 2014).

Application in cosmetic products

Kokum is used as a natural moisturizer to keep skin supple and silky smooth. Effective for treatment for severely dry skin, ulceration and fissures of lips, hands, feet, etc. Kokum butter is used in preparation of cosmetics, bar soaps and skin lotions (Swami *et al.* 2014).

CONCLUSION

The rich bioactive profile of kokum makes it a highly nutritious fruit crop. The research evidences shows that kokum and its extract may protect against diseases including obesity, antioxidant and digestion tonic. It may even help to prevent and arrest the development of certain cancers, in addition to protecting the health of mouth and skin. The kokum fruit and its derivatives, such as dried rind powder, sarbat, solkadhi, Kokum beverage, Kokum Aamsul and butter from seed are rich sources of several high-value compounds with potential beneficial physiological activities.

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ISSN: 0976-0563 (Online), 0971-4456 (Print), Naas Rating: 4.20