

## Review on *Luffa acutangula* L.: Ethnobotany, Phytochemistry, Nutritional Value and Pharmacological Properties

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### ABSTRACT

*Luffa acutangula* L. (Common name: Ridge gourd, Family: Cucurbitaceae) is a popular vegetable in India and other Asian countries. It is a healthy food and contains good amount of fiber, vitamins and minerals including Vitamin B2, Vitamin C, carotene, niacin, calcium, phosphorus, iron and small quantities of iodine and fluorine. It is reported to contain many phytochemicals such as flavonoids, saponins, luffangulin, saponin, oleanolic acid and Cucurbitacin B. *L. acutangula* has been used extensively in Indian traditional system of medicines as diuretic, expectorant, laxative, purgative, hypoglycemic agent and bitter tonic. The ethnobotanical survey revealed its use to protect jaundice, insect bites, swollen hemorrhoids, dysentery and headache. Various biological activities of this plant were reported including its use in weight loss, jaundice, blood purification, hypoglycemia, constipation, skin care, immune system booster, wound healing, eye problems, stomach worms and asthma. The present review work focused on its distribution, botanical characters, ethnobotanical uses, folklore claims, nutritional value, phytochemical constituents, medicinal properties and biological properties of *L. acutangula*.

**Keywords:** *L. acutangula*, ridge gourd, nutritional value, phytochemicals, medicinal value, biological activity

### INTRODUCTION

*Luffa acutangula* L., belongs to the family Cucurbitaceae, is commonly known as ridge gourd and it is used as vegetable in Asian countries. It has different vernacular names in different languages like English (Ridge gourd, Angled lufa, Chinese okra, Dish-cloth gourd, Ribbed lufa, Silk gourd, Sinkwa towel sponge, Siqua melon, Vegetable sponge), Hindi (Jhimani, Karvitarui, Karvituri, Sankirah, Rantorai), Sanskrit (Gantali, Kosataki, Ksweda, Mridangaphalika, Sutikta), Urdu (Turai), Kannada (Kahire, Kahi Heere, Naaga daali balli), Malayalam (Athanga), Marathi (Divali, Kadudodaki, Kadushirali, Kaduturai, Ranturai, Kadudod-ka, Dadudodaka), Telugu (Adavibira, Chedubira, Sendubirai, Verribira, Adivibeera, Verri beera, Chedu beera, Adavi beera, Chathi beera), Punjabi (Jhinga, Shirola), Tamil (Peerku, Itukari, Itukarikkoti, Kacappi, Kacappuppirkku, Kaccam, Kaippuppirkku, Karniti)<sup>1</sup>. The entire plant of *Luffa acutangula* L. is medicinally important and is used extensively in Indian traditional system of medicines. From Ayurvedic point of view, ridge gourd increases *vata* (the impulse principle necessary to mobilize the function of the nervous system) and *kapha* (the body fluid principle which relates to mucous, lubrication and the carrier of nutrients into the arterial system) and also it cools down and pacifies the *dosha pitta* (the energy principle which uses bile to direct digestion and hence metabolism into the venous system) in the body<sup>2</sup>.

*Habit and habitat*

*L. acutangula* is a pan tropical climbing herb and cultivated throughout India and can grow in all types of soils and in naturalized tropics and subtropics and can be grown in summer or in rainy season. It is propagated by seeds and can be sown either in February-March or June-July<sup>3</sup>.

#### Botanical characters

Roots are yellowish-brown in colour, almost cylindrical in shape. They are rough because of the longitudinal wrinkles and also showed the presence of few adventitious roots. Stem is brownish-yellow in colour, 0.2-0.4 cm thick, 5 angled, glabrous, and consists of tendrils (3-fid tendril). Petiole is brownish yellow coloured, 3-8 cm in length; somewhat twisted, wrinkled, orbicular, and angular lamina is pale or light-green in colour, crimped and broad. Flowers Gynoecious, petals yellow and showy, female flower solitary in long pedicel, occasionally in clusters, ovary long, slightly ribbed stigma. Male flower is light greenish-yellow coloured, occurs in small racemes having pubescent calyx and lanceolate lobes. Three stamens are present and corolla is yellow in colour whereas female flower is solitary, yellow coloured having a long pedicel. Ovary is strongly ribbed and stigma tri-fid. Fruits are obovate, cylindrical or club-shaped, pale yellowish-brown in colour, tapering towards the base and covered with 8-10 prominent longitudinal ribs on outer surface. There are three chambers, of which inner part is fibrous and easily detachable from outer one. Seeds are black coloured, bitter

Table 1: Chemical constituents reported in *L. acutangula*

S. No.	Parts studied	Chemical constituents identified	References
1	Fruit	Luffeine, vitamins and minerals. Lignin (58.7 mg/kg), Tannin (1.84 mg /kg), Phenol (0.62 mg/kg), Flavonoid (0.45 mg/kg) and Alkaloid (0.19 mg/kg)	[15]
2	Seed	Fixed oil, palmitic, stearic, and myristic acids. Lectin and chito-oligosaccharides. Luffangulin, cucurbitacin B, sapogenin and oleanolic acid.	[16] [13]

Table 2: Nutritional values of *L. acutangula*.

S. No.	Parts studied	Food Materials	References
1	Edible portion of fruit (100 g)	Carbohydrate (0.2 g), dietary fiber (3.3 g), organic acid (0.11-0.6 g), Ca (14 mg), K (160 mg), Mg (14 mg), Zn (0.2 mg), thiamine (0.05 mg), riboflavin (0.01 mg) and niacin(0.20 mg)	[7]
2	Fruit	Protein (9.6 mg/g), carbohydrates (5.5 mg/g), crude fiber (2.8 mg/g), total fat (2.5 mg/g), energy value (22.9 Kcal), vitamin E (0.01 mg/g), vitamin C (2.05 mg/g), free fatty acid (43.9 mg/g), P (4.86%), S (2.22%), Mo (0.07%), Mg (2.62%), Si (2.19%) and Fe (0.85%)	[15]
3	Seed	Amino acids, phosphorous, iron and magnesium	[13]

in taste, shape ovoid-oblong<sup>4,5</sup>.

#### Ethnobotanical uses

The ethnobotanical survey of the hilly areas in Maharashtra revealed that very fine powder of fruits of *L. acutangula* is used as a snuff to protect jaundice<sup>16</sup>. It is also used traditionally in insect bites by tribes of Western Maharashtra. A powder of the fruit is used for rubbing on the swollen hemorrhoids. Kernel of the seeds is soft smooth and an efficient remedy for dysentery while the juice of roasted young fruit is applied to cure headache<sup>7</sup>.

#### Folklore claims

Ribbed gourd has diuretic properties; used as an expectorant, laxative and purgative; hypoglycemic agent, bitter tonic; used in the enlargement of spleen. The roots of ridge gourd added to milk or water is helpful in the removal of kidney stones. The roots of ridge gourd are added to cooled water, boiled and applied on skin in the swelling of the lymph glands. The leaves of the ridge gourd are useful in the treatment of dysentery. The leaves or juice of the ridge gourd are used as dressing in the diseases such as inflammation of spleen, ringworms, piles and even in leprosy. Pounded leaves mixed with garlic are applied locally for a relief in leprosy. Oil is extracted from the seeds of ridge gourd and used in the treatment of skin diseases. Ridge gourd is also an effective home remedy for the prevention of premature greying of hair. Ridge gourd is chopped in small pieces along with the ribbed skin and completely dried in the sun. Once the ridge gourd is fully dried, made into a powder and used to prevent the premature greying of hair<sup>8</sup>.

#### Phytoconstituents

Various phytochemicals reported in *L. acutangula* were given in Table 1. Chemical constituents of *L. acutangula* mainly include carbohydrates, carotenoids<sup>9</sup>, fat, protein, phytin, amino acids (alanine, arginine, cystine, glutamic acid, glycine, hydroxyproline, leucine, serine, tryptophan),

pipecolic acid, flavonoids<sup>10</sup> and saponins<sup>11</sup>. Luffangulin, a novel N-terminal ribosome inactivating peptide was isolated from the seeds of *L. acutangula*<sup>12</sup>. Presence of sapogenin, oleanolic acid and a bitter principle, Cucurbitacin B were also identified from the seeds of *L. acutangula*<sup>13</sup>. The oil characteristics of *L. acutangula* with iodine value, saponification value and acid value were 99.5, 190.8 and 10.5, respectively with the melting point range -3°C and -10°C was reported with its nutrient value<sup>14</sup>.

#### Nutritional value

The most common use of the ridge gourd fruit is cooked as a vegetable. It is very nutritive plant and has a bitter taste if taken raw. Ridge gourd acts as an appetizer and it is a healthy food and contains good amount of fiber, vitamins and minerals including Vitamin B2, Vitamin C, carotene, niacin, calcium, phosphorus, iron and small quantities of iodine and fluorine (Table 2). Ridge gourd has a sweet taste, cooling in nature and easy to digest. They form a low calorie diet, which is considered good for diabetes. Both the soft pulp and skin of ridge gourd are used in making various recipes, especially in South Indian cuisine. Chutneys made from the pulp and the peel of ridge gourd is known for their health benefits<sup>8</sup>.

#### Medicinal uses

Ayurvedic literature revealed that fruits of *L. acutangula* are used in the treatment of vata, kapha, anaemia, leucoderma, tumors and also useful as diuretic and in splenic enlargement<sup>6</sup>. Various biological activities reported on *L. acutangula* were shown in Table 3. In addition to its medicinal value, the fruit of *L. acutangula* are consumed as food in almost every part of India. Ayurveda has attributed ridge gourd with a number of health benefits which current clinical research is also supporting as well. From Ayurveda point of view, ridge gourd increases vata and kapha, but it cools down and

Table 3: Biological activities of *Luffa acutangula*

S. No.	Parts studied	Biological activity	References
1	Hydroalcoholic extract of <i>L. acutangula</i>	Hepatoprotective activity	[17]
	Saponin fraction of <i>L. acutangula</i> seeds		[3]
	Ethanollic fruit extracts of <i>L. acutangula</i>		[18]
2	Ether, chloroform, ethanol and aqueous extracts of fruits of <i>L. acutangula</i>	Anti-diabetic activity	[19]
	Juice of <i>L. acutangula</i>		[13]
	Methanolic and aqueous extracts of fruit of <i>L. acutangula</i>		[20]
3	Methanolic and aqueous extracts of fruit of <i>L. acutangula</i>	Anti-ulcer activity	[21]
4	Methanolic extract of fruit of <i>L. acutangula</i>	Anti-proliferative and anti-angiogenic effects	[22]
5	Ethanollic and aqueous extracts of <i>L. acutangula</i>	Anti-cancer	[5]
6	Extracts were prepared by cold maceration using aerial parts of <i>Luffa acutangula</i>	Antioxidant activity	[23,24]
	Methanolic and aqueous extracts of <i>L. acutangula</i>		[25]
	Ethanollic seed extract of <i>L. acutangula</i>		[26]
7	Ethanollic extract of <i>L. acutangula</i> fruits	CNS depressant activity	[27]
8	Seeds of <i>L. acutangula</i>	Fungistatic property	[28]
9	Ethanollic extract of fruit of <i>L. acutangula</i>	Anti-cataleptic activity	[29,30,31]
10	Ethanollic extract of fruit of <i>L. acutangula</i>	Analgesic activity	[26]
11	Fruit extract of <i>L. acutangula</i>	Antimicrobial activity	[7]
	Methanolic and aqueous extracts of <i>L. acutangula</i>		[32]
12	<i>L. acutangula</i> fruits	Developmental toxicity	[33,34]
13	Aerial parts of <i>L. acutangula</i>	Larvicidal activity	[6]
14	Ethanollic extracts of Pericarp of <i>L. acutangula</i>	Immuno-modulatory activity	[35]

pacifies the dosha *pitta* in the body [8]. In spite of their bland taste, ridge gourds have many health benefits:

**Weight loss:** Since the ridge gourd is low in saturated fats and cholesterol, it is an ideal diet for those who are looking for weight loss. Ridge gourd has a high water content which makes it a food with very less calories.

**Jaundice:** The ridge gourd juice is a very good natural remedy for the treatment of jaundice. The juice which is prepared by pounding the ridge gourd or the seed powder is useful in controlling jaundice. The dried fruits are powdered and used as snuff in the treatment of jaundice.

**Blood purification:** Ridge gourd has blood purifying properties. It helps in the purification, restoration and nourishment of the liver and is also helpful in the liver detoxification resulting due to alcohol intoxication.

**Hypoglycemia:** Ridge gourd has certain peptides which are exactly like insulin, alkaloids and charantin chemicals

which help in reducing the blood sugar and urine sugar levels.

**Constipation:** the cellulose fibers present in ridge gourd are used in the treatment of constipation and are also effective in the treatment of piles.

**Skin care:** Ridge gourd is allowed to dry and mature on the vine and it can be harvested as a sponge. This sponge has been used traditionally as an exfoliating product while bathing. They are considered to be useful in removing dead cells from the skin thus making the skin smooth and conditioned. The blood purifying properties of ridge gourd are helpful against pimples and acne problems. Luffa sponge is also effective in fighting off foot and body odor.

**Immune system booster:** Juice of ridge gourd mixed with other healthy vegetables taken daily helps in strengthening the immune system and helps the body in fighting against infections effectively.

**Eye problems:** The high  $\beta$ -carotene content of ridge gourd fruit is considered good for the eyes. Fresh juice is also put in eyes to treat granular conjunctivitis and sties.

**Wound healing:** The pulp of the ridge gourd is ground and applied on the wound to stop the bleeding.

**Stomach worms:** Ridge gourd is boiled in two glasses of water and then added adequate salt. This mixture is taken twice daily, to kill stomach worms.

**Asthma:** The gourd is ground and ½ cup ridge gourd juice extracted mixed with sugar and taken twice a day to control asthma.

**Other:** Ridge gourd is also useful as an emetic, expectorant and demulcent.

## CONCLUSION

Overview of *L. acutangula* revealed that the plant is the source of many nutrients and therapeutically important chemical constituents. Ethnobotanical and folklore claims indicated its traditional use in indigenous and traditional medicinal systems of India. Studies have exposed that it has hepatoprotective, antidiabetic, antiulcer, antiproliferative and antiangiogenic, anticancer, antioxidant, CNS depressant, fungistatic, anticataleptic, analgesic, antimicrobial, larvicidal and immunomodulatory activity. Due to its high nutritional value and proven medicinal importance, some nutraceutical products could be developed from *L. acutangula*, since it is already being consumed as vegetable throughout India. Further, studies should also be focused on its bioactive principles of *L. acutangula* which are responsible for the health benefits offered by this plant, so that the bioactive compounds could give some leads for new drug discovery to various chronic diseases.

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## REFERENCES

- Jyothi V, Ambati S, Asha Jyothi V. The pharmacognostic, phytochemical and pharmacological profile of *Luffa acutangula*. *Int J Pharm Technol* 2010; 2 (4): 512-524.
- Anitha J, Miruthula S. Traditional medicinal uses, phytochemical profile and pharmacological activities of *Luffa acutangula* Linn. *Int J Pharmacog* 2014; 1 (3): 174-83.
- Gowtham KNP, Kuppast IJ, Mankani KL. A review on *Luffa acutangula*. *Int J Pharm World Res* 2012; 3 (1): 1-15.
- Behera TK, Dey SS, Sirohi PS. 'DBGy-201' and 'DBGy-202': two gynoeccious lines in bitter gourd (*Momordica charantia* L.) isolated from indigenous source. *Indian J Genet* 2006; 66: 61-62.
- Dashora N, Chauhan LS, Kumar N. *Luffa acutangula* (Linn.) Roxb. Var. Amara (Roxb.) - A consensus review. *Int J Pharm Biosci* 2013; 4 (2): 835-846.
- Das S, Basu PS. Effect of cephalixin on flowering fruit setting and development of *Luffa acutangula* Roxb. *Indian J Plant Physiol* 1997; 2 (1): 18-20.
- Dandge VS, Rothe SP, Pethe AS. Antimicrobial activity and pharmacognostic study of *Luffa acutangula* Roxb var amara on some deuteromycetes fungi. *Int J Sci Inn Discover* 2010; 2 (1): 191-196.
- Pullaiah T. Encyclopedia of world medicinal plants, Vol 4, A.P. Regency Publications, New Delhi, 2006; pp. 1962-1964.
- Badgujar SB, Patil MB. Estimation of the chemical constituents of *Luffa acutangula*. *Nat Prod Rad* 2008; 7 (1): 79-81.
- Schilling EE, Heiser CB. Estimation of phytochemical constituents of *Luffa*. *Bioch System Ecol* 1981; 9: 263.
- Nagao T, Tanaka R, Iwase Y, Hanazono H, Okabe H. Studies on the constituents of *Luffa acutangula* Roxb. Structures of acutosides A-G, oleanane type triterpene saponins isolated from herb. *Chem Pharm Bull* 1991; 39: 599.
- Pal S, Chakraborti SK, Banerjee A, Mukerji B. Search for anticancer drugs from Indian medicinal plants. *Indian J Med Res* 1968; 56: 445-455.
- Kamel BS, Blackman B. Nutritional and oil characteristics of the seeds of angled *Luffa acutangula*. *Food Chem* 1982, 9 (4), 277-282.
- Hertog MG, Hollman PC, Katan MB, Kromhout D. Intake of potentially anticarcinogenic flavonoids and their determinants in adults in The Netherlands. *Nutr Cancer* 1993; 20 (1): 21-29.
- Manikandaselvi S, Brindha P. Quality control studies on *Luffa acutangula* L. *Int J Pharm Pharm Sci* 2014; 6 (1): 55-62.
- Anantharam V, Patanjali SR, Surolia A. A chitotetrose specific lectin from *Luffa acutangula* physico-chemical properties and the assignment of sugars in lectin binding site. *Proc Int Symp Biomol Struc* 1985; 8: 403-404.
- Jadhav VB, Thakare VN, Suralkar AA, Deshpande AD, Naik SR. Hepatoprotective activity against CCl<sub>4</sub> and Rifampicin induced liver toxicity in rats. *Indian J Exp Biol* 2010; 48: 822-829.
- Abid M, Abid Z, Ahamed MF, Aara A, Ibrahim M. Phytochemical and hepatoprotective activity of fruit extracts of *Luffa acutangula* Roxb. var. amara. *J Med Pharm Innov* 2014; 1 (6): 49-56.
- Priyanka PS, Patel MM, Bhavsar CJ. Comparative anti-diabetic activity of some herbal plant extracts. *Int J Pharm Sci* 2010; 1 (1): 12-19.
- Pimple BP, Kadam PV, Patil MJ. Antidiabetic and antihyperlipidemic activity of *Luffa acutangula* fruit extracts in streptozotocin induced NIDDM rats. *Asian J Pharm Clin Res* 2011; 4 (2): 156-163.
- Pimple BP, Kadam PV, Patil MJ. Protective effect of *Luffa acutangula* extracts on gastric ulceration in NIDDM rats: Role of gastric mucosal glycoproteins

- and antioxidants. Asian Pac J Trop Med 2012; 5 (8): 610-615.
22. Reddy BR, Kannaiah Goud R, Venkata Mohan S, Sharma PN. Antiproliferative and antiangiogenic effects of partially purified *Luffa acutangula* fruit extracts on human lung adenocarcinoma epithelial cell line (A-549). Cur Trend Biotechnol Pharm 2009; 3 (4): 396-404.
23. Shekhawat N, Soam PS, Singh T, Vijayvergia R. Antioxidant activity of 5 vegetables traditionally consumed by South Asian migrants. Indian J Pharm Sci 2010; 5 (4): 298-301.
24. Ansari NM, Houlihan L, Pierni A. Antioxidant activity of 5 vegetables traditionally consumed by South Asian migrants in Bradford, Yorkshire UK. Phytother Res 2005; 19: 907-911.
25. Dashora N, Chauhan LS. *In vitro* antioxidant and *in vivo* anti-tumor activity of *Luffa acutangula* against Dalton's Lymphoma Ascites (DLA) cells bearing mice. J Chem Pharm Res 2015; 7 (6): 940-945.
26. Gill NS, Arora R, Kumar SR. Evaluation of antioxidant, anti-inflammatory and analgesic potential of *Luffa acutangula* Roxb. var. amara. Res J Phytochem 2011; 5 (4): 201-208.
27. Misar AV, Upadhye AS, Mujumdar AM. CNS depressant activity of ethanol extract of *Luffa acutangula* var. amara C.B. Clark fruits in albino mice. Indian J Pharm Sci 2004; 66: 463-465.
28. Dixit SN, Tripathi SC. Fungi toxicity of some seed extracts. Nat Acad Sci Lett 1978; 1: 287.
29. Vinod BK, Shankar RP, Karan RS, Handu SS. Effect of the 5HT<sub>3</sub> receptor antagonist ondansetron on amphetamine induced hyperactivity on stereotypes in rats. Indian J Physiol Pharmacol 2000; 44 (3): 355-358.
30. Marklund S, Marklund G. Involvement of superoxide anion radical in the autoxidation of pyrogallol and a convenient assay of superoxide dismutase. Eur J Biochem 1974; 47: 469-474.
31. Gandhare B. Protective effect of *Luffa acutangula* extract on haloperidol induced catalepsy in rats. Int J Exp Pharmacol 2012; 2 (1): 37-43.
32. Jaysingrao JS, Sunil CN. Evaluation of antimicrobial activity of *Luffa acutangula* (L.) Roxb. var. amara (Roxb.) Clarke. Int J Adv Res 2013; 1 (10): 323-326.
33. Jusal P, Quanico L, Evangeline CA, Grace GP. Analgesic and hypoglycemic activities of *Bixa orellana*, *Kyllinga monocephala* and *Luffa acutangula*. Philippine J Sci 2008; 137 (1): 69-76.
34. Pasha MK, Sen SP. Seed protein patterns of cucurbitaceae and their taxonomic implications. Biochem System Ecol 1991; 19 (7): 569-576.
35. Mohan GK, Sanjay JS. Free radical scavenging, immunomodulatory activity and chemical composition of *Luffa acutangula* Var. amara (Cucurbitaceae) pericarp. J Chilean Chem Soc 2014; 59 (1): 2299-2302.