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A review on *Luffa acutangula*

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ABSTRACT

Many nutraceuticals are not very popular but they are having great potential to produce certain pharmacological properties. Study of evidence based scientific reporting's can become the foundation for further research keeping in view of the Phytochemical constituents and their pharmacological responses. *Luffa acutangula* is one such plant which has not grabbed considerable attention. This article was designed with an intention to provide complete review of its Pharmacognostic details, Phytochemical constituents and Pharmacological activities.

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KEYWORDS

Luffa acutangula;
 Hepatoprotective activity;
 Antidiabetic activity;
 Antioxidant
 antiproliferative;
 Antiangiogenic effects.

INTRODUCTION

Plants have had and still have a key role in history of life on earth. Plants have been part of our lives since the beginning of time; we get numerous products from plants, most of them not only beneficial but also crucial to our existence. Before the onset of synthetic era, man was completely dependent on medicinal herbs for prevention and treatment of diseases. Plants have evolved the ability to synthesize chemical compounds that help them, defend against attack from a wide variety of predators such as insects, fungi, herbivorous mammals. By chance, some of these compounds whilst being toxic to plant predators turnout to have beneficial effects when used to treat human diseases. The use of plants to heal or combat illness is as old as humankind. In the present scenario, the demand for herbal products is growing throughout the world and major pharma-

ceutical companies are currently conducting extensive research on plant materials for their potential medicinal value.

Luffa acutangula (Family: Cucurbitaceae) is commonly known as Ridge gourd. It is a widely growing vegetative climber. The fruits are base ball club shaped. Various pharmacological activities include hepatoprotective activity^[1], antidiabetic activity^[2], antioxidant activity^[3], fungistatic property^[4], CNS depressant activity^[5] etc. Its chemical constituents were found to be carbohydrates, carotene, fat, protein, phytin, aminoacids, alanine, arginine, cystine, glutamicacid, lysine, hydroxyproline, leucine, lectin, serine, tryptophan, pipercolic acid^[6-8]. It has a good hepatoprotective potential and supports the claims made in folklore medicine. Though many activities of *L.acutangula* were reported, its potential as a pharmacological aid has to be still explored. Ancient literature concludes that the plant is signifi-

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cantly used as abortifacient and antifungal agent. [9]The plant is known as Sanskrit: Gantali, Kosatiki, and Ksweda. Hindi: Jhimani, Karvitarui, Karvituri, Sankirah, Rantorai. Punjabi: Jhinga, Shirola. English: Ridge gourd, Chinese okra, Ribbed loofah, Silk gourd. Bengali: Titorai, Titojhinga, Titodhunda, Jhinga, Ghoshalata. Kannada: Kahire, Kahi Heere, Naaga daali balli. Malayalam: Athanga. Marathi: Divali, Kadudodaki, Kadushirali, Kaduturai, Ranturai, Dadudodaka. Tamil: Itukari, Itukarikkoti, Kacappi, Kacappuppirkku, Kaccam, Kaippuppirkku, Karniti. Telugu: Adavibira, Chedubira, Sendubirai, Adavi beera, Chathi beera.

PHARMACOGNOSY

Taxonomical classification

Kingdom: Plantae, Division: Magnoliophyta, Class: Magnoliopsida, Order: Cucurbitales Family: Cucurbitaceae, Genus: *Luffa*, Species: *acutangula*.

DESCRIPTION

Luffa acutangula is a large monoious climber.

Stems: It has 5 angled glabrous stem and 3-fid tendril.

Leaves: All leaves of this plants are orbicular, pale green in colour 15-20 cm across and palmately 5-7 angled or lobed. Veins and veinlets are prominent.

Fruits: Fruits of *Luffa acutangula* are obovate, pale yellowish brown in colour, 4-10 cm long, 2-4cm broad and outer surface being covered with 8-10 prominent longitudinal ribs. The fruits are divided into 3 chambers. The inner part is fibrous and easily detachable as a whole from the outer part. Taste is bitter. Transverse section through a rib shows a single layer of papillose epidermis covered with thick striated cuticle. It is followed by 4-6 layers of parenchymatous cells.

Distribution: *Luffa acutangula* is pantropical and cultivated throughout India.

Habit: Herb.

Propagation: Propagation of *L.acutangula* is by seeds.

Native range: India and naturalised tropic and subtropics.

Cultivation: *Luffa acutangula* can grow in all type of soils and can be grown in summer or in rainy season. Seeds can accordingly be sown either in february-march or june-july.

Standards: Studies conducted on identity, purity and strength of *Luffa acutangula* revealed that it contains^[24].

- Total ash content not more than 16%,
- Foreign matter not more than 2%,



Figure 1 : Leaves of *Luffa acutangula*

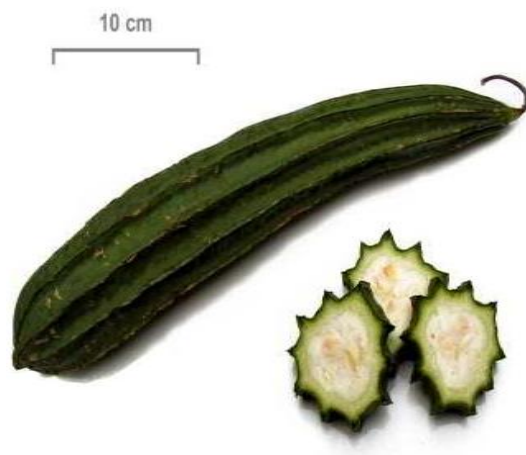


Figure 2 : Fruit of *Luffa acutangula*



Figure 3 : Seeds of *Luffa acutangula*

- Acid-insoluble ash not more than 4%,
- Water soluble extract not more than 13%
- Alcohols soluble extract not more than 6%.

PHYTOCHEMICAL CONSTITUENTS

Chemical constituents of *Luffa acutangula* mainly include carbohydrates, carotene^[19], fat, protein, phytin, aminoacids, alanine, arginine, cystine, glutamic acid, glycine, hydroxyproline, leucine, serine, tryptophan, pipercolic acid^[8], flavonoids^[20], saponins^[21]. The fruit contains an amorphous bitter principle, luffeine. The seeds contain a fixed oil which consists of the glycerides of palmitic, stearic, and myristic acids.^[22]

Lectin specific for chito-oligosaccharides was isolated from *Luffa acutangula* and has been purified to homogeneity by affinity chromatography and its macromolecular properties and combining affinity with different sugars was studied. The studies revealed that lectin has a molecular weight of 48,000 and Stokes radius of 2.9 nm. When sodium dodecyl sulfate-polyacrylamide gel electrophoresis was performed, only single band corresponding to molecular weight of 24,000 was observed both in the presence as well as absence of 2-mercaptoethanol. The subunits in this dimeric lectin are therefore held by non-covalent interactions alone. The lectin is not a glycoprotein and circular dichroism spectral studies indicate that this lectin has 31% α -helix and no β -sheet. The lectin is found to bind specifically to chito oligosaccharides and the affinity of the lectin increases with increasing oligosaccharide chain length as monitored by near ultra-violet circular dichroism and intrinsic fluorescence titration. The thermodynamic data revealed that binding site in lectin accommodates a tetrasaccharide and the values of G, H and S for the binding process showed a pronounced dependence on the size of the oligosaccharide.^[7]

A chito oligosaccharide specific lectin (*Luffa acutangula* agglutinin) has been purified from the exudate of ridge gourd fruits by affinity chromatography on soybean agglutinin glycopeptides coupled to Sepharose-6B. The affinity purified lectin was found homogeneous by polyacrylamide gel electrophoresis. Based on the thermodynamic data, blue shifts and fluorescence enhancement, spatial orientation of chito oligosaccharides in the

combining site of the lectin were studied.^[10] Luffangulin, a novel ribosome inactivating peptide with an N-terminal sequence, was isolated from seeds of *Luffa acutangula*. The 5.6 kDa-peptide designated luffangulin inhibited cell-free translation with an IC₅₀ of 3.5 nM but lacked inhibitory activity toward HIV-1 reverse transcriptase.^[12] A bitter principle, Cucurbitacin B, an acid saponogenin, oleanolic acid were isolated from the seeds of *Luffa acutangula*.^[15]

The study of nutritional and oil characteristics of the *Luffa acutangula* seeds showed that it has Iodine value, saponification value and acid value as 99.5, 190.8 and 10.5 respectively. The maximum melting and freezing points were found to be -3°C and -10°C respectively.^[14]

NUTRITIONAL COMPOSITION

The seeds of *Luffa acutangula* were studied for potential nutritional and oil characteristics. The fatty acid profile indicates that the glycerides of oleic and linoleic acid constitute 68% of the total kernel oil. The seeds were also found to be a good source of certain amino acids, phosphorous, iron and magnesium.^[14]

ETHANOMEDICAL PROPERTIES

The ethano medico botanical survey of the hilly areas in Maharashtra revealed that fruits of *Luffa acutangula* are used to protect from jaundice when taken in the form of very fine powder through nose.^[19]

PHARMACOLOGICAL STUDIES

Hepatoprotective activity

Hydroalcoholic extract of *Luffa acutangula* (HAELA) was tested for hepatoprotective activity. Standard drug used was silymarin. HAELA showed significant hepatoprotection against CCl₄ and rifampicin induced hepatotoxicity in rats. Hepatoprotective action of HAELA was due to the decreased levels of serum marker enzymes (AST, ALT, ALP and LDH) and increased total protein including the improvement in histoarchitecture of liver cells of the treated groups as compared to the control group. HAELA also showed significant decrease in malondialdehyde (MDA) formation, increased activity of non-enzymatic intracellular

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antioxidant, glutathione and enzymatic antioxidants, catalase and superoxide dismutase. Results of this study demonstrated that endogenous antioxidants and inhibition of lipid peroxidation of membrane contribute to hepatoprotective activity of hydroalcoholic extract of *L. acutangula*.^[1]

Investigations were made for hepatoprotective activity of saponin fraction of *Luffa acutangula* seeds in liver fibrocytic rat-induced with CCl₄ male Wistar rats were divided into six groups consisting of normal group, control group, comparator group and three test groups (given saponin fraction of *Luffa acutangula*). The study concluded that administration of saponin fraction at dose 10 mg/kg bw twice a week, 20 mg/kg b.w twice a week and 20 mg/kg b.w once daily showed hepatoprotective activity and the highest effect was showed at a dose of 20 mg/kg b.w once daily.

Antidiabetic activity

A comparative study of leaves of *Grewia asiatica*, fruits of *Luffa acutangula* and bark of *Bombax ceiba* has been conducted for screening of anti-diabetic activity. Ether, chloroform, ethanol and aqueous extracts (200 mg/kg b.w.) of leaves of *Grewia asiatica*, fruits of *Luffa acutangula* and bark of *Bombax ceiba* were screened. Among all extracts, chloroform and alcoholic extracts of fruits of *Luffa acutangula* has reported more significant ($p < 0.01$) reduction in blood glucose level in alloxan induced diabetic Wistar rats compared to control and glibenclamide (10 mg/kg b.w.).^[2]

Antiproliferative and antiangiogenic effects

The fruit of *Luffa acutangula* (*cucurbitaceae* family) as a potential anticancer agent was studied by examining its antiproliferative and antiangiogenic activities. Fruit methanolic extract showed significant antiproliferative activity (IC 50, 131.63±2.31 µg/ml) on human lung adenocarcinoma epithelial cell line (A-549). Vascular endothelial growth factor (VEGF), Matrix metalloproteinases-2 (MMP-2) and Matrix metalloproteinases-9 (MMP-9) protein expressions were significantly inhibited in F2-3 treated A-549 cells compared to control cells (VEGF: 4.36±0.47 and 14±0.75 pg/ml, MMP-2: 10.17±1.3 and 20.28±1.68, MMP-9: 12.93±1.70 and 21.12±2.12 ng/ml, respectively). In conclusion, data provided

a scientific proof for *Luffa acutangula* as a potential antitumor agent.^[11]

Antioxidant activity/Free radical scavenging activity

A comparative study of *Citrullus colocynthis*, *Clitoria ternata*, *Luffa acutangula* and *Madhuca indica* was made for free radical scavenging activity. The IC 50 value of *L. acutangula* was determined and was found to be 0.33 µg/mg.^[3] A comparative study of extracts of vegetables traditionally consumed like angular loofah (*Luffa acutangula*), charungli (*Caralluma edulis*), okra (*Abelmoschus esculentus*), bitter melon (*Momordica charantia*) was made for free radical scavenging activity (antioxidant property). These extracts were prepared both by cold maceration and also by boiling the plant in the solvent under reflux. Extracts from angular loofah (*Luffa acutangula*) showed a significant difference in the antioxidant activity between the extract obtained by using cold maceration and that prepared by boiling the plant in the solvent under reflux, suggesting the chemical composition of the plant changed during the heating process, leading to an increase in the amount of antioxidant components.^[13]

CNS depressant activity

Ethanol extract of *Luffa acutangula* fruits were studied for effect on behavioral changes, exploratory activity, barbiturate sleeping time in mice. The extract exhibited dose-dependent CNS depressant activity.^[5]

Fungistatic property

Extract from the seeds of *Luffa acutangula* produced 12% inhibition of spore germination of *Cephalosporium sacchari*.^[4]

Toxicity studies

The tea made from *Luffa acutangula* fruits was used to study abortive action in eleven pregnant wistar female rats. On the 15th gestational day, six rats are dosed with 10ml/kg of *L. acutangula* tea (50g of dried fruit in 100ml of water) and the other five rats were dosed with saline solution. On the 25th gestational day, all the rats were submitted to cesarean section. The study concluded saying the ingestion of *L. acutangula* during pregnancy may promote developmental toxicity.^[23] The ethanolic extract of *L. acutangula*

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was found to exhibit promising abortifacient activity in female rats. The drug in a dose of 400 mg/kg/day orally fed for 2 days exhibited expulsion of foetus in midterm pregnant rabbits^[16].

Other properties

The seeds of *Luffa acutangula* contain a saponin which cause haemolysis and also possess digitalis like action. In the indigenous system of

medicine the pounded leaves are applied locally in splenitis, haemorrhoids and leprosy. It also contains cucurbitacin compounds which have got significant anti-neoplastic properties.^[15] Studies on *Luffa acutangula* shows that it posses larvicidal activity.^[18] The oil obtained from the seeds of *L.acutangula* can be used both as an edible oil and also for soap- making. The plant is also used as an emetic. The juice of heated ridge gourd is good for diabetes.^[17]

TABLE 1: Showing the pharmacological activities of *Luffa acutangula*

Sr. NO	PHARMACOLOGY	PLANT PART	EXTRACT	DOSE	MODEL	pVALUE	AUTHOR
1	Hepatoprotective activity ¹	Fruit	Hydroalcoholic extract of fruit	200 mg/kg	Rat (CCl ₄ & Rifampicin induced liver toxicity)	<0.01	Vishal etal (2010)
2	Antioxidant activity ³	Aerial parts	Ethanol extract	500 µg/ml		-	Neha etal (2010)
3	Anti diabetic activity	Fruit	Chloroform and alcoholic Extracts	200 mg/kg b.w.	Healthy adult Wistar Rats.	<0.01	Priyanka etal (2010)
4	CNS Depressant activity	Fruit	Ethanol extract	5-10 mg/kg b.w.	Swiss mice	<0.05	Misar etal (2004)
5	Developmental toxicity ²³	Fruit	Tea extract	10 ml/kg	Rat	<0.05	Fernandes etal (2010)
6	Antiproliferative and antiangiogenic activity ¹¹	Fruit	Methanolic Extract	131.63 µg/ml	Human lung adenocarci noma epithelial cell line	-	Mohan etal (2010)

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