Review Article

Luffa acutangula: A brief review on phytochemical and pharmacological profile

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Abstract

The fruits of *Luffa acutangula* contained tannin, saponin, anthroquinone, sterols, glycosides, carbohydrates, reducing sugar, flavinoids, phenolic compounds, quinines, lignins, cucurbitacins, oil, and triterpenes, according to a phytochemical examination of the extracts. Pharmacological research revealed that *Luffa acutangula* has antibacterial, antiparasitic, anticancer, antioxidant, hypoglycemic, hepatoprotective, cardioprotective, nephroprotective, and gastroprotective activities. It also had immunomodulatory, abortifacient, anticataleptic, and behavioural altering effects. The chemical make-up and pharmacological effects of *Luffa acutangula* were covered in the current review.

Keywords: *Luffa acutangula,* anthraquinones, saponin, triterpene, antioxidant, flavinoids

Introduction

Luffa acutangula L., belongs to the family Cucurbitaceae, is commonly known as ridge gourd and it is used as vegetable in Asian countries. The fruits of *Luffa acutangula* contained tannin, saponin, anthroquinone, sterols, glycosides, carbohydrates, reducing sugar, flavinoids, phenolic compounds, quinines, lignins, cucurbitacins, oil, and triterpenes, according to a phytochemical examination of the extracts. Pharmacological research revealed that *Luffa acutangula* had a number of beneficial properties, including those that were antimicrobial, antiparasitic, anticancer, antioxidant, hypoglycemic, hepatoprotective, cardioprotective, nephroprotective, and gastroprotective, anti-inflammatory and analgesic, immunomodulatory, abortifacient, anticataleptic, and behavioral changing (Danish et al., 2011). *Luffa acutangula* L.'s entire plant has significant medicinal value and is utilised widely in India's traditional medical system (Munshi et al., 2010). Ridge gourd is considered to increase vata (the impulse principle required to activate the nervous system) and kapha (the body fluid principle relating to mucous, lubrication, and the carrier of nutrients into the arterial system), as well as to cool down and calm the pitta dosha (the energy principle that uses bile to direct digestion and consequently metabolism into the venous system) in the body (Lucas et al., 2010; Encyclopaedia Britannica, 2018). The chemical make-up and pharmacological effects of *Luffa acutangula* were covered in the current review (Quattrocchi, 2012).

Habit and habitat

It can thrive in all sorts of soil, in naturalised tropics and subtropics, and can be grown in the summer or during the rainy season. *L. acutangula* is a pantropical climbing herb that is cultivated throughout India. It is propagated by seeds, which can be sown in either June or July or in February or March (Nadkarni, 1996).

Botanical characters

The roots are practically cylindrical in shape and have a yellowish-brown colour. They have longitudinal wrinkling that makes them tough, and they also revealed a few adventitious roots. The brownish-yellow, 0.2–0.4 cm thick, five-angled, glabrous, and tendril-filled stem has five angles (3-fid tendril). The lamina is pale or light-green in colour, crimped and broad, while the petiole is brownish yellow in colour, measuring 3 to 8 cm in length. Flowers: Gynoecious; female flowers: solitary in long pedicel, occasionally in groups; petals yellow and showy; ovary long; stigma somewhat ribbed (Basu and Kirtikar, 1987). Male flowers have lance-shaped lobes and a light greenish-yellow colour. They grow in little racemes and have pubescent calyxes. While the male flower is solitary, yellow in colour, and has a

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long pedicel, the female flower has three stamens and a corolla that is yellow in colour. The stigma is tri-fid and the ovary is heavily ribbed. Obovate, cylindrical or club-shaped fruits have 8–10 noticeable longitudinal ribs on the outside. They are a light yellowish-brown colour, taper towards the base, and have these characteristics. There are three chambers, the inner of which is fibrous and separates from the outer one with ease. Black, bitter-tasting seeds have an ovoid-oblong form (Das and Basu, 1997; Samvatsar and Diwanji, 2000).

Ethnobotanical uses

According to an ethnobotanical study conducted in Maharashtra's hilly regions, *L. acutangula* fruit powder, ground to a very fine powder, is used as a snuff to prevent jaundice. Insect bites are another traditional usage for it among the tribes of western Maharashtra. The fruit's powder is applied to the bloated haemorrhoids. The juice of the roasted young fruit is used to treat headaches, while the soft, smooth kernel of the seeds is an effective treatment for dysentery (Kanaka et al., 2013).

Folklore claims

Being a diuretic, expectorant, laxative, and purgative as well as a hypoglycemic agent and bitter tonic, ribbed gourd is also used to enlarge the spleen. When milk or water with ridge gourd roots are combined, kidney stones can be removed. When lymph glands swell, ridge gourd roots are mixed to cooled water, cooked, and applied topically. The ridge gourd's leaves are effective in the treatment of dysentery (Dandge et al., 2010). The ridge gourd's juice or leaves are applied topically to treat conditions like leprosy, piles, ringworm, and spleen inflammation. Leprosy is relieved locally by applying pounded leaves and garlic. Ridge gourd seeds are used to make oil that is used to treat skin conditions. Ridge gourd works well as a home cure to stop hair from going grey too soon. The ribbed skin of the ridge gourd is also sliced into little pieces before being entirely dried in the sun. When the ridge gourd is completely dried, it is ground into a powder and used to stop hair from going grey too soon (Katewa et al., 2004).

Phytoconstituents

Several phytochemicals are identified in *L. acutangula* like Carbohydrates, carotenoids, lipids, protein, phytin, amino acids (alanine, arginine, cystine, glutamic acid, glycine, hydroxyproline, leucine, serine, tryptophan), pipecolic acid, flavonoids, and saponins are the primary chemical components of *L. acutangula* (Mahbubar, 2013). A novel N-terminal ribosome inactivating peptide called luffangulin was discovered in the seeds of *L. acutangula* . The seeds of *L. acutangula* also contained sapogenin, oleanolic acid, and a bitter compound called cucurbitacin B. It was found that the oil properties of *L. acutangula* had iodine values of 99.5, saponification values of 190.8, and acid values of 10.5, respectively, and melting points between -3°C and -10°C (Nadkarni, 1996).

Nutritional value

The ridge gourd fruit is most frequently prepared as a

Table 1. Chemical components discovered in *L. acutangula* (Nithiyavathi et al., 2021; Orudzhev et al., 2021; Rajeswari et al., 2021)

Parts studied	Chemical constituents identified
Fruit	Luffeine, vitamins and minerals.
Seed	Lignin, Tannin, Phenol, Flavonoid and Alkaloid Palmitic, stearic, myristic, and fixed oil acids. Chito-oligosaccharides and lectin. oleanolic acid, sapogenin, luffangulin, and cucurbitacin B.

Table 2. Values of *L. acutangula*'s nutrition (Gong et al., 2007; Allahverdiyev et al., 2011; Anitha and Miruthula, 2014; Dandge et al., 2010)

S. No.	Parts studied	Food Materials	References
1	Fruit that can be consumed	Carbohydrate, dietary fiber, organic acid, Ca, K, Mg, Zn, thiamine, riboflavin and niacin	(Jin, 1985; Leah et al., 1991) (Au et al., 2000; Wang et al., 2002) (Bolognesi and Polito, 2004) Junkai et al. (2002) (Junkai et al., 2002) (Wang and Ng, 2002)
2	Fruit	Protein, carbohydrates, crude fiber, total fat, energy value, vitamin E, vitamin C, free fatty acid, P, S, Mo, Mg, Si and Fe	Schilling and Heiser (1981) Kamel and Blackman, (1982) Nagao et al., (1991) Vanajothi and Srinivasan, (2015)
3	Seeds	Amino acids, phosphorous, iron and magnesium	Fernando and Grun, (2001) Suryanti et al., (2017) Nagarajaiah and Prakash, (2014)

vegetable. It is a very nutritious plant, but if eaten raw, it tastes harsh. Ridge gourd is a nutritious vegetable that serves as an appetiser. It is high in fibre, vitamin B2 and vitamin C, carotene, niacin, calcium, phosphorus, iron, and minor amounts of iodine and fluorine (Table 2). Ridge gourd has a sweet flavour, is cooling, and is simple to stomach. These make up a low-calorie diet, which is recommended for those with diabetes. The ridge gourd's soft pulp and skin are both utilised in a variety of cuisines, particularly in South Indian cooking.

Medicinal uses

According to ayurvedic literature, fruits of *L. acutangula* are useful as diuretics and for splenic enlargement in addition to being used to cure vata, kapha, anaemia, leucoderma, and tumors. Table 3 displays many biological processes associated with *L. acutangula*. The fruit of *L. acutangula* is used as food across practically all of India in addition to its medicinal benefits. Ridge gourd has been associated with several health advantages in Ayurveda, and contemporary clinical research is also in favour of these claims. According to Ayurveda, ridge gourd boosts vata and kapha, yet it calms and balances the body's pitta dosha.[8]. In spite of their bland taste, ridge gourds have many health benefits:

Hepatoprotective Activity

The medicinal potential of *Luffa acutangula* against liver disorders has been shown in numerous investigations. In carbon tetrachloride-induced liver necrosis, ethanolic fruit

Table 2. Values of *L. acutangula*'s nutrition (Gong et al., 2007; Allahverdiyev et al., 2011; Anitha and Miruthula, 2014; Dandge et al., 2010)

S. No.	Parts studied	Biological Activity	References
1	Hydroalcoholic extract of *L. acutangula;* Saponin fraction of *L. acutangula* seeds; Ethanolic fruit extracts of *L. acutangula*	Hepatoprotective activity	(Vanajothi and Srinivasan, 2015)
2	Ether, chloroform, ethanol and aqueous extracts of fruits of *L. acutangula* Juice of *L. acutangula;* Methanolic and aqueous extracts of fruit of *L. acutangula*	Anti-diabetic activity	(Kamel and Blackman, 1982)
3	Methanolic and aqueous extracts of fruit of *L. acutangula*	Anti-ulcer activity	(Nagao et al., 1991)
4	Methanolic extract of fruit of *L. acutangula*	Anti-proliferative and anti angiogenic effects	(Fernando and Grun, 2001)
5	Ethanolic and aqueous extracts of *L. acutangula*	Anti-cancer	(Suryanti et al., 2017); Kalasakar and Surana, 2014
6	Extracts were prepared by cold maceration using aerial parts of *L. acutangula* Methanolic and aqueous extracts of *L. acutangula* Ethanolic seed extract of *L. acutangula*	Antioxidant activity	Bulbul et al., 2011; Kalasakar and Surana, 2014
7	Ethanolic extract of *L. acutangula* fruits	CNS depressant activity	Nagarajaiah and Prakash (2014); Moideen and Prabha, 2014
8	Seeds of *L. acutangula*	Fungistatic property	Ibrahim et al., 2014; Iyyamperumal et al., 2013; Gill et al., 2011
9	Ethanolic extract of fruit of *L. acutangula*	Anti-cataleptic activity	Jadhav et al., 2010; Vanajothi et al., 2012
10	Ethanolic extract of fruit of *L. acutangula*	Analgesic activity	Mishra and Mukerjee, 2017; Dashora and Chauhan, 2015
11	Fruit extract of *L. acutangula* Methanolic and aqueous extracts of *L. acutangula*	Antimicrobial activity	Ulaganathan et al., 2010; Singh et al., 2014
12	*L. acutangula* fruits	Developmental toxicity	Sharmin et al.,2013; Quanico et al.,; Rahman et al., 2014 2008
13	Aerial parts of *L. acutangula*	Larvicidal activity	Juma et al., 2013; Patil et al., 2010
14	Ethanolic extracts of Pericarp of *L. acutangula*	Immuno-modulatory activity	Mohan Raj et al., 2012; Pimple et al., 2011

extract significantly outperformed pet ether extract in terms of hepatoprotective efficacy (Ibrahim et al., 2014).

SGPT, SGOT, serum alkaline phosphatase, bilirubin, cholesterol, triglycerides, serum high density lipoproteins, serum total proteins, and serum albumin were all likewise markedly decreased (Mishra and Mukerjee, 2017).

Histopathological analyses of the liver revealed that the petroleum ether extract caused early necrosis while the ethanolic extract did not, demonstrating the latter's potential for hepatoprotection (Jadhav et al., 2010).

Researchers looked into the hepatoprotective properties of hydro-alcoholic fruit extract (70%) against rifampicin and carbon tetrachloride-induced hepatotoxicity in Wistar rats (Mishra and Mukerjee, 2017). The serum levels of the marker enzymes AST, ALP, ALT, and LDH were dramatically lowered by dosages of 100, 200, and 400 mg/kg, p.o., which was indicative of the extract's hepatoprotective effects in the rat Ulaganathan et al. (2010).

Mishra and Mukerjee (2017) examined the hepatoprotective efficacy of various fractions of an alcoholic fruit extract against liver damage caused by paracetamol. Biochemical parameters were evaluated after oral administration of toluene, chloroform, and ethyl acetate fractions of the ethanolic extract (100 mg/kg). When compared to other fractions, the direct bilirubin level in the ethyl acetate fraction increased while the levels of ALT, AST, and ALP were returned to normal. A histopathological analysis of liver cells revealed that there was less vacuole development and no necrosis (Mishra and Mukerjee, 2017).

Ulaganathan et al. (2010) also tested the ethanolic extract of the leaves for hepatoprotective efficacy against carbon tetrachloride. By giving leaf extract orally, high serum levels of the indicators (SGPT, SGOT, and ALP) caused by carbon tetrachloride were returned to normal.

Improved levels of catalase, glutathione peroxidase, superoxide dismutase, reduced glutathione, glutathione-s-transferase, and lipid peroxidation have allowed researchers to observe the extract's tissue-specific antioxidant activity. When considered collectively, these findings are in favour of the plant *Luffa acutangula* 's traditional use as a hepatoprotective agent. While no investigations on people have been done, the hepatoprotective effect is yet not substantiated. As a result, research on ridge gourd should be conducted since it has potential as a cure for human liver illnesses. Blood Sugar Control Fruit juice was mentioned in ancient writings as a treatment for a type of diabetes that affected the adrenals (Mishra and Mukerjee, 2017).

Antiparasitic effect

The larvicidal efficacy of extract from *Luffa acutangula* was investigated against the Culex quinquefasciatus late third larval age group. After a 24-hour exposure, the larval mortality was noticed. The extract from *Luffa acutangula* had an LC_{50} value of 839.81 ppm (Moideen and Prabha, 2014).

An *in vitro* assay using the earth worm Pheretima posthuma was used to examine the anthelmintic activity of the *Luffa acutangula* aerial parts extract. Moderate anthelmintic activity was demonstrated by the methanol extracts of *Luffa acutangula* 's aerial component. It caused paralysis and death after more than 90 minutes at a dosage of 10 mg/ml (Jadhav and Chavan, 2013).

Anticancer effect

The ability of *Luffa acutangula* 's ethanolic and aqueous extracts to kill human neuronal glioblastoma cells (U343) and lung cancer cells was assessed (A549). The findings revealed a considerable, concentration-dependent decline in the cells' viability. In the MTT and SRB assays, the ethanolic and aqueous extracts of *Luffa acutangula* significantly exhibited cytotoxic activity. The aqueous extract demonstrated more effective cytotoxicity in the brine shrimp lethality test when compared to the ethanolic extract (Dashora and Chauhan, 2015).

Luffa acutangula leaf extracts were tested in vitro against a human lung cancer cell line for their anticancer properties (NCI-H460). Using the MTT assay, it was found that the leaf extract has strong anti-proliferative effects on the tested cell line. 20 g/ml was the IC50. When compared to control groups, the extract-treated group displays higher DCF fluorescence (higher ROS levels) and a sizable increase in mitochondrial depolarization. In cells treated with leaf extracts, nuclear morphology and apoptosis induction were also seen under a microscope. inspection employing the acridine orange-ethidium bromide dual staining method (Vanajothi et al., 2012).

Luffa acutangula 's ethanolic and aqueous extracts were tested in mice for their ability to inhibit the growth of the Ehrlich ascites carcinoma (EAC) cell line at doses of 200 and 400 mg/kg bw orally every day for 13 days. The life span of EAC tumor-bearing mice was increased by ethanol and aqueous extracts, which also significantly reduced ($p<0.0001$) tumour volume, viable cell count, and tumour weight. In the treated mice, the levels of red blood cells, haemoglobin, and white blood cells all returned to normal (Vanajothi et al., 2012).

Mice with solid tumours caused by Dalton's lymphoma ascites (DLA) cells were used to study the anti-cancer effects of a methanolic and aqueous extract (200 and 400 mg/kg, oral) of the fruit of *Luffa acutangula* . Both extracts greatly decreased the growth of solid tumours in mice (Kirthi et al., 2011).

Luffa acutangula was used to extract five principal fractions, which were then tested for their ability to inhibit the growth of non-small cell lung cancer cells (NCI-H460). One of the studied fractions had an IC50 value of 10 g/ml, which successfully slowed the proliferation of cancer cells. Moreover, it markedly enhanced intracellular reactive oxygen species and lowered the potential of the mitochondrial membrane. Cell shrinkage, membrane blebbing, and the development of apoptotic bodies served as proof of this fraction's apoptogenic activity. One bioactive substance, 1, 8 dihydroxy-4-methylanthracene 9,10-dione, was isolated from the active fraction (Nithiyavathi et al., 2021).

Antioxidant effect

By using the 1-diphenyl-2-picrylhydrazyl hydrochloride (DPPH) reduction method, the lipid peroxidation method, reduced glutathione, and the nitric oxide scavenging method, the antioxidant effect of ethyl acetate and ethanol extracts of dried leaves of *Luffa acutangula* var amara was assessed. At doses ranging from 25 to 800 mcg/ml, the ethanol and ethyl acetate extracts significantly reduced oxidative stress in DPPH and nitric oxide models. The extracts also exhibited notable inhibition of lipid peroxidation and glutathione reduced test (Iyyamperumal et al., 2013).

Different ridge *Luffa acutangula* peel extracts' ability to scavenge DPPH was examined. Five distinct extracts were able to quench the DPPH radical, however the aqueous extract had the highest level of scavenging activity (24.71%), followed by those of ethanol (18.87%), acetone (13.05%), methanol (11.13%), and ethyl acetate (7.14%) (Iyyamperumal et al., 2013).

With the aid of the DPPH, ABTS, superoxides radical, reducing power, and phosphomolybdenum assays, the antioxidant activity of the extracts of *Luffa acutangula* var. amara was evaluated. One of the strongest antioxidant activities was created by the ethanolic extract of fruit pericarp, which also contained gallic acid and catechin. The total phenolic and flavonoid contents of the extract also exhibited a positive link with its antioxidant capacity (Gill et al., 2011).

The antioxidant activity of the ethanolic seed extract of *Luffa acutangula* var. amara was evaluated using the 1,1-Diphenyl-2-picryl hydrazyl and hydrogen peroxide method. The extract showed notable antioxidant activity (75.330.592 and 76.500.281%) at 200 g/ ml (Kalasakar and Surana, 2014).

Using the β-carotene bleaching method, the antioxidant activity of the methanol extract of *Luffa acutangula* and its derivative fractions, including n-hexane, chloroform, ethyl acetate, n-butanol, and residual aqueous fraction, was investigated. The outcomes demonstrated that *Luffa acutangula* methanol extract, n-hexane extract, and chloroform extract all displayed strong antioxidant activity. N-hexane extract showed the strongest antioxidant activity (Kalasakar and Surana, 2014).

The antioxygenic activity of *Luffa acutangula* pulp and peel powders as well as their extracts was assessed utilising the linoleic acid peroxidation, β-carotene-linoleic acid bleaching, and 1,1-diphenyl-2-picryl-hydrazyl (DPPH) techniques. The pulp and peel of *Luffa acutangula* were extracted using ethanol/water, which was followed by water extracts. Petroleum ether extract had a moderate amount of antioxygenic activity. The antioxygenic activity of *Luffa acutangula* peel powder and its extracts was slightly higher than that of *Luffa acutangula* pulp powder and its extracts (Dandge et al., 2010).

Four L. amara pericarp (LAP) extracts were tested in vitro for their antioxidant effects. The DPPH and ABTS assays revealed the extracts to have substantial antioxidant activity. In the superoxide radical scavenging assay, ethanol and ethyl acetate extracts demonstrated the maximum scavenging activity, similar to the findings of the DPPH assay, while petroleum ether and aqueous extracts demonstrated the least. It was discovered that the concentration of test extracts increased the reducing power (Vanajothi et al., 2012).

Antimicrobial effects

The antimicrobial effects of the different extracts of *Luffa acutangula* var amara fruits were studied for its antimicrobial activity. When compared to the common antibiotic ceftriaxone, the chloroform extracts demonstrated greater antibacterial action against Gram-negative bacteria. Also, a study found that chloroform extract had stronger antibacterial effects than aqueous extract. Both extracts had marginal antifungal effects (Iyyamperumal et al., 2013).

Hypoglycemic effect:

Using oral glucose tolerance tests in glucose-loaded mice, the antihyperglycemic efficacy of the methanolic fruit extract of *Luffa acutangula* was assessed. Blood sugar levels were lowered by 38.5, 39.6, and 41.8% at 100, 200, and 400 mg/kg bw by the methanolic extract of the fruits, respectively. While lowering blood sugar levels by 13.1% at a lesser extract dose of 50 mg per kg bw, the impact was not statistically significant (Patil et al., 2010).

In streptozotocin-induced diabetic rats, the antidiabetic effect of *Luffa acutangula* 's fruit and seed ethanolic extract was investigated. The extract (200 and 400 mg/kg) significantly decreased the fasting blood sugar of streptozotocin diabetic rats in a dose-dependent manner, with the maximal hypoglycemic impact occurring after 21 days (Fernandes et al., 2010).

The methanolic leaf extract of *Luffa acutangula* was tested on mice for its ability to lower blood sugar levels. *Luffa acutangula* demonstrated the most powerful glucose level lowering effect (37.5%) among the three plant extracts (Bixa

orellana, Kyllinga monocephala, and *Luffa acutangula*), comparable to that of glibenclamide (37.88%) (Arunachalam et al., 2012).

In alloxan-induced diabetic Wister rats, the hypoglycemic effects of fruit extracts from *Luffa acutangula* were examined. In comparison to control and glibenclamide, chloroform and alcoholic extracts of the fruits of *Luffa acutangula* significantly reduced the blood glucose level in Wister rats that had been induced with diabetes by alloxan (Wiley, 2001).

In rats that have been induced with streptozotocin and nicotinamide to develop non-insulin dependent diabetes mellitus, the antidiabetic and antihyperlipidemic potentials of methanolic and aqueous extracts of *Luffa acutangula* fruits have been investigated. At a dose of 100 mg/kg, the methanolic extract was shown to be effective, but at 200 and 400 mg/kg, it greatly outperformed the aqueous extract in terms of antidiabetic efficacy (Fernandes et al., 2010).

Cardio and nephroprotective effects

Using a variety of measures, including blood biomarkers, antioxidant levels in the target organs, and histoarchitecture changes, the protective effects of a hydroalcoholic extract of *Luffa acutangula* on doxorubicin-induced cardiotoxicity and nephrotoxicity were examined in mice (Pimple et al., 2012). The raised serum levels of alanine amino transferase, lactate dehydrogenase, and creatinine phosphokinase in the heart and kidney of doxorubicin-treated animals were dramatically reduced by pretreatment with hydroalcoholic extract. Treatment with a hydroalcoholic extract also reduced the level of increased malondialdehyde and restored the glutathione, catalase, and superoxide dismutase that had been lost in the heart and kidney tissue. Hydroalcoholic extract also alleviated the doxorubicin-induced changes in the histoarchitecture of the heart and kidney tissue. The antioxidant capability of the plant extract was associated with the protective activity on doxorubicin-induced cardiotoxicity and nephrotoxicity in mice demonstrated with hydroalcoholic extract (Rajakumar et al., 2011; Jayaseelan et al., 2013; Fu et al., 2001).

Gastro protective effect

In streptozotocin-induced diabetic rats, the gastroprotective efficacy of *Luffa acutangula* methanolic and aqueous extracts on aspirin-induced stomach ulcerations was investigated. In comparison to water extract, methanolic extract dramatically elevated mucosal glycoprotein and antioxidant enzyme levels in the stomach mucosa of diabetic rats. In diabetic rats, methanolic extract proved effective in correcting the delayed healing of stomach ulcers and bringing them close to normal. Due to its antihyperglycemic and mucosal protecting properties, it had a stronger ulcer healing effect than glibenclamide and aqueous extract (Pimple et al., 2012).

CNS effects

The impact of ethanolic extracts of the defatted fruits of *Luffa acutangula* var. amara on behavioural alterations, exploratory behaviour, and barbiturate sleeping time in mice was investigated. The CNS depressing effect of the extract was dosage dependant. In a dose-dependent way, the ethanolic extract significantly reduced exploratory activity. Also, it improved the hypnosis that pentobarbitone sodium-treated groups of mice in both single-dose and chronic treatment received (Pimple et al., 2012).

Using the block method, locomotor activity in an actophotometer, and exploratory behaviour in a hole board apparatus, researchers examined the anticataleptic efficacy of an ethanol extract of *Luffa acutangula* in rats with catalepsy brought on by haloperidol. When compared to the negative control group, rats administered with ethanol extract after a haloperidol exposure exhibited a substantial increase in head dippings and line crossings. In addition to the extract's antioxidant properties, the author hypothesised that the protective effect of *Luffa acutangula*'s ethanol extract against Parkinson's disease symptoms may be caused by the regulation of neurotransmitters like dopamine, serotonin, and glutamate, which were crucial in the prevention of catalepsy (Arunachalam et al., 2012).

Anti-inflammatory and analgesic effects

Rats with carrageenan-induced hind paw edoema and cotton pellet granuloma models were used to assess the anti-inflammatory effects of ethanol and ethyl acetate extracts of dried leaves of *Luffa acutangula* var amara. In both acute and chronic settings, both extracts had a significant anti-inflammatory impact (Bulbul et al. (2011).

Rats with carrageenan-induced paw edoema were used to test the anti-inflammatory efficacy of an ethanolic extract from the fruit of *Luffa acutangula*. The paw volume was significantly inhibited by the ethanolic extract of *Luffa acutangula* fruit (Mohan Raj et al. (2012).

The analgesic effect of the *Luffa acutangula* var. amara ethanolic seed extract was assessed using the carrageenan-induced rat paw edoema method and the tail flick and tail immersion procedures. By using the tail flick and tail immersion procedures, the extract demonstrated considerable analgesic efficacy and a strong anti-inflammatory impact as compared with diclofenac sodium (Fernandes et al., 2010).

In gastric pain model mice, where pain was generated by intraperitoneal administration of acetic acid, resulting in pain and concurrent abdominal constrictions, the antinociceptive potential of the methanolic fruit extract of

Luffa acutangula was assessed. At doses of 100, 200, and 400 mg/kg bw, respectively, the extract decreased the number of abdominal constrictions brought on by stomach discomfort in mice. For each of the extract doses, the results were statistically significant (Fernandes et al., 2010).

Immunomodulatory effect

By adopting an in vivo phagocytosis assay with neutrophil adhesion and carbon clearance, the ethanol extract of *Luffa acutangula* var. amara was assessed for immunomodulatory activities. The ethanolic extracts significantly raised the percentage of neutrophil adhesion, the phagocytic index, and the in vitro antioxidant activity (Fernandes et al., 2010).

Abortifacient effect

Some farmers from Brazil's northeast have reported cases of abortions in ruminants that have consumed *Luffa acutangula* fruits. Women used to induce abortions with tea produced from this plant. Reduced foetal weight and the prevalence of a single cleft palate were signs that *Luffa acutangula* consumption during pregnancy prevented proper development of rat pups (Jadhav et al., 2010).

Toxicity

The oral LD50 of the ethanolic extract of *Luffa acutangula* 's fruits and seeds in rats was greater than 5 g/kg in acute toxicity and lethality tests. Mice receiving doses up to 10 g/kg of the hydro-alcoholic (70%) fruit extract of *Luffa acutangula* did not experience any mortality, even after 72 hours (Ulaganathan et al. (2010).

Conclusion

An examination of *L. acutangula* showed that the plant is the source of numerous nutrients and chemical components that are crucial for medicinal purposes. Folklore and ethnobotanical assertions suggested its historical use in India's indigenous and traditional medical systems. It has been shown through studies to have hepatoprotective, anti-diabetic, anti-ulcer, anti-proliferative and anti-angiogenic, anti-cancer, antioxidant, CNS depressant, fungistatic, anticataleptic, analgesic, antibacterial, larvicidal, and immunomodulatory properties. Although *L. acutangula* is already consumed as a vegetable across India, several nutraceutical products may be produced from it due to its high nutritional content and demonstrated medical importance. The bioactive components of *L. acutangula*, which are responsible for the plant's health advantages, should also be the subject of investigations, as they may provide some clues for the development of novel drugs to treat a variety of chronic conditions.

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