

# Ethnobotanical Uses and Pharmacological Potentials of *Citrullus colocynthis*

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## Abstract

A valuable cucurbit plant, *Citrullus colocynthis* (L.) Schrad is found throughout the world's desert regions. *Citrullus colocynthis* fruits are typically known for their many therapeutic applications, as well as their potential as pharmaceuticals and nutraceuticals. Using a critical examination of the gaps and opportunities for further research, this review attempts to evaluate the existing data on the ethnobotanical knowledge, ethnopharmacology, nutraceutical potential, and safety investigations of *Citrullus colocynthis* (bitter apple) fruit. According to scientific research, *C. colocynthis* has bioactive substances such as cucurbitacin, flavonoids, polyphenols, and other strong chemicals that support its anti-inflammatory, anti-cancer, antioxidant, and antidiabetic effects. More research is necessary to fully understand its potential therapeutic uses for cardiovascular, pulmonary, and digestive diseases.

**Keywords:** *Citrullus colocynthis*, Cucurbit, Medicinal, Ethnobotanical, Bioactive compounds

## Introduction

Harshberger in 1895 instituted the term ethnobotany to show plants utilized by the aboriginals (Bhodiwal et al., 2022). One of the most genetically varied families of food plants is the Cucurbitaceae. The plants of this family often tolerate drought, however they are sensitive to frost and intolerant of moist, poorly drained soils. Gourd, cucumber, melon, bitter apple, and pumpkin are some of the well-known members of this family (Robinson and Decker-Walters, 1999). Their production appears to have expanded over time as a result of consumer awareness of the health advantages of cucurbit fruits and plants. China and India have been the biggest producers of cucurbits over the past 20 years, followed by the United States, Russia, Egypt, and the Republic of Iran.

A useful cucurbit plant with both medicinal and nutraceutical uses, *Citrullus colocynthis* (L.) Schrad is found throughout the world's arid regions, including Pakistan (Asyaz et al., 2010). Indrayan in Hindi, Kattu Kattuvellari in Malayalam, Hanjal in Urdu, Anedri in Sanskrit, Rakhhal in Bengali, and Pcitummatti in Tamil are some common names for the fruit of *Citrullus colocynthis* (Amamou et al., 2011). *Citrullus colocynthis* research articles are becoming more and more common each year, according to data from the Australian New Crop website. According to Qureshi et al. (2010), this plant is a well-known traditional medication for treating diabetes, jaundice, and asthma. Numerous investigations on phytochemistry, toxicological, and pharmacology have been carried out recently (Ali et al., 2013). Thus it includes the review and assessment

of plant-human relations in all stages and the impact of plant climate on human culture (Bhodiwal et al., 2022).

There isn't currently a comprehensive evaluation that covers every facet of this priceless fruit. We compiled current and dispersed published material on this plant in the form of a thorough assessment because of its many uses as a functional food ingredient, a nutritious fruit, and a folk remedy. In addition to contemporary research on the ethnopharmacology and pharmacological properties of the *Citrullus colocynthis* fruit, this paper provides a review of its ethnobotanical usage.

### Nutritional Value

The primary fatty acids are palmitic and stearic, which are present in amounts 8.1–17.3% and 6.1–10.5%, respectively. The main ingredient for the healing properties is the high concentration of linoleic acid, an essential monounsaturated fat, which makes up 50.6% to 60.1% of seed oil. Unsaturated fatty acid fat profiles reveal that the linoleicoleic acid class is closely related to a small number of other vegetable oils. Like several other cucurbit seed oils, it is therefore probably going to have potential culinary applications (Dhakad et al., 2017). For every 100 g of seeds, there are 13.19 g of protein, 18.59 g of fat, 4.91 g of moisture, and 2 mg of ash. 569 mg of Ca, 465 mg of K, 210 mg of Mg, 30.0 mg of P, 11.9 mg of Na, 11.6 mg of Fe, 5.1 mg of Cu, and 1.1 mg of Zn are among the minerals found in the seeds (Hussain et al., 2014).

### Pharmacological Properties

Numerous pharmacological studies have been prompted by *Citrullus colocynthis*'s traditional therapeutic uses. Figure 1 show the fruit *Citrullus colocynthis*. Several extracts and isolated compounds have been evaluated for their biological activities.



**Figure 1: Fruit *Citrullus colocynthis***

- i. **Anti-microbial activity:** Six fungus strains and sixteen bacteria were tested for the leaf extract's antimicrobial activity, which was compared to standards (piperacillin 100µg/disc and gentamicin 10µg/disc). Water extracts exhibit a greater level of antibacterial activity against strains of *Staphylococcus aureus* and *E. coli*, while organisms such as *Klebsiella pneumoniae* and *Bacillus subtilis* exhibit a lesser level of antibacterial activity. Methanol extracts demonstrated the strongest antibacterial activity against

Salmonella typhi, Streptococcus pyogenes, and Bacillus subtilis strains (Gurudeeban et al., 2010). Acetone, ethanol, methanol, and water extracts shown strong antibacterial action against bacterial strains, Salmonella typhi, Staphylococcus aureus, Shigella shigella, and the fungus Candida albicans. However, none of the strains mentioned above respond well to petroleum ether extracts (Rodge & Biradar, 2012). Disc diffusion was used to study the antifungal activity of hydroalcoholic extracts against Aspergillus strains, and broth macrodilution techniques revealed extract sensitivity. Comparing A. niger and A. fumigatus's antifungal activity to that of C. krusei and C. guilliermondii, it was shown to be extremely high (Eidi et al., 2015).

- ii. **Antioxidant Activity:** The methanolic fruit extract of *C. colocynthis* was used to investigate its antioxidant qualities. Its good free radical scavenging action was revealed to be caused by gallic acid, a phenolic component. At a dosage of 2500 mg/mL, the extract demonstrated the strongest antioxidant and free radical scavenging properties (Kumar et al., 2008). The extract was also found to contain the antioxidant cucurbitacin, which can stop lipid peroxidation and degradation and eliminate free radicals such hydroxyl, superoxide, and oxygen singlets. According to reports, the bitter apple extracts include polyphenolic compounds that provide traditional medicinal and nutraceutical plants their therapeutic effects, as well as organic compounds that can function as potent antioxidants (Bernard & Olayinka, 2010). With an IC50 value of 0.021 mg/mL, it was discovered that the aqueous leaf extract of *C. colocynthis* has a DPPH free radical scavenging effect. Because it directly scavenges numerous free radicals, cucurbitacin glycoside, which is generated from bitter apples, also showed ABTS radical scavenging capabilities (IC50, 145 M). According to an in-vitro study, *C. colocynthis*'s several biochemical components with potent antioxidant qualities can lessen the harm that free radicals cause to the body. It was discovered that the oil extracted from *C. colocynthis* enhanced the activity of antioxidant enzymes and shielded the liver from harm (Amamou et al., 2015). Gallic acid, cucurbitacin, and other biochemicals make *C. colocynthis* an excellent antioxidant all around.
- iii.
- iv. **Antilipidemic activity:** *Citrullus colocynthis*'s ability to decrease cholesterol was investigated in both hyperlipidemic human participants and an animal model. In hyperlipidemic rabbits, the plant's ethanol extract (1.2 g/kg/day) restored the serum cholesterol level to normal (Daradka et al., 2007). In hyperlipidemic non-diabetic patients, a daily consumption of 300 mg of powdered *Citrullus colocynthis* seeds reduced the concentration of triglycerides and cholesterol (Rahbar and Nabipour, 2010).
- v. **Anti-inflammatory activity:** It is well recognised that gastrointestinal tract ulcers can result from the use of non-steroidal anti-inflammatory medicines (NSAIDs) in modern practice (Graham et al., 1988). Although NSAIDs with selective COX-2 inhibitory effect are thought to be less likely to induce ulcers, several of them have been taken off the market because of reports of their deadly cardiac toxicity. As a result, the demand for safer anti-inflammatory medications is rising. Because of its anti-inflammatory qualities, *Citrullus colocynthis* is one of the primary plants used in folk medicine (Marzouk et al., 2010). The carrageenan-induced paw oedema experiment in rats was used to screen for anti-inflammatory activity in the fruit's aqueous extract (4 mg/kg) (Marzouk et al., 2010), validating the plant's therapeutic usage in rheumatoid arthritis as well as an analgesic and anti-inflammatory agent. Another study used the carrageenan-induced paw oedema paradigm in albino rats to reveal the in vivo anti-inflammatory efficacy of the several *Citrullus colocynthis* extracts (Aly and Naddaf, 2006). The carrageenan-induced paw oedema assay in rats was used in an anti-inflammatory investigation on the crude extract of immature fruit from South Tunisia, demonstrating the plant's anti-inflammatory properties. *Citrullus colocynthis* may be free of ulcerogenic action and provide a safer and more effective anti-inflammatory alternative, even though its

antiulcer activity has not yet been investigated. Plants are known to be rich in antiulcerogenic activity (Zaidi et al., 2012).

- vi. **Other pharmacological properties:** The impact of *Citrullus colocynthis* on hair growth was investigated in albino rats due to its therapeutic use as a hair tonic in Ayurveda (Roy et al., 2007). The findings showed that, in comparison to untreated control animals, the time it took for hair to grow was cut in half when the petroleum ether extract was administered. Furthermore, a higher percentage of hair follicles (470%) were successfully brought to the anagenic phase by the treatment than by the conventional medication minoxidil (67%). Using a type I allergic model in mice, the antiallergic component of cucurbitacin E, which was extracted from the methanolic fruit extract of *Citrullus colocynthis*, demonstrated an inhibitory impact on ear passive cutaneous anaphylaxis. The anti-allergic properties of Cucurbitacin E and its aglycone were demonstrated at 100 and 125 mg/kg, p.o., respectively (Yoshikawa et al., 2007). Hexane, methylene chloride, chloroform, and ethanol extracts of *Citrullus colocynthis* fruits were found to have insecticidal action against *Aphis craccivora*. The corresponding extracts' LD50 values were 23,065, 19,497, 17,328, and 11,033 ppm, respectively. In a different investigation, several extracts from *Citrullus colocynthis* shown larvicidal effects on mosquito larvae (Rahuman et al., 2008).

## Conclusion

The literature makes clear that *Citrullus colocynthis* has many medicinal applications and has been thoroughly investigated for its anti-inflammatory, anti-cancer, antioxidant, anti-microbial, and antidiabetic properties. However, it has potential for treating disorders of the gut, airways, and heart has not yet been investigated. The plant has enormous potential for use in pharmaceutical and nutraceutical applications, according to critical analysis, with some signs of synergistic and/or side effect-neutralizing combinations of activity.

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