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Review Article

## Ethnomedicinal significance of *Citrullus lanatus* (Watermelon): A pharmacological review

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### Abstract

Watermelon (*Citrullus lanatus*) is a popular fruit eaten worldwide that contains a lot of seeds and pulp. These seeds have significant nutritional and functional value. The most exported and consumed fresh fruit has its seeds and peels thrown away. Due to its adaptability to temperature and soil types, it is grown in many places and has considerable commercial value internationally. Due to its flavour and chemical composition, melon is a good source of physiologically active substances for humans. Melon contains glucose, fructose, vitamins A, D, C, K, E, and specific B vitamins. The melon seed contains many biologically active substances, such as tocopherols, phospholipids, and sterols, which benefit humans. Thus, these seeds are unique functional foods for a healthy food chain. Melon pulp and seed's anti-inflammatory, hypoglycemic, antibacterial, antigenic, and antioxidant bioactive compounds are justified.

**Keywords:** Watermelon, Cucurbitacin, phytonutrient, citrulline, immunity, vitamins, ethnomedicinal

### Introduction

The watermelon, also scientific known as *Citrullus lanatus*, is a fruit crop that comes from an herbaceous creeping plant that is a member of the Cucurbitaceae family. Most of its offspring come from the plant's own seeds, and it does best in warm climates. Because it is a tropical plant, it must be exposed to a great deal of sunlight and kept at temperatures of at least 25 degrees Celsius in order to thrive. The ideal growing conditions for watermelon are well-drained, fertile soil that has a somewhat acidic pH. It is possible to cultivate it along the coast of Ghana, in the forest zone, and particularly along river banks in the Northern Savannah areas [1-3]. The *Citrullus lanatus* plant's fruit, also known as the "water melon," gets its name because it contains about 93% water. The name "melon" was given to the fruit because it is huge and round like a melon and has a flesh that is both delicious and pulpy [4, 5]. The name of the watermelon in scientific circles comes from a combination of Greek and Latin origins. The word "citrus," which refers to the fruit, is where the "Citrullus" component of the scientific name originates from. The lanatus component of the name comes from Latin, and it means "woolly." This refers to the small hairs that are found on the stems and leaves of the plant. Infectious diseases account for 50% of all deaths in tropical countries, according to research by the WHO published in 1977 [6].

### 2. Botanical Specifications and Origin

The fruit of the *Citrullus lanatus* plant, also known as the "water melon," gets its name from the fact that it contains roughly 93% water. The name "melon" was given to the fruit because it is huge and round like a melon and has a flesh that is both delicious and pulpy. The name of the watermelon in scientific circles comes from a combination of Greek and Latin origins. The word "citrus," which refers to the fruit, is where the "Citrullus" component of the scientific name originates from. It is believed that watermelon originated in southern Africa due to the fact that it can be found growing wild throughout the region and attains its greatest diversity of forms in that region. More than four thousand years have passed since it was first planted in Africa. The Spanish were responsible for *Citrullus lanatus*' initial introduction to the Americas and its subsequent meteoric rise to prominence as a crop [6-8].

*Citrullus lanatus* is an annual plant that can grow prostrately or climbing, and it has numerous herbaceous, robust, and stout stems that can grow up to 3 metres in length. The older sections are hairless, but the younger parts are thickly fuzzy and covered in hairs ranging from yellow to brown. The leaves are herbaceous but inflexible, becoming rough on both sides; they range in length from 60 to 200 mm and width from 40 to 150 mm, but they are often profoundly 3-lobed, with the segments again lobed or doubly lobed; the central lobe is by far the largest of the three. The leaf stalks can be up to 150 mm long and have a slight hairy texture. The tendrils are typically split in the upper portion and are quite robust overall. The plant is monoecious, producing both male and female flowers on the same plant. The flower stalk can grow to be up to 40 mm long and is hairy. The wild form of the fruit is subglobose, indehiscent, and can reach a diameter of up to 200 millimetres; the fruit stem can reach a length of up to 50 millimetres. The fruit ranges from 5 to 70 centimetres and weighs from 0.1 to 1 kilogramme. It is often globose, oblong, or ellipsoid, although it can also be oval. Fruits of the *Citrullus lanatus* species have yellow flesh. The seeds are obovate to elliptical, flattened, 0.5–1.5 cm 0.5–1 cm, smooth, yellow to brown or black, and very rarely white 3.0 kg (0.1–2.5 kg in egusi melon; 1.5–3.0 kg in watermelon) [3, 6].

### 3. Nutritional values

The rind and the seeds of a watermelon both contribute to the fruit's overall nutritional profile and should not be discarded. The pink or yellow flesh of the watermelon is typically eaten raw, just as it was while the watermelon was growing, and this is the most popular manner in which watermelon is consumed. However, other frequent ways of consuming it include making pickles out of the watermelon rind, deep-frying watermelon, baking with watermelon, and drinking watermelon lemonade (Wind, 2008). Alongside other cereals and grains, including sorghum and maize, it has been cultivated throughout southern Africa since pre-colonial times. The young, sensitive leaves and fruits are both used in cooking as green vegetables. The fruit flesh, on the other hand, can be used to make porridge with maize flour. Additionally, it is an important feed for livestock, particularly during periods of drought. The fruit can be cooked in it or used as a container for storing berries if it is hollowed out first [6, 8].

The flavour of the meat is not nearly as appetising as the flat brown seeds, which have a significantly higher nutritional value than the flesh. They have been shown to provide significant levels of riboflavin, vitamin C, fat, and minerals, as well as starch and minerals. Either they are dried, roasted, and consumed naturally, or milled into flour and used to make bread. It is believed that the flour contains saponin, which can also be used as a cleaning agent. According to Moldenke and Moldenke's research from 1952, the seeds have a high percentage of an oil that is quite similar to the oil extracted from pumpkin seeds and can be used in cooking [6, 9].

In West Africa, the seeds are ground into a pulp, which is then used as a thickener in various soups. They are also fermented to generate a sweetener known in the area as "Ogiri," or they are roasted, mashed, wrapped in leaves, and then boiled to produce another sweetener known as "igblo." In Nigeria, the residue that is left behind after oil extraction is formed into balls and then fried to create a local delicacy

known as "robo." The residue is also used to feed livestock. According to Moldenke & Moldenke (1952), the residue that is left over after oil extraction is either formed into balls or fried to create a local delicacy in Nigeria known as "robo," or it is used as feed for cattle. In semiarid places, *Citrullus lanatus* seeds are increasingly cultivated for their oil production and other use [6, 10].

### 4. Ethnomedicinal significance

Wild melon, also known as *Citrullus lanatus* var. *citroide*, is said to have played a significant role in the practise of traditional herbal therapy. According to Saiwal, N., (2019), the fruits of *Citrullus lanatus* can be consumed as a febrifuge when they are fully ripe or even when they are almost rotting [2]. According to Khalid, (2021), the root acts as an emetic and a purgative when taken in sufficient quantities [1]. According to Erhirhie, E. O., & Ekene, N. E. (2013). The seed has demulcent, pectoral, and tonic properties [4]. It is sometimes used in treating urinary tract infections as well as bed wetting Both of these treatments may be found in Moerman. Additionally, the fruit has been shown to be beneficial in the treatment of dropsy and renal stones as well as having a diuretic effect [6]. Additionally, the seed is effective as a vermifuge and can lower blood pressure. According to preliminary research, eating watermelon may help lower blood pressure [10, 11]. This benefit was attributed to the fruit's high water content. *Citrullus lanatus* is used in Northern Sudan to treat burns, swellings, rheumatism, gout, and as a laxative. The fruits are consumed as a harsh laxative. They are used as a treatment for diarrhoea, gonorrhoea, and other gastrointestinal disorders. Tar may be produced from the plant's seeds and used as a remedy for scabies and a tanning agent for the skin [Sharma *et al.* 2020]. According to Ijaz, A., *et al* (2022), the oil extracted from the seeds has an anthelmintic activity that is superior to that of pumpkin seed oil. *Citrullus lanatus* is a medicinal plant. Many of its traditional therapeutic uses have yet to be proven by researchers. This article reviews the plant's medicinal benefits [11].

### 5. Botanical Description [6]

**Kingdom:** Plantae

**Order:** Cucurbitales

**Family:** Cucurbitaceae

**Genus:** *Citrullus*

**Species:** *C. lanatus*

**Botanical Name:** *Citrullus lanatus*

### 6. Indian local name [4, 6]

Sanskrit: Kharabuja; Bengali: Tormuj; Hindi: Tarbooz; Gujrati: Indark; Marati: Kadu Vrindavana. Urdu: Tarbooz; Panjabi: Tarabuuja; Tamil: Palam; Telugu: Puchakaya.



**Fig 1:** Watermelon (*Citrullus lanatus*) fruit.

## 7. Plant description

Annual herb, watermelon. India and other warm countries grow it. It has long stems, curly tendrils, and large, hairy leaves. 3-5-lobed leaves are rough. The monoecious plant has hairy, long flower stalks and male and female flowers. Wild fruit is 1.5-20 cm, malting, greenish, subglobose, dark green, and has a 50 mm fruit stalk. Wild pulp is yellow or green; cultivar pulp is dark red. Brown or black (rarely white) ovate, flattened 9-12-5-7 mm seeds [6, 7, 8].

## 8. Nutritional values

The *Citrullus lanatus* fruit has around 6% sugar by weight and 92% water by weight. Carbohydrates: approximately 7.5–8.5 grammes, Sugars: approximately 6-8 grammes, Protein: approximately 0.5-1 gramme, Fibre in the diet: around 0.4 grammes. About 0.6 grammes of protein are contained in this serving. Approximately 0.2 grammes of fat, Approximately 30-40 kcal in terms of calories. It is an excellent source of vitamins A, B, and C, all of which are important for the manufacturing of energy. *Citrullus lanatus* contains approximately 6% sugar but 92% water based on their total weight. Vitamin C is abundant in this food source. The dried seed without the shell has the following components per one hundred grammes: protein 28.3 grammes, fat 47.4 grammes, water 5.1 grammes, energy 2340 kilojoules (557 kilocalories), carbohydrates 15.3 grammes, calcium 54 mg, phosphorus 755 mg, iron 7.3 mg, thiamin 0.19 mg, riboflavin 0.15 mg, niacin 3.55 mg, and folate 58 micrograms. It was observed that the seed oil included oleic, palmitic, and stearic acids in addition to glycosides of linoleic acid [6, 9]. Antioxidants, vitamins, and minerals can all be found in medicinal plants in healthy amounts. They have the potential to be used in the production of a wide variety of food goods, such as cookies, to raise the nutritional value of those products, which can assist in meeting nutritional requirements and warding off a variety of degenerative diseases.

### 8.1 Citrulline

Watermelon is rich in citrulline [8, 9]. Citrulline is a powerful osmolyte and radical scavenger against drought and salt stress [7]. Watermelon contains 0.7–3.6 mg/g of citrulline. Citrulline averaged 3.1 mg/g across 56 cultivars in recent research. Watermelon citrulline content is still being studied [9, 10]. L-citrulline conjugates with more NO-boosting substances than L-arginine. Nitric acid deficiency can cause essential hypertension, heart failure, decreased skeletal muscle metabolism, insulin resistance, type 2 diabetes, and age-related muscle atrophy [6]. L-citrulline efficiently converts to L-arginine and nitric oxide, which may improve endothelial vasodilation [10-12]. Sickle cell anaemia, immunological function, wound healing, and cardiovascular health have been researched using citrulline [13]. Citrulline is a precursor to arginine, a semi-essential amino acid for babies and very ill or damaged adults. Watermelon has unique amino acids. Citrulline is spontaneously created by an enzyme reaction of nitrogen-carbon-containing L-glutamine and absorbed in the colon [6].

Nitrite and nitrate, substrates for cell nitric oxide generation, are rapidly metabolised from plasma nitric oxide [6]. L-citrulline and watermelon supplements may improve cardiovascular and metabolic health. L-citrulline directly and indirectly affects skeletal muscle and adipose tissue metabolism, which mediate cardiometabolic diseases. L-

arginine availability for nitric oxide generation is the main health benefit of L-citrulline supplementation. Citrulline, a powerful antioxidant and hydroxyl radical scavenger, has many health benefits [5].

## 9. Watermelon Ethnomedicinal Health Benefits

Watermelon (*Citrullus lanatus*) is delicious but hydrating, and may have health advantages. Watermelon, observed for its high water content and pleasant taste, contains minerals and bioactive substances with ethnomedicinal beneficial effects on health.

### 9.1 Antioxidant activity

In their investigation, *Citrullus lanatus* chloroform, ethyl acetate, and methanol extracts showed antioxidant activity. All chloroform, ethyl acetate, and methanol extracts were antioxidant-tested using DPPH. Methanolic extract of *Citrullus lanatus* (MECL) seeds has the highest antioxidant potential [2, 5].

### 9.2 Anti-inflammatory action

*In vivo* and *in-vitro* *Citrullus lanatus* seed oil (CLSO) anti-inflammatory study Carrageenan-induced paw edema in rats and human red blood cell membrane stabilisation *in vitro* evaluated the oil for anti-inflammatory efficacy. Oil potency was compared to diclofenac (10 mg/kg). The oil significantly reduced edema in the carrageenan-induced rat paw edema model at maximum at 3 hr (percentage reduction in paw volume: 44.44%, 55.56%, and 63.11% for CLSO (50 mg/kg), CLSO (100 mg/kg), and diclofenec (10 mg/kg), respectively) and protected HRBC in hypotonic solution at 100, 250, and 500 mcg/ml [5, 6, 14].

### 9.3 Immune System

Immunity means resistance to an illness or poison. Immunity is the body's defence against many diseases. Infection, immunisation, and external triggers cause immunity [2]. The innate and adaptive immune systems are divided by function. The adaptive immune system recognizes specific antigens, but the innate response is triggered by the "Pattern Recognition Receptor" (PRR), which recognizes components that are conserved across broad groups of microorganisms [22]. Immunomodulators induce, enhance, and inhibit any immune system component. Immunostimulators and immunosuppressants are immunomodulators. When severe tissue damage occurs, the immune system is suppressed or stimulated to control auto-immune illnesses. Immunomodulators regulate pathophysiological processes [2, 4]. Researchers are interested in plant-based immunomodulators. Innovative technology and extensive study on immunomodulatory natural products, plants, their extracts, and their active moieties may provide novel immunomodulatory drugs to enhance current chemotherapies [5]. Multiple sclerosis is treated with immunomodulatory medicines like thalidomide and lenalidomide.

### 9.4 Anti-ulcer activity

A crude methanolic extract of watermelon seeds was tested in two different ulcer models: pyloric ligation (PL, 4 h ligation) and water immersion (WS, 25 °C for 3 h) stress-induced ulcer models in albino Wistar rats. In the pyloric ligation model, *Citrullus lanatus* decreases stomach volume (53.55%), free acidity (57.02%), and total acidity (36.53%).

Methanolic seed extract has dose-related antiulcer action, peaking at 800mg/kg <sup>[6]</sup>.

### 9.5 Antimicrobial activity

A research study demonstrated the antimicrobial activity of chloroformic, hexane, and ethanolic extracts of leaves, fruits, stems, and seeds from *Citrullus lanatus* var. Citroides (CL) against bacteria (*Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aureginosa*, *Bacillus subtilis*, and *Proteus vulgaris*) and fungi (*Aspergillus niger* and *Candida albicans*). Cup-plate and disc diffusion tests tested antimicrobial CL. Fruit chloroform extract has the most potent antibacterial activity. It inhibited *S. aureus*, *B. subtilis*, *E. coli*, and *P. vulgaris*. Ethanolic extract of *C. albica* fruit pulp and stem has the best anti-fungal activity (41 m). The seed and leaf chloroform and ethanolic extracts were particularly sensitive to nigers. *Citrullus lanatus* seed extract's antimicrobial activity was also investigated. Seed extracts against the selected bacteria showed that extracts from cold maceration, Soxhlet extraction, chloroform, and methanol exhibit antibacterial potential, especially against *Staphylococcus sp.* and *P. aeruginosa* <sup>[5, 6]</sup>.

### 9.6 Liver protection

*Citrullus lanatus* seeds protected rats from carbon tetrachloride-induced hepatotoxicity by measuring serum hepatic enzyme levels and liver tissue histopathology. *Citrullus lanatus* seed oil (125 mg and 250 mg) and standard silymarin (100 mg/kg) were given orally to rats for 10 days. In treated groups with CCl<sub>4</sub>-induced liver injury, blood ALT, AST, and ALP levels decreased significantly, comparable to standard medication. *Citrullus lanatus* seed oil protects the liver, according to histopathological studies <sup>[6, 15]</sup>.

### 9.7 Antioxidant, anti-inflammatory, and analgesic potential

*Citrullus lanatus* seed extract was tested in rodents for antioxidant, anti-inflammatory, and analgesic properties. High-polarity solvents extracted the seeds. All extracts were DPPH and H<sub>2</sub>O<sub>2</sub>-tested for free radical scavenging. The *Citrullus lanatus* seed methanolic extract was tested for *in vivo* anti-inflammatory and analgesic activities utilising carrageenan-induced rat paw edema and tail flick and tail immersion procedures. MECL was the most potent antioxidant. MECL 200mg/kg had a considerable (p 0.05) anti-inflammatory and analgesic effect compared to diclofenac sodium and morphine. The methanolic extract of *Citrullus lanatus* seeds exhibits antioxidant, anti-inflammatory, and analgesic properties and may be used as a dietary medicine <sup>[6, 17, 18]</sup>

### 9.8 Antisecretory Effects

*Citrullus lanatus* juice was tested for gastric acid output and pH in Indomethacin-induced ulceration in male albino rats. Two investigations comprised the experiment. Each study pretreated four groups of rats with distilled water (control), 25%, 50%, or 100% watermelon juice for 30 days. *Citrullus lanatus* juice reduced gastrointestinal lesions in rats (P 0.05). Pretreatment reduced ulcerogenesis (P 0.05). In Indomethacin-induced stomach ulcers, *Citrullus lanatus* (watermelon) juice appears to be gastroprotective <sup>[5, 6, 19]</sup>

### 9.9 Anti-diabetic action

*In vivo* watermelon (*Citrullus vulgaris* Schrad) anti-diabetic potential was assessed. ICR mice were fed diets with none, 10% watermelon flesh powder (WM-P), or 1% watermelon rind ethanol extract (WM-E). After 4 weeks, mice received streptozotocin (40 mg/kg, i.p.) for 5 days to develop diabetes. WM-E supplementation effectively lowered blood glucose and boosted serum insulin. WM-P feeding caused moderate but non-significant alterations. Watermelon prevented pancreatic cell death in an immunohistochemical investigation, suggesting it may help diabetes <sup>[5, 6, 20]</sup>.

### 9.10 Laxative action

Aqueous *Citrullus lanatus* fruit pulp extract was tested in albino Wistar rats for laxative effects. Rats were placed into five groups of six animals each. The first group was a control, the second was a standard (sodium picosulfate), and groups 3, 4, and 5 were treated with *Citrullus lanatus* fruit pulp aqueous fruit pulp extract at doses of 250, 500, and 1000mg <sup>[6]</sup>.

### 10. Future Perspectives

Even though watermelon (*Citrullus lanatus*) was the highest source of lycopene and citrulline among all fruits, research has established that tomatoes and products based on tomatoes supply at least 85 percent of our dietary lycopene. This is the case even if watermelon (*Citrullus lanatus*) was discovered to be the highest source of lycopene and citrulline among all fruits. Thus, watermelon-based products are needed. Watermelon had the most lycopene and citrulline of any fruit. Watermelon can be used with other fruits to make more marketable products. According to various studies, watermelon processing only partially removes its lycopene. Lycopene can be extracted from watermelon and used in pharmaceutical and food fabrication. Watermelon quality is still being monitored during processing to develop high-grade products <sup>[5, 6]</sup>. In the future, food processors must understand how maturity and processing modify watermelon's properties <sup>[19-21]</sup>.

### 11. Conclusion

Watermelon (*Citrullus lanatus* Linn) is a popular summer fruit, fruit salad, and drink garnish. Antioxidants are natural. Watermelon is a rare source of lycopene and phenolic antioxidants. Cucurbitacin E, a triterpene anti-inflammatory phytonutrient, and exceptional levels of L-arginine and citrulline are present. Watermelon contains immune-boosting vitamins C and A. Watermelon provides potassium and magnesium. Watermelon contains carbs, sugar, soluble and insoluble fibre, vitamins, minerals like magnesium and potassium, fatty acids, and amino acids. Watermelon's chemical components help it scavenge cell membrane LDL and HDL. It has a lot of weight-loss evidence. Watermelon seeds have been used for generations as antibacterial, antifungal, antimicrobial, antiulcer, and anti-inflammatory agents. The pharmacological, economic, and health benefits of mature watermelon seeds are similar to those of fresh pulp. On the other hand, not nearly as much research has been done on the nutritional value or antioxidant properties of watermelon seeds; hence, further research in this area must be conducted in the near future.

### 12. Conflict of interest

The authors declare that they have no potential conflicts of interest.

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