

Antimicrobial Properties of Different Parts of *Citrullus Lanatus* - A Review

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ABSTRACT

Citrullus lanatus (watermelon) is a popularly studied fruit crop for its various medicinal application because of the presence of many bioactive compounds. The different parts of the plant especially the fruit pulp and seeds are reported to have many applications based on its antioxidant, anti-plasmodial, anti-inflammatory, antisecretory, antidiabetic properties. The antimicrobial aspects of different parts of *Citrullus lanatus* including the seeds, fruit pulp, rind and leaves are discussed in this study. The effectiveness of rind extract as antibacterial and anti-fungal agent is of great potential since it is considered as a waste material after watermelon processing in industries. The present review aims to compile the antimicrobial action and the targeted microorganism so that the data can be used to stimulate further scientific research.

KEYWORDS: *Citrullus lanatus*, antimicrobial, bioactive compounds, seed, rind

INTRODUCTION

Watermelon (*Citrullus lanatus*) is a herbaceous creeping plant belong to the family cucurbitaceae and commonly grown as a tropical plant in warm areas. The fruit contains 93% water, because of which the name is derived as 'watermelon' [1]. It is used for treating various ailments in the Ayurvedic system of Indian medicine because of the presence of flavonoids, alkaloids, saponins, glycoside, tannins and phenols. It belongs to the family of Cucurbitaceae and the most consumed fruit worldwide, also known as an energy booster, due to its rich content of nutrients, vitamins and minerals [2,3,5].

Botanical Description [4]:

Taxonomy

Class: Equisetopsida

Kingdom: Plantae

Genus: Citrullus

Family: Cucurbitaceae

Order: Cucurbitales

Botanical name: Citrulluslanatus (Thumb)

The different parts of *Citrullus lanatus* have many proven medicinal applications. The fruit is most widely used for consumption, it also is a diuretic, being effective in the treatment of dropsy and renal stones [6]. The rind of the fruit is prescribed in cases of alcoholic poisoning and diabetes. The root is purgative and in large dose is said to be emetic and the seed is demulcent, diuretic, pectoral and tonic [7].

In addition to these medicinal roles, *Citrullus lanatus* is also

How to cite this paper: Sruthi Menon "Antimicrobial Properties of Different Parts of *Citrullus Lanatus* - A Review"

Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-4 | Issue-3, April 2020, pp.1106-1109,

URL: www.ijtsrd.com/papers/ijtsrd30818.pdf



IJTSRD30818

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studied for its antimicrobial properties. This study describes the different parts of *Citrullus lanatus* and their corresponding role in acting as antimicrobial agents.

FRUIT PULP

The watermelon is the one of the largest edible fruits grown in the world and it contains an array of important vitamins and minerals including vitamin A, vitamin C, vitamin B-6, potassium, and beta-carotene.

TABLE 1. *Citrullus lanatus* fruit pulp components [9,10]

Component	Weight per 100 g of watermelon pulp
Protein	0.6 g
Carbohydrate	7.6 g
Fats	0.13 g
Energy	30 calories
Vitamin C	8 mg
Vitamin A	570 IU
Potassium	112 mg
Magnesium	10 mg
Vitamin B6	0.04 mg
Thiamin	0.03 mg
Vitamin E	0.05 mg
Manganese	0.04 mg
Dietary fibre	0.4 mg
Iron	0.26 mg
Phosphorus	11.2 mg
Folate	3.3 mcg
Calcium	7.23 mg

Watermelon fruit also contains the important bioactive compounds citrulline and lycopene [8]. The nutrient composition of watermelon fruit is given in Table 1.

Other than its application in food industry, the extracts of *Citrullus lanatus* fruit pulp is used as anti-ageing agent, antioxidant, protective agent and hydrating agent in cosmetic industry. because of the presence of lycopene carotenoid, it is used as a UV protecting agent too [1].

Many studies have been carried out for estimating the antimicrobial potential of the fruit pulp. The chloroform

extracts and ethanol extracts of fruit pulp has shown very efficient antibacterial effect against *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli*, *Proteus vulgaris*, *Pseudomonas aeruginosa*. Their activity was higher as compared to similar extracts of watermelon leaves and seed. Also, it has been reported that the bioactive agents in the fruit pulp are better extracted in chloroform and ethanol than in hexane. The solvent based extracts of fruit have also shown anti-fungal properties against *Aspergillus niger* and *Candida albicans* [11]

SEED

Composition of dried seed without shell per 100 g is given in Table 2. Many studies have also analysed the seed oil to carry oleic, palmitic, stearic acid and glycosides of linoleic. [12,13].

TABLE 2. *Citrullus lanatus* seed composition [12]

Components	Weight per 100 g driseed
Protein	28.3 g
Fat	47.4 g
Water	5.1 g
Carbohydrate	15.3 g
Calcium	54 mg
Phosphorus	755 mg
Iron	7.3 mg
Thiamin	0.19 mg
Riboflavin	0.15 mg
Niacin	3.55 mg
Folate	58 µg

The flat brown seeds have a nice nutty taste and have a good food value because of the nutritional contents mentioned in Table 2. Reports have also stated that the seed pulp has been used as thickener in soup in different parts of Africa. The seed oil is also having an important application in cosmetic industry, pharmaceutical industry and in infant diet supplements [14,15]. Studies have also reported about the anti-inflammatory, anti-ulcerogenic, antioxidant and hepatoprotective properties of seed extract [16-19].

The antimicrobial effect of chloroform, ethanol and aqueous extract of seeds of *Citrullus lanatus* has been successfully established against organisms such as *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Bacillus cereus*, *Proteus mirabilis* and *Streptococcus pyogenes* [20-22]. *Klebsiella pneumoniae* was seen to be comparatively more resistant to ethanol extract than the other organisms tested [22,23]. The minimum inhibitory concentrations for aqueous extract are reported as 6.25 mg/ml, 25 mg/ml, 12.5 mg/ml and 6.25 mg/ml for *S. aureus*, *E. coli*, *K. pneumonia* and *P. aeruginosa* respectively, whereas for ethanol extract, it has been reported as 6.25 mg/ml, 6.25 mg/ml and 25 mg/ml for *E. coli*, *S. aureus* and *P. aeruginosa* respectively [22]. All the results from different analysis have shown good antimicrobial potential of seed of watermelon which is a clear indication of therapeutic property possessed by the seeds just like other parts of the plant.

TABLE 3. Phytoconstituents of different parts of *Citrullus lanatus*

Seed [30]	Seed Oil [29,30]	Fruit [24,25]	Rind [27]	Leaves [20]
Lycopene, beta-carotene, xanthophylls, phenolics, vitamin C Globulin, albumin, glutelin. arginine, isoleucine, leucine Flavonoids, vitamin C, thiamine, riboflavin, polyphenolic compounds	Oleic, Lenolic fatty acid, Palmitic acid, Stearic acid,	polyphenols, vitamin C, β-carotene, lycopene, Antioxidants Flavanoids, Terpenoids, Saponins	saponins, flavonoids, steroids, tannins, cardiac glycosides and lipids.	Alkaloid, Flavanoid, Tanins, Simple phenols, Terpenes, Steroids

RIND

The rind of *Citrullus lanatus* has been reported to be a rich source of natural citrulline, a non-essential amino acid, which is more abundant in the rind than the flesh. An enormous amount of watermelon rind is generated as waste per year and discovering new uses for these rinds will be of great advantage [26]. The phytochemical constituents in rind of watermelon is listed in table 3 [27].

The methanol extract of *Citrullus lanatus* rind has antibacterial effect against *Proteus sp.*, *Escherichia coli* and *Pseudomonas aeruginosa*. The aqueous extract has also shown effective action against *Klebsiella pneumoniae* [27]. The ethanol extract of has shown higher antibacterial effect against *E. coli* and antifungal effects against *Candida albicans*, *Aspergillus niger* and *Penicillium chrysogenum* as compared to fruit and seed extract. The aqueous extract also shows effect against *Trichosporo bePELLI* [28].

LEAVES

The phytochemical components of leaves of *Citrullus lanatus* are listed in table 3. Hexane, Chloroform and Ethanol extract of leaves of *Citrullus lanatus* have shown antibacterial effect against *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli*, *Proteus vulgaris* and *Pseudomonas aeruginosa*. Maximum effect was seen in the chloroform and ethanol extract against *B. subtilis*. This extract also has antifungal effect against *Aspergillus niger* and *Candida albicans* [20].

CONCLUSION

The above analysis of *Citrullus lanatus* thus indicates that other than having high nutritive properties, different parts of watermelon also show potential anti-microbial properties. The widely available components from watermelon rind should be exploited to its maximum since it proves to be a cheaper and better antimicrobial agent. The above knowledge of antimicrobial properties can be applied in different fields such as environmental treatments, use for destruction of biofilms, use in food preservation and packaging industry, application in pharmaceutical and cosmetic industry etc. Further investigation will widen the range of microbes that can be targeted using these extracts and thus broadening its application in various fields.

REFERENCES

[1] Erhirhie EO, Ekene NE. Medicinal values on *Citrullus lanatus* (Watermelon). *Int J Res Pharm Biomed Sci* 2013; 4:1305-12.

[2] Mercy GA, Bosa EO. The morphological characterization of the melon species in the family cucurbitaceae. juss. and their utilization in Nigeria. *Int J Mod Bot.* 2013; 3(2):15-19.

[3] Kumawat G*, Goyal M, Mathur K, Yadav S K, *Citrullus lanatus*: An Overview on Pharmacological Activities, *International Journal of Pharmaceutical & Biological Archives* 2017; 8 (1): 6 - 9.

[4] Mercy GA, Bosa EO. The morphological characterization of the melon species in the family cucurbitaceae. and their utilization in Nigeria. *Int J Mod Bot.* 2013;3(2):15-19.

[5] Tropical Plants Database, Ken Fern. tropical.theferns.info. 2020-04-25.

[6] Chiej R (1984). *Encyclopaedia of medicinal plants*. MacDonald ISBN 0- 356-10541-5.

[7] Duke JA, Ayensu ES (1985). *Medicinal plants of China: Reference Publications*.

[8] Graper D. Year of the Watermelon. March 25, 2013. IGrow site.

[9] Basic Report: 09326, Watermelon, raw. Agricultural Research Service, United States Department of Agriculture website.

[10] Food as Medicine: Watermelon (*Citrullus lanatus*, Cucurbitaceae), *HerbalEGram: Volume 12, Issue 7, July 2015*.

[11] Loiy Elsir Ahmed Hassan , Hasnah Mohd Sirat , Sakina M. Ahemd Yagi, Waleed S. Koko and Siddig Ibrahim Abdelwahab. In vitro Antimicrobial activities of chloroformic, hexane and ethanolic extracts of *Citrullus lanatus* var. citroides (Wild melon), *Journal of Medicinal Plants Research* Vol. 5(8), pp. 1338-1344

[12] Schippers RR. African indigenous vegetables, an overview of the cultivated species. Revised edition on CDROM. National Resources International Limited, 817. Aylesford, United Kingdom, 2002.

[13] Godwin, O.O., Udo, W.A., Abraham, A.N., Babatunde, A., & Joseph, U.I. (2015). An Assessment of the Phytochemicals and Antibacterial Activity of Seed Extract of *Citrullus Lanatus* (Watermelon), *International Journal of Research & Review*, Vol.2; Issue: 4; April 2015

[14] Moldenke HN, Moldenke AL. *Plants of the Bible*. Chronica Botanica, Waltham, Mass., U.S.A, 1952.

[15] Maynard DN. *Watermelons: characteristics, production and marketing*. American Society for Horticultural Science (ASHS) Press. Horticulture Crop Production Series. Alexandria, VA, United States. 2001, 227.

[16] Madhavi P, Maruthi R, Kamala V, Habibur R, Chinna E M. Evaluation of Anti-Inflammatory Activity of *Citrullus lanatus* Seed Oil by In-vivo and In-vitro Models. *Int. Res J Pharm. App Sci.* 2012; 2(4):104-108.

[17] Alok B, Rajeev K, Vivek D, Niyaz A. Evaluation of Anti-Ulcer Activity of *Citrullus lanatus* Seed Extract in Wistar Albino Rats. *International Journal of Pharmacy and Pharmaceutical Sciences*. 2011; 4(5):135-139.

[18] Gill SN. Evaluation of Antioxidant activity of *Citrullus lanatus* Seed extract in Rats. *Latin American journal of pharmacy (formerly Acta Farmaceutica Bonaerense)*, *Lat. Am. J. Pharm.* 2011; 30(3):429.

[19] Madhavi P, Kamala V, Habibur R. Hepatoprotective Activity of *Citrullus lanatus* Seed Oil on CCl4 Induced Liver Damage in Rats. *Scholars Academic Journal of Pharmacy*. 2012; 1(1):30-33.

[20] Loiy E, Ahmed H. In-vitro Antimicrobial activities of chloroformic, hexane and ethanolic extracts of *Citrullus lanatus* var. citroides. *Journal of Medicinal Plants Research*. 2011; 5(8):1338-1344

[21] Adelani ATA, Ajiba LC, Dahunsi SO, Oluyori AP. Antibacterial activity of watermelon (*Citrullus lanatus*) seed against selected microorganisms, *African Journal of Biotechnology*, 2015; 14(14):1224-1229.

- [22] Bello, H. S., Ismail, H. Y., Goje, M. H., Mangga, H. K. Antimicrobial Activity of Citrullus Lanatus (Watermelon) Seeds on Some Selected Bacteria, Journal of Biotechnology Research, Vol. 2, No. 6, pp: 39-43, 2016.
- [23] Sola, A., Temitayo, O., Olufunke, A., & Shittu, F. (2019). Chemical Composition, Nutritional Values and Antibacterial Activities of Watermelon Seed (Citrullus lanatus). International Journal of Biochemistry Research & Review, 27(1), 1-9.
- [24] Makaepa M. Maoto, Daniso Beswa & Afam I. O. Jideani (2019) Watermelon as a potential fruit snack, International Journal of Food Properties, 22:1, 355-370.
- [25] Njoya HK, Erifeta GO, Okwuonu CU and Elendu Ziquin Ezinne, Estimation of some phytoconstituents in the aqueous extract of the endocarp, seeds and exocarp of watermelon (Citrullus lanatus) fruit, Journal of Pharmacognosy and Phytochemistry 2019; 8(3): 4750-4757.
- [26] Rimando A.M and Perkins P. 2005. Determination of citrulline in water melon rind. J. Chrom. A. 1078 (1-2): 196 – 200.
- [27] Oluyori A. P. , Ndulue N , Adelani-Akande T.A , Dada A. O. , and Inyinbor A. A., Preliminary Phytochemical Investigation and Antibacterial Activity of Citrullus lanatus' Rind, Journal of Life & Physical Sciences (acta SATECH) 9 (1):1-7 (2017).
- [28] C. Egbuonu Anthony Cemaluk, Comparative Investigation of the Antibacterial and Antifungal Potentials of the Extracts of Watermelon (Citrullus lanatus) Rind and Seed, European Journal of Medicinal Plants 9(4): 1-7, 2015, Article no.EJMP.18142.
- [29] Oluba OM, Ogunlowo YR, Ojieh GC, Adebisi KE, Eidangbe GO, Isiosio IO. Physicochemical properties and fatty acid composition of Citrullus lanatus (egusi melon) seed oil. Journal of Biological Sciences, 2010; 8(4):814- 817.
- [30] Gupta Alka, Singh Anamika and Prasad Ranu, A review on watermelon (Citrullus lanatus) medicinal seeds, Journal of Pharmacognosy and Phytochemistry 2018; 7(3): 2222-2225

