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A REVIEW ON COSMECEUTICAL PERSPECTIVE OF *LUFFA CYLINDRICA*

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ABSTRACT

The demand for herbal cosmetics is increasing rapidly due to their skin friendliness and consumer concern about the side effects of synthetic ingredients. The use of plants for medicinal purposes is as old as humanity and day by day they are evolving with great potentials containing natural compounds derived from a variety of natural sources. One such herb is *Luffa cylindrica Roem* belongs to family Cucurbitaceae is used as a common vegetable. They are native to most countries around the world, especially the tropics, where they are grown in every nation, state, and province. The phytochemical constituents present in *Luffa cylindrica* are glycosides, flavonoids, triterpenoid, phenolics, oleanolic acid, ascorbic acid, carotenoids, saponins, carbohydrates, proteins, alkaloids, and tannins. The *Luffa cylindrica* possesses several pharmacological activities such as antioxidant, anti-inflammatory, antibacterial, wound healing, and many more. The biologically active component purporting to have skincare benefits and can be used in products such as moisturizers, anti-aging, anti-inflammatory cream, facial cleanser, body oil, sponge soap, etc. The intention of this article of *Luffa cylindrica* is to focus on cosmetic importance and its benefits.

KEYWORDS: Anti-inflammatory, Antioxidant, *Luffa cylindrica*, Phytochemical constituents.

INTRODUCTION

In recent years, there is increasing skincare concern to maintain overall skin in healthy and flawless conditions and to get rid of acne, scarring, dark spots, etc. The greater attention is being paid towards the use of herbal plants taking advantage of their abundance, availability, and its safety and cost-effectiveness.[1] The word Herb refers to any part of the plant with fruit, seeds, leaves, etc used for the food, medicine, or flavoring. They occur naturally and contain complex chemical constituents with effective pharmacological advantages. Chemical components are extracted from them using several extraction techniques. Herbal formulations always have attracted considerable attention because of their good activity and comparatively lesser or no side effects as compared to synthetic substances. Therefore some newer herbs will also be placed in the cosmetics world for enhancing beauty and maintaining the physiological balance of the human skin.

Since ancient times, numerous plants in India have been used for pharmacology, medicinal and cosmetic properties. Loofa is one of them. The botanist Phillip Miller saw the gourd growing in Egyptian gardens in the 17th century. The young fruits of the sweet variety of *Luffa cylindrica* are used for food and are commonly grown for this purpose in tropical Asia, possibly India, and have reached around 600 AD (Purseglove,1976*)* in China and Middle Ages in Egypt (Mansfeld,2001).[2] It is derived from the cucumber and several species in the genus Luffa varies from 5 to 7. There are two species *L. cylindrica* and ribbed or ridge gourd [*L. acutangula (L.) Roxb*] are domesticated and 2 wild species are *L. graveolens* and *L. echinata*.[3] All over the world, Sponge-gourds, the fruit of Luffa [*Luffa cylindrica (L.) Roem syn L. aegyptiaca Mill*] is widely used, is a member of the Cucurbitaceae family. It is an annual climbing crop that produces fruit containing fibrous vascular system and seeds containing oil. It mostly occurs in the summer season.[4] Plants contain many complex compounds like anthocyanins, glycosides, flavonoids, triterpenoid, cardiac glycosides, saponins, carbohydrates, proteins, alkaloids, and tannins which are beneficial for human skin.[5] They are regarded as secondary metabolites that are produced in all parts of the plant body and it shows the different activities like antimicrobial activity, antifungal activity, anti-acne activity, anti-inflammatory activity, antioxidant activity, analgesic, etc.[6] So, it is considered an excellent source of all the essential constituents required for cosmetic preparation.[5] The most useful part of the *L. cylindrica* are luffa sponges used for personal cleanliness and household cleaning.[7] The presence of a few flavone glycosides the methyl ester of diosmetin 7-O-beta-d-glucuronide present in the fruits of *Luffa cylindrica* is

important in antihelmintic, analgesic, antimicrobial activities. They also have carminative, laxative, depurative, emollient, expectorant, galactagogue properties. *Luffa cylindrica* seed extract and oil possess anti-inflammatory and antimicrobial activity and also, it is used in leprosy and skin diseases.[8] Luffa has usefulness in Ayurvedic, cosmeceutical, and medicinal needs of man because of the presence of phytoconstituents.[7]

Fig.1: *Luffa cylindrica* leaves and flowers[9]

Fig.2: *Luffa cylindrica* fruits[10]

Table No. 1: Common Names.[6]

Common Name
Hindi : Peerkankai, Jhinga torooee, Jhingli torai, Kali, Torai, Turai, Hireballi
English : Loofah, Smooth loofah, Sponge gourd, Vegetable-sponge, Courge torchon
Arabic : Bamya seeny
Chinese : Si gua
French : Petole
German : Schwammgurke
Japanese : Hechima
Korean : Susemioi
Portuguese : Lufa riscada
Spanish : Estropajo, paste.

Table No. 2: Taxonomic Classification.[6]

Taxonomic Classification		
Kingdom	:	Plantae
Subkingdom	:	Viridiplantae
Infrakingdom	:	Streptophyta
Division	:	Tracheophyta
Subdivision	:	Spermatophytina
Class	:	Magnoliopsida
Superorder	:	Rosanne
Order	:	Cucurbitales
Family	:	Cucurbitaceae
Genus	:	Luffa
Species	:	Luffa cylindrica.

Geographical Distribution

Luffa cylindrica has been cultured in tropical countries since ancient times. It has alternate and palmate 5 leaves comprising of petiole, 10-20 cm long, and has the acute end lobe, both surfaces are finely scabrous. Male flowers are arranged axillary in 4-20 flowered racemes and female flowers are solitary, yellow and bloom in August-September.[11] Its fruit is 12-30cm long, is green, and has a long, cylinder-like shape, blunt at the end with marked longitudinal lines. The fruit outside has vertical lines and the flesh inside forms a reticulate *L. cylindrica* grows about 12 cm in length.[12] It is widely available in countries like India, Bangladesh, Sri Lanka, China, and Vietnam.[13] The seed is black smooth when the fruit becomes old and dry the endocarp becomes a never-ending fibrous muscular network that is used in various ways such as when used as a scrubber. They are rice source of 50 percent oil and 35 percent protein.[14] The luffa sponge is a highly complex macroscopic arrangement, an inexpensive and feasible resource. Unlike the sponge made with cellulose which is extracted from trees, the luffa sponge is cultivated. The plant has increasing economic importance and it is cultivated in many countries, including Brazil. The main commercial production countries are China, Korea, India, Japan, and Central America.[3]

Methods used for Collection

The fresh leaves of *Luffa cylindrica* are first washed with water to remove clinging dirt and then cut into small pieces, sun-dried for about 4 days. After complete drying, the dried leaves can be pulverized into a coarse powder with the help of a grinding machine and stored in an airtight container for further use.[15]

The seeds can be mechanically removed from the hull to separate seed coat. They can be sun-dried in the open area for up to four days until the seed coat split and then the cotyledon shredded. The seed coat can be separated from the cotyledon by air blowing. A fuel operated grinding machine used to crush the dried dehulled seed to coarse form.[4]

The fruits of *Luffa cylindrica* can be collected from plants during August and September, the stalks removed and fruits can shade dried for 25 days.[16]

Methods used for Extraction

The dried and coarsely powdered plant material such as leaves, flowers, fruits, etc can be extracted with petroleum ether (60-80°) by hot percolation in the soxhlet apparatus. The extraction with methanol contains defatted plant material. The concentrated extract obtained

under reduced pressure to yield a crude semi-solid mass. Standard methods can be used for preliminary phytochemical screening of the extract to recognize the phytoconstituents present therein. It may be found that the extract contained terpenoids, steroids, flavonoids and glycosides, carbohydrate, tannins, saponins, alkaloids, phenols, resins, and anthraquinone.[17]

Oil Extraction- The coarse meal from the seeds can be added into the solvent extraction for 5h at 55–60°C using the Soxhlet extraction method. The oil solutions can be filtered using a Buchner funnel, weigh and put into well-closed containers. At the end of the extraction, the resulting mixtures containing the oils can be heated to recover the solvent from the oil.[18]

Fig 3: *Luffa cylindrica* Seeds.[19]

Fig 4: *Luffa cylindrica* Sponges.[20]

Chemical Constituents

The phytochemical contents of *Luffa cylindrica* include anthocyanins, glycosides, flavonoids, triterpenoid, cardiac glycosides, saponins, carbohydrates, proteins, alkaloids, and tannins.[6]

Table no 3: Chemical Composition.

Plant Parts	-	Chemical Constituents
1. The seeds	-	Contain oil 45 — 51%. More than half of the seed kernel is oil consisting primarily of oleic and Linoleic acids (31.47%).[14,21] Seed Flour contains amino acid. Important amino acid - histidine2.21,arginine 9.75, lysine 5.08,threonine 2.26,valine 4.19,methionine 2.14,isoleucine 3.58, leucine 5.35 and phenylalanine 4.20. Non-essential amino acids - aspartic acid 10.02,serine 3.20, glutamic acid 12.27,proline 2.85,glycine 0.98,alanine 3.34, Cystine 0.66 and tyrosine 0.63. The total saturated fatty acids 33.07%, Total monounsaturated fatty acids 14.90%, Total polyunsaturated fatty acids 52.02%.[21]
2. The leaves	-	Carbohydrate 87.49% , crude protein 0.3%, crude fiber 12%, ash 0.23%, moisture content 0.19% And fat content 0.006%.

3. The fruits	-	Carbohydrate was 71.84%, crude protein 25 %, crude fiber 27%, ash 0.9%, moisture content 0.34% and fat content 0.006%.[6]

Cucurbitacins are present in the *Luffa cylindrica* fruit.[22] Phenolics, flavonoids, anthocyanins, and ascorbic acid are major components of the peel water extract, while oleanolic acid, carotenoid, and chlorophyll are the main bioactive compounds in Luffa peel ethyl acetate extract.[23] Qizhen du et al. differentiated the methyl ester of diosmetin 7-O-beta-D-glucuronide, a flavone glycoside from the *Luffa cylindrica* fruits.[24]

Okuyama T et al. reported two new fibrinolytic saponins, Lucyoside N and P from *Luffa cylindrica* seeds.[25] Saponins of oleanolic acid, gypsogenin, aegyptinin B, 3-0-B-D-glucopyranosyl oleanolic acid, and lucyosides A to P are present in different parts of *Luffa cylindrica*. Yoshikawa K et al. has isolated Echinocystic acid, a triterpenoid sapogenin has been from *Luffa cylindrica*.[6] Hussain M et al. isolated from petroleum ether extract of *Luffa cylindrica* fruit, 3-hydroxy-1-methylene-2, 3, 4, 4tetrahydroxynapthalene-2-carbaldehyde(1), 22, 23-dihydroxy spinasterol (2) and crude extract exhibited mild to moderate antimicrobial action.[26]

Du Q et al. has executed many polyphenolic compounds include p-coumaric acid, 1-O-feruloyl-β-d-glucose, 1-O-p- coumaroyl-β-d-glucose, 1-O-caffeoyl-β-d-glucose, 1-O-(4-hydroxy benzoyl) glucose, diosmetin-7-O-β-d- glucuronide methyl ester, apigenin-7-O-β-d-glucuronide methyl ester, and luteolin-7-O-β-d-glucuronide methyl ester are present as hydrophilic antioxidant constituents from the fruits of *Luffa cylindrica*.[27]

Etim E et al. has investigated the presence of Saponins, Flavonoids, Glycosides, Alkaloids, and Terpenoids in the methanolic extract of leaf of *Luffa cylindrica*.[7]

Traditional uses

From ancient civilization, the crop has been used in pharmacology, Ayurveda and medicinal purpose. In Ayurveda, *Luffa cylindrica* is also known as ‘Dhamargava’ and the paste of the leaves is applied over the local area to treat swelling. Traditional herbal medicine is readily available in rural areas; the fruit of *Luffa cylindrica* is mainly used in Panchakarma practice to induce emesis and purgation as part of Shodhana Karma. It is used in the treatment of skin disorder, poisoning, inflammatory condition, and high Kapha.[28] The fully ripened fruits are strongly fibrous and inedible skeleton which are used for scrubbing bath sponges, oil and water filters, shock absorbers, sound-proof linings, and many other industrial uses. It is

known by the popular names such as dishrag gourd, rag gourd, sponge gourd, and vegetable-sponge. So, it is called a smooth luffa.[20]

Pharmacological Action of *Luffa cylindrica*

Various studies have shown that the extracts of different parts of *Luffa Cylindrica* contain different secondary metabolites such as flavonoids, tannins, phenolic acid, alkaloids, saponins, terpenoids, etc and possess different pharmacological actions. They are as follows.

Antioxidant Effect

Antioxidants are compounds that combine to prevent oxidative damage to cells and tissues by neutralizing reactive oxygen species.[29] The antioxidant effect acquires by using various organic solvent extracts of leaves of *Luffa cylindrical.*[30] Carotenoids function as antioxidants because of the ability to quench ROS such as singlet molecular oxygen or superoxide, peroxide, and hydroxyl radicals formed by exposure to UV radiation. These radicals damage cells by initiating lipid peroxidation.[31] Hasanat A et al. has shown that the antioxidant effect of 3 different extracts of the n-hexane, chloroform, and ethyl acetate of the leaves of *Luffa cylindrica* has been studied using (DPPH) assay and the extracts were found to increase in a concentration-dependent manner. IC50 of the chloroform, n-hexane and ethyl acetate extracts was 61.24, 56.27 and 50.32µg/ml.[2]

Anti-inflammatory Activity

Anti-inflammatory is the property of a substance or treatment which reduces swelling or inflammation. Flavonoids possess anti-inflammatory activity. Ethanol extract of *Luffa cylindrica* leaves was found to have the highest amount of flavonoids, saponins, and triterpenes as studied by Rotelli et al., Mahato et al., Safayhi and Sailer et al. respectively. The extract was found to have anti-inflammatory effect.[32]

Antibacterial Effects

An Antibacterial is an agent that kills bacteria or stops their growth. Devi S et al. have investigated the antibacterial activity of ethanolic extracts of against *Staphylococcus aureus, Staphylococcus epidedermis, Micrococcus luteus, Bacilllus subtilis, Bacillus cereus, Bacillus subtilis, Pseusomonas aeruginosa, Escherichia coli, and Klebsiella pneumonia*. The zone of inhibition of the ethanolic extract of the plant was 40-80 mm against bacteria.[12] Ahmad B et al. reported *Luffa cylindrica* has screened for antibacterial activity. The n-hexane fraction of *Luffa cylindrica* showed good (64%) and the crude methanolic extract, modest (58%)

antibacterial activity against *Bacillus subtilis*. Butanol fraction gave modest activity (58%) against *S. flexenari*.[32]

Antifungal Effects

Luffa cylindrica is a great source of useful phytochemicals, which have inhibitory effects against some fungus and are effective in the care of various conditions.[34] Devi S et al. showed that ethanolic extract of *Luffa cylindrica* fruit has antifungal property against *Aspergillus fumigates Aspergillus Niger and Candida albicans*. The zone of inhibition was 45-92.5 mm against fungi.[12] Indumathy R et al. has examined the antifungal activity of chloroform extract of *Luffa cylindrica* against *Aspergillus flavus, Aspergillus Niger, Aspergillus fumigates and Aspergillus rhyzobus*. The maximum antifungal activity was possessed by chloroform extract at 266.66 µg/ml.[35] Ahmad B et al. reported that the butanol fraction of *Luffa cylindrica* possesses antifungal activity against *Fusarium solani* (85%) and *Trichophyton longifusus* (80%), the methanolic extract and ethyl acetate fraction is also reported growth inhibition against *Microsporum canis* (70%).[33]

Antimicrobial Effect

An Antimicrobial is an agent that prevents the growth of microbial colonies and may destroy microorganisms. Antimicrobial activity of different solvent extracts of *Luffa cylindrica* showed that the ethanol, chloroform, and methanol extracts of root impart sufficient inhibitory actions against the test microbe ranging from 6 to 10 mm diameter inhibitory zones.[36] The extracts of *Luffa cylindrica* showed antimicrobial activity against *Staphylococcus aureus* and *Candida albicans*. The zones of inhibition ranged between 18.00 and 27.00 mm, the greater inhibitory zone against *Candida albicans* ranging from 20 to 27 mm. It has been proven that the fresh plant extract is more active than the dried plant extract.[16, 37]

Analgesia Effect

An analgesic or painkiller is any member of the group of drugs used to treat analgesia and pain relief. *Lufffa cylindrica* is used to achieve analgesia effect.[38] Flavonoids, saponins, and triterpenes possess analgesic properties of different parts of plant extract. Ahmed S et al., recorded *Luffa cylindrica* ethanol extracts of leaves, flowers, and fruit peel at a dose of 500 mg/kg, to produce significant and comparable analgesic effects as with diclofenac sodium.[39]Velmurugan V et al. has reported analgesic activity of *Luffa cylindrica* fruit

alcoholic and aqueous extracts using the acetic acid-caused writhing process and the tail immersion process.[8]

Wound Healing Activity

Wound healing is a complex and dynamic process of re-establishing cellular structures and tissue layers in damaged tissue as closely as possible to its normal state. Abirami MS et al. had studied the wound healing activity of the whole plant of *Luffa cylindrica*. Chloroform extract was observed to have wound healing activity by reduction of wound area and period of epithelization.[40] The high content of arginine, which is an essential amino acid that plays an important role in cell division and healing of wounds, provides healthy cell benefits.[41]

Sunscreening Effect

Sunscreens are used to support the body's natural protection mechanisms to shield it from the sun, protect from harmful UV radiation. Its function is based upon its ability to absorb, reflect, or distribute the rays of the sun.[42] Flavonoids are secondary metabolites present in the *Luffa cylindrica* plant that serve as UV protectant functions including protection from mutagenic UV rays.[43]

Human skin is more intense between 10 am and 2 pm, during the summer months.[42] UVA (320-400nm) can penetrate deeper into the skin while the UVB (290-320nm) can only affect the superficial layer of the skin.[43] The exposure of the skin to UV, therefore, induces oxidative stress, leading to inflammatory reactions, such as acute erythema and chronic damage. The most problematic consequences of chronic damage include premature skin aging, suntan, and skin cancer.[44] Ascorbic acid, Carotenoids which are present in *Luffa cylindrica* act as photo protectants when applied to the skin before exposure to ultraviolet (UV) radiation.[45]

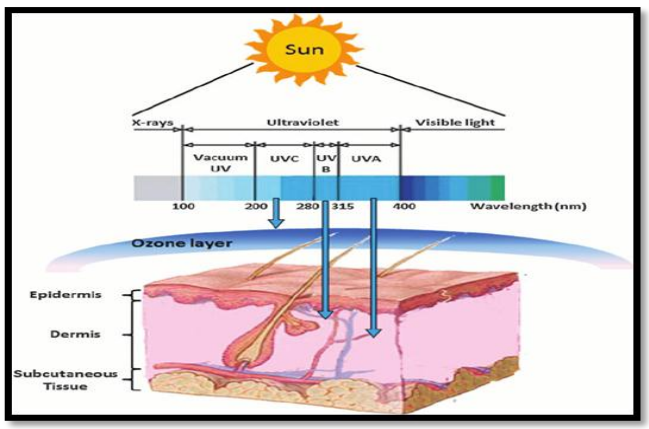

Fig 5: Absorption of UV light in the skin.[46]

Cosmetic Uses

Luffa cylindrica is a good source of phytochemicals like phenolic acids, flavonoids, tannins, alkaloids, saponins, terpenoids, etc and various pharmacological activities due to which it can be used in various cosmetic product formulations.

Luffa cylindrica also contains flavonoids and nutrients like copper, iron, manganese, vitamins A and D and zinc making it a good antiaging ingredient for skin around the eyes.[20,47] Flavonoids are stronger antioxidants, which are alpha-tocopherol and beta-carotene and phenolic acid both are considered as the most popular natural antioxidants and effective secondary metabolic products as they help to provide protection against oxidation at a cellular level by interfering in enzyme activity, chelation of redox-active metals, and by scavenging free radicals.[5,44] Carotenoids such as alpha-carotene, beta-carotene, beta-cryptoxanthin, and lycopene also contribute to UV protection. Xanthophyll pigments are carotenoid derived and often have photoprotective properties.[44] Antioxidants are most effective when used in combination such as vitamin C, vitamin E, lycopene, beta-carotene, and ascorbic acid shows photoprotective potential human dermal fibroblasts when exposed to ultraviolet-A (UVA).[46] The cosmetic formulation with the plant extract improve the appearance and health of the skin by eliminating wrinkles and reducing the appearance of age spots, improving the skin luster and elasticity when applied or consumed.

Saponins, flavonoids, and triterpenes are key ingredients of *Luffa cylindrica* which are used as anti-inflammatory effects. This prevents redness, swelling, and discomfort caused by inflammation.[5,32] The extraction of parts of *Luffa cylindrica* is a better way to obtain lipophilic substances that are easy to penetrate the skin and fibers are hydrophilic.[48,49] Most often, the fibers are used for scrubbing and exfoliating dead skin and stimulate the skin. The extracts of the *Luffa cylindrica* pulp contain vitamin C is beneficial for fair skin complexion used as a cosmetics supplement for moistening and whitening skincare.[50] The seed oil of *Luffa cylindrica* contains essential fatty acids (linoleic acid 50.3%, oleic acid 27.3%, and palmitic acid 13.3%) and total unsaturated fatty acids(77.8%).[51] It is a rich emollient that adds smoothness and softness to the skin. Since it is a natural vegetable oil, it contains moisturizing elements for use in anti-aging cosmetics.[41] The seed oil is a substitute for olive oil.[52]

Luffa's popularity for personal hygiene products is due to its gentle, soft, and non-scratching exfoliating effect on the skin. So, it is widely used in bath sponges.[53] It is a great organic

alternative to man-made petroleum-based products such as the nylon shower puff and also a much better alternative to the "natural" Dead Sea sponge animal corpses that are cut off from the bottom of the ocean.[54] Therefore, the extracts of *L. cylindrica* can be used in appropriate cosmetic formulation aiming at the prevention of acne, dandruff owing to antibacterial properties. It can also be used in hand sanitizer and medicated talcum powder due to its antimicrobial property. It is high in the essential amino acid, arginine therefore it is considered as an excellent lubricant, and externally used for shingles and boils, leprosy and skin diseases.[42] It has a wound-healing property; therefore it can be employed in aftershave products and other foot cosmetics as treatment of chilblain, athlete foot. *Luffa cylindrica* has a wide range of applications in various fields and possesses various advantages such as biocompatibility and better thermal processibility.[51]

CONCLUSION

Luffa cylindrica is a green herbal plant that plays an important role in all around the world. The current review documented existing information about phytochemistry, pharmacology, and therapeutic effects of *Luffa cylindrica* as a promising plant with a wide range of skincare benefits. The data gathered from different studies revealed that the plant is rich in phenolic acids, flavonoids, tannins, alkaloids, saponins, terpenoid nutrients, and vast biological constituents. It is more effective as the herbal component when used in modern formulations such as sunscreens, anti-aging, moisturizers, body oil, facial cleanser and it can be a safe, efficacious, and cost-effective alternative to synthetic products. This review serves the purpose of aiding in future Research work on this plant.

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