

## IS BOTTLE GOURD A NATURAL GUARD??

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### ABSTRACT

Bottle gourd is one of the excellent fruits gifted by nature to human beings having composition of all the essential constituents that are required for good health and quality human life. *Lagenaria siceraria* (Cucurbitaceae), popularly known as bottle gourd, lauki or ghiya, is a climbing plant, which bears hard-shelled and bottle-shaped gourds as fruits. It forms an excellent diet being rich in vitamins, iron and minerals. The fruit is reported to contain the triterpenoids cucurbitacins B, D, G, H, two sterols viz., fucosterol and campesterol, a terpenoid bicyclic acid (an allergic compound), flavone-C glycosides (a ribosome inactivating protein) and lagenin. Extract of the ghiya seeds show antibiotic activity. The fruit juice is helpful in constipation, premature graying hair, urinary disorders and insomnia. Lauki has the highest content of choline among all the vegetables known to man till date, which serves as the precursor of neurotransmitter acetylcholine, which in turn is crucial for retaining and enhancing memory. Furthermore, *Lagenaria siceraria* is a vegetable useful in the management of many diseases like cardiac disorders, hepatic diseases and ulcer. Bottle gourd juice helps to regulate blood pressure of hypertensive patients, because of its high potassium content. It helps in losing weight quickly, because of its high dietary fiber and low fat and cholesterol content. In the light of above facts, the authors have made a humble attempt to compile an up-to-date review article on *Lagenaria siceraria* covering its phytochemistry, pharmacological actions and folk medicinal uses.

**Keywords:** *Lagenaria siceraria*, traditional uses, cardio-protective, cucurbitacin

### INTRODUCTION

Cucurbitaceae family is commonly known as the gourd, melon or pumpkin family. This family is composed of 118 genera and 825 species, which are widely distributed in the warmer regions of the world. The plants of cucurbitaceae family provide the major contribution for economically important domesticated species and are cultivated for medicinal and nutritional value<sup>1</sup>. Among all plants of the cucurbitaceae family, *Lagenaria* species is the most popular. The bottle gourd belongs to the genus *Lagenaria* that is derived from the word lagena, meaning the bottle. In the older literature, it is often referred to as *Lagenaria vulgaris* (common) or *Lagenaria leucantha* (white flowered gourd), but it is now generally agreed that the correct name is *Lagenaria siceraria* (Mol.) Standl. It seems that bottle gourd was originated from India because its wild races are still found in Dehradun (high humid area) and Malabar coastal area. Old Indian script reveals its cultivation around 2000 B.C. Archeological survey supports man's association with bottle gourd in Peru from 1100 to 13000 years B.C<sup>2</sup>. The bottle gourd is a favorite warm-season vegetable. It is grown throughout India and is available

in the market throughout the year. The bottle gourd can be found in the forests of India, Moluccas and Ethiopia. The centre of origin has been located as the coastal areas of Malabar (North Kerala) and the humid forests of Dehradun (North India). The fossil records indicate its culture in India even before 2000 B.C. The archaeological evidences suggest that *Lagenaria* is not a monotypic genus and has an ancient pan tropical distribution. Genus *Lagenaria* to which bottle gourd belongs is characterized by following key features: The fruits are fleshy and multi seeded, flowers are solitary and chalky white. Both the male and female flowers open at the same time. Male flowers remain open only for a few hours, after which the petals get withered, thus the flowers are short lived. Being a monoecious crop, bottle gourd is strictly cross pollinated. Bees are the major pollinators. *Lagenaria siceraria*, commonly known as Bottle gourd is one of the excellent fruits gifted by the nature to human beings having composition of all the essential constituents that are required for normal and good human health<sup>1</sup>. Two varieties of this fruit viz., sweet and bitter are available. Botanically, both belong to the same genus, the former known by the

Sanskrit synonym Alaba and Tumbi and latter by the names as Iksuaku, Katutumbi and Mahaphala. Nevertheless, the difficulty in procuring and losing interest in cultivation of wild variety, the sweet and edible variety is now being used in medicine as well.

### Botanical Classification of Bottle Gourd

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Cucurbitales
Family	Cucurbitaceae
Genus	<i>Lagenaria</i>
Species	<i>L. siceraria</i>
Botanical name	<i>Lagenaria siceraria</i> .

### SYNONYMS

#### International Synonyms

COUNTRY	NAMES
China	Hulu
Japan	Hyōtan
Korea	Bak
Myanmar(Burma)	Boo thee
Philippines	Upo
Italy	Cucuzza
Central America	Morro or jícaro.
Colombia	Tapara or totuma.
Tanzania	buyu
Pakistan	Lauki in Urdu.
Bangladesh	Lau
Nepal	Lauka
Saudi Arabia	Qara
Vietnam	bầu canh or bầu nậm

#### Indian Synonyms

REGION	NAMES
Punjab, Haryana, Delhi	lauki, dudhi or ghiya
Kerala	Churakka
Assam	Jatila
Bengal	Lau
Andhra Pradesh	Sora kaaya
Maharashtra	Dudhi-Bhopala
Karnataka	Sorekayi
Tamilnadu	Suraikkaai

#### Geographical Distribution

It is widely cultivated in tropical and pan-tropical regions of the world. It is cultivated in Delhi, U.P, Punjab, Haryana, Gujarat, Assam, Meghalaya, Maharashtra, Karnataka and Rajasthan in India.

#### CULTIVATION

- ✓ Climate and Soil
- ✓ It can be grown on all types of soils, if these are not too much acidic (pH<5.5) or alkaline.
- ✓ Loam soil or sandy soil is the most suitable soil. The soil should be rich in organic matter and with good drainage.
- ✓ Acidity and alkalinity adversely affect the crop.

- ✓ Night temperature of 18 °C to 22 °C and day temperature of 30 °C to 55 °C is optimum for its proper growth.
- ✓ Day temperature above of 40 °C may cause scorching of leaves.
- ✓ Temperature lower than 10 °C reduces metabolic activity of the seeds for germination.
- ✓ Seed germination occurs fast at 25 °C to 30 °C.

#### PHYTOCHEMISTRY

Now, it's time to turn camera on overall constituents and character of *Lagenaria siceraria* fruit, so as to have a quality human life. The edible portion of lauki is a fair source of ascorbic acid, beta carotene and a good source of vitamin B complex, pectin and dietary soluble fibers. It is also a good source of carbohydrates, minerals, amino acids and vitamins<sup>3</sup>. The fruit is reported to contain the triterpenoid cucurbitacins B, D, G, H and 22-deoxy cucurbitacin the bitter principle of cucurbitaceae. The fruit juice contains beta glycosidase-elastase enzyme. Two sterols were isolated from petroleum ether fractions of dried fruit pulp of *Lagenaria siceraria* namely Fucosterol and campesterol<sup>4</sup>. The HPLC analysis of the extract of flowering plant of *Lagenaria siceraria* shows presence of flavone-C glycosides<sup>5</sup>. It contains more proportion of Soluble Dietary Fibers (SDF) than insoluble fibers. SDF are having profound effect in lowering serum cholesterol, which also reveals that the pectin is a predominant component of soluble fibers in *Lagenaria siceraria* fruits<sup>6</sup>. The seeds are having prime role in the human nutrition due to encapsulation of innumerable phytochemicals, such as vitamins, minerals, amino acids along with saponin and essential fixed oils especially of unsaturated type<sup>1</sup>. A ribosome inactivating protein, lagenin was isolated from lyophilized water extracts of seeds, the biological actions of which include anti-proliferative, immunosuppressive and anti-fertility. A triterpene bryonolic acid, an anti-allergic compound was reported from callus culture of *Lagenaria siceraria* roots. Bitter fruits yield 0.013% of a solid foam containing cucurbitacins B, D, G and H, mainly cucurbitacin B. The leaves contain cucurbitacins B, D and traces of E. The fruit juice contains beta-glycosidase (elastase). The mucilage is also present in the fruit, which can be extracted by microwave assistance extraction<sup>7,8</sup>. Mixture of sterols and two flavonoids were isolated from the n-butanol and ethyl acetate soluble fractions of successive methanol extract of *Lagenaria siceraria* fruit and were identified as oleanolic acid (I), mixture of β-sitosterol (II) and campesterol (III), isoquercitrin (IV) and Kaempferol (V).

## PHARMACOLOGICAL ACTIONS

### Anti-hyperlipidemic activity

Chloroform and alcoholic extracts of bottle gourd at two different doses (200 and 400 mg kg<sup>-1</sup>, p.o.) showed significant lowering of total cholesterol, triglyceride and low density lipoproteins along with an increased HDL level<sup>9</sup>. LSN-I, LSN-II and LSN-III isolated from *Lagenaria siceraria* fruit juice extract were found to have anti-hyperlipidemic activity against triton-X induced hyperlipidemia<sup>10</sup>.

### Analgesic and anti-inflammatory activity

*Lagenaria siceraria* fruit juice (150-300 mg kg<sup>-1</sup>, p.o.) showed a dose dependent inhibition of acetic acid induced writhing and a significant inhibition of both the phases of formalin pain test, but with a less intense effect on the first than the second phase. Juice extract of *L. siceraria* also showed anti-inflammatory activity against acute inflammatory models such as, ethyl phenyl propionate-induced ear edema, carrageenan and arachidonic acid-induced hind paw edema<sup>11</sup> and also the albumin induced paw edema in rats<sup>9</sup>.

### Diuretic activity

Diuretic activity of *L. siceraria* fruit was assessed by measuring different parameters like total urine volume, urine concentration of sodium, potassium and chloride. It was found that the extracts of *Lagenaria siceraria* fruit (100-200 mg kg<sup>-1</sup>, p.o.) showed higher urine volume and exhibited dose dependent increase in excretion of electrolytes.

### Anti-oxidant activity

Acetone extract of fruit epicarp of *L. siceraria* fruit showed maximum anti-oxidant activity *in-vitro* model using DPPH. The fresh juice of the fruit also showed free radical scavenging activity<sup>12</sup>. The fruit extract was also effective in CCl<sub>4</sub> induced liver damage, where it maintained the level of endogenous antioxidant enzymes (superoxide dismutase, catalase and glutathione peroxidase) and marker of lipid peroxidation to normal<sup>13</sup>.

### Immuno-modulatory activity

The methanolic extract of LSF possessed promising Immuno-modulatory activity. The LSF significantly increased total WBC, neutrophils and lymphocytes count while insignificant changes were observed in monocytes, eosinophils and basophils count<sup>14</sup>. Ethanol extract of LS also showed significant prevention in reduction of humoral immune response, cellular immune response and percent neutrophil adhesion in mice in the presence of chemical stressor, pyrogallol<sup>15</sup>.

### Hepatoprotective activity

Deshpande et al. (2008) evaluated ethanolic extract of LS epicarp for hepatoprotective activity<sup>15</sup>. The LS ethanolic

extract (100 and 200 mg kg<sup>-1</sup>) showed significant prevention of elevated levels of serum glutamate oxaloacetate, serum glutamate pyruvate transaminase, alkaline phosphatase and bilirubin. The anti-hepatotoxic activity of different fractions of the ethanolic extract of *L. siceraria* fruit administered orally to different groups of rats in a dose of 250 mg/kg showed significant anti-hepatotoxic activity, with the petroleum ether fraction exhibiting comparatively higher activity.

### Cardioprotective activity

The fruit powder of *L. siceraria* showed good cardio protective effects. The drug was studied against Doxorubicin induced cardio toxicity in rats at 200 mg/kg, p.o. for 18 days. The LS prevented the alteration in endogenous antioxidants (superoxide dismutase, reduced glutathione) and lipid peroxidation, where as markers of cardio toxicity i.e., CK-MB and LDH were significantly reduced. Further the LS powder also showed the protection against changes in ECG and histopathological alterations induced by doxorubicin<sup>13</sup>. Ethanolic extract of *L. Siceraria* fruits also showed increased force of contraction and decreased rate of contraction (from 66 to 44) in isolated frog heart, when perfused with normal ringer solution<sup>15</sup>.

### Anthelmintic activity

The ethanolic extracts of the seeds of *Cucumis sativus*, *Cucurbita maxima* and *L. siceraria* exhibited a potent anthelmintic activity against tapeworms, which was comparable to the effect of piperazine citrate. Some activity against pinworms was demonstrated by seeds of *Cucurbita maxima*<sup>16</sup>.

## TRADITIONAL USES

Cardio protective, General tonic, Diuretic (Stem bark), Aphrodisiac, Mild purgative, Cooling agent, Analgesic, Anti-ulcer agent, Antipyretic, Broncho-dilator, Antibilious, Emetic (Roots), Alopecia, leucoderma, Dropsy (Seeds), Worm infection (Seeds), Migraine (Topical seed oil), Toothache, Gingivitis, Diabetes mellitus, Antidote to certain poisons such as scorpion stings

## MISCELLANEOUS USES

- ✓ *Lagenaria siceraria* is a common sight everywhere in the tribal dominated pockets of Khammam district, where the ethnic groups mainly use the dry shells for carrying country liquor (mahua drink, toddy), honey and water.
- ✓ Domestic utensils like bottles, bowls, milk pots, spoons and containers of several types are made out of the dried shells.
- ✓ In some of the pockets, it is being used for making stringed and wind musical instruments and pipes.

- ✓ At few places, the natives use the dried shells as floats on water bodies as well.
- ✓ Though, it is nutritionally less calorific, tribals prefer bottle gourd as a vegetable for preparation of curries and pickles.
- ✓ The seed oil is used for both cooking purpose and as hair oil.

**STRANGE FACTS**

- ✓ The bottle gourd is so named because of one of its purposes: To serve as a bowl, cup, or bottle. In other parts of the world, it is known as calabash, lauki, doodhi, ghia, kaddu, tarkari.
- ✓ Bottle gourd is one of the excellent fruits gifted by the nature to human beings having composition of all the essential constituents that are required for good health and quality human life.
- ✓ It represents both earth and heaven in shape.
- ✓ It helps in losing weight quickly because it is low in fat and cholesterol, and provides high dietary fiber.
- ✓ Traditionally, lauki has been recommended for its anti-diabetic and aphrodisiac properties.
- ✓ The flesh of lauki has a cooling influence on the body.
- ✓ The ghiya juice is used in *Ayurvedic medicine* to treat high blood pressure and heart problems.
- ✓ Lauki has the highest content of choline (a lipotropic factor), a mental healer and also a precursor of acetylcholine, which is essential for memory than any other vegetable known to man till date.

**CONCLUSION**

*Lagenaria siceraria*, popularly known as bottle gourd, lauki or ghiya is a climbing plant, which bears hard-shelled and bottle-shaped gourds as fruits. *L. siceraria* fruit is cultivated in India, Japan, Sri Lanka, China and Thailand for its kitchen use. Ghiya makes an excellent diet being rich in vitamins, iron and minerals. Lauki has the highest content of choline, which serves as the precursor of neurotransmitter acetylcholine, which in turn is crucial for retaining and enhancing memory, among all the vegetables known to man till date. Furthermore, *Lagenaria siceraria* is a vegetable useful in the management of many diseases like cardiac disorders, hepatic diseases and ulcer. Bottle gourd juice helps to control blood pressure of hypertensive patients, because of its high potassium content. It helps in losing weight quickly, because of its high dietary fiber and low fat and cholesterol content. In the light of above mentioned multiple benefits of bottle gourd, it may be regarded as a natural guard against diseases.

**REFERENCES**

1. Habib-ur-Rahaman AS. Bottle gourd (*Lagenaria siceraria*)-a vegetable for good health. *Nat. Prod. Radiance* 2003; 2: 249-256.

2. Sirohi PS, Sivakami N. Genetic diversity in cucurbits. *Indian Hort.* 1991; 36: 44-45.

3. Modgil M, Modgil R, Kumar R. Carbohydrate and mineral content of chyote (*Sechium edule*) and bottle gourd (*Lagenaria Siceraria*). *J. Hum. Ecol.* 2004; 15: 157-159.

4. Shirwaikar A, Sreenivasan KK. Chemical investigation and antihepatotoxic activity of the fruits of *Lagenaria siceraria*. *Indian J. Pharm. Sci.* 1996; 58: 197-202.

5. Baranoswka KM, Cisowski W. HPLC determination of flavone-Cglycosides in some species of Cucurbitaceae family. *J. Chromatogram A* 1994; 675: 240-243.

6. Chang SC, Lee MS, Li CH, Chen ML. Dietary fiber content and composition of vegetable in Taiwan area. *Asian Pacific J. Clin. Nutr.* 1995; 4: 204-210.

7. Shah BN, Seth AK. Pharmacognostic studies of the *Lagenaria siceraria* (Molina) standley. *Int. J. Pharm. Technol. Res.* 2010; 2: 121-124.

8. Shah BN, Seth AK, Nayak BS. Microwave assisted isolation of mucilage from the fruits of *Lagenaria siceraria*. *Der Pharmacia Lett.* 2010; 2: 202-205.

9. Ghule BV, Ghante MH, Saoji AN, Yeole PG. Hypolipidemic and antihyperlipidemic effects of *Lagenaria siceraria* (Mol.) fruit extracts. *Indian J. Exp. Biol.* 2006; 44: 905-909.

10. Mohale DS, Dewani AP, Saoji AN, Khadse CD. Antihyperlipidemic activity of isolated constituents from *Lagenaria siceraria* in albino rats. *Int. J. Green Pharma.* 2008; 2: 104-107.

11. Shah BN, Nayak BS, Bhatt SP, Jalalpure SS, Seth AK. The anti-inflammatory activity of the leaves of *Colocasia Esculenta*. *Saudi Pharma. J.* 2007; 15: 228-232.

12. Deshpande JR, Mishra MR, Meghre VS, Wadodkar SG, Dorle AK. Free radical scavenging activity of *Lagenaria siceraria* (Mol.) Standl. fruit. *Nat. Prod. Radiance* 2007; 6: 127-130.

13. Fard MH, Bodhankar SL, Dikshit M. Cardioprotective activity of fruit of *Lagenaria siceraria* (Molina) standley on doxorubicin induced cardio toxicity in rats. *Int. J. Pharmacol.* 2008; 4: 466-471.

14. Gangwal A, Parmar SK, Gupta GL, Rana AC, Sheth NR. Immunomodulatory effects of *Lagenaria siceraria* fruits in rats. *Pharmacognosy Mag.* 2008; 4: S234-S238.

15. Deshpande JR, Choudhari AA, Mishra MR, Meghre VS, Wadodkar SG, Dorle AK. Beneficial effects of *Lagenaria siceraria* (Mol.) Standley fruit epicarp in animal models. *Indian J. Exp. Biol.* 2008; 46: 234-242.

16. Elisha EE, Twajj HAA, Ali NM, Tarish JH, Al-Omari MM, Karim S. The anthelmintic activity of some Iraqi plants of the Cucurbitaceae. *Pharma. Biol.* 1987; 25: 153-157.

**Table – 1: DIETARY CONSTITUENTS OF BOTTLE GOURD**

Sr.	Constituents	With Peel (g/100g of dry ghiya)	Without Peel (g/100g of dry ghiya)
1	Total sugar	5.870	8.290
2	Reducing sugar	5.220	7.920
3	Non-reducing sugar	0.650	0.290
4	Starch	1.310	1.570
5	Curd fiber	4.450	3.400
6	Neutral detergent fiber	22.710	21.160
7	Acid detergent fiber	16.260	15.670
8	Hemicellulose	6.450	5.580
9	Cellulose	16.070	16.400
10	Lagenin	0.193	0.167

Table – 2: MINERAL CONTENT OF BOTTLE GOURD

Sr.	Minerals	With peel (mg/100g of lauki)	Without peel (mg/100g of lauki)
1	Iron	11.87	2.33
2	Phosphorous	240.33	187.33
3	Potassium	3320.00	3356.67
4	Zinc	3.77	3.47
5	Magnesium	162.33	146.33
6	Copper	0.19	0.24
7	Sodium	27.88	36.68
8	Manganese	0.26	0.31



Table – 3: AMINO ACIDS PRESENT IN BOTTLE GOURD

Sr.	Amino Acids	Fruits (g/100g ghiya)	Seeds (g/100g ghiya)
1	Tryptophan	0.003	0.431
2	Threonin	0.018	0.903
3	Isoleucine	0.033	1.264
4	Leucine	0.036	2.079
5	Methionine	0.004	2.079
6	Cystine	.....	0.551
7	Phenylalanine	0.015	1.222
8	Valine	0.027	1.972
9	Arginine	0.14	4.033
10	Histidine	0.004	0.681



Table – 4: VITAMIN CONTENT OF BOTTLE GOURD

Sr.	Vitamins	Fruits (mg/100g ghiya)	Seeds (mg/100g ghiya)
1	Vitamin C	10.100	1.900
2	Thiamin	0.029	0.210
3	Riboflavin	0.022	0.320
4	Niacin	0.320	1.745
5	Vitamin B6	0.040	0.224
6	Pantothenic acid	0.152	0.339
7	Vitamin E	16.02/g	1.000