



## PHYTOCHEMICAL AND PHARMACOLOGICAL PROFILE OF *LAGENARIA SICERARIA*: AN OVERVIEW

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Article Received on: 03/01/12 Revised on: 17/02/12 Approved for publication: 09/03/12

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### ABSTRACT

Cucurbitaceae family is major source of medicinal agents since ancient time. Various plants parts including fruits of this family have been established for their pharmacological potential. *Lagenaria siceraria* (Molina) standley (family Cucurbitaceae) commonly known as lauki (Hindi) and bottle gourd (English) is a medicinal plant. It is used as medicine in India, China, European countries, Brazil, Hawaiian island, etc. for its cardiotoxic, general tonic and diuretic properties. Further the antihepatotoxic, analgesic and anti-inflammatory, hypolipidemic, antihyperglycemic, immunomodulatory and antioxidant activities of its fruit extract have been evaluated. It is used as vermifuge purgative diuretic and it is also recommended for increasing lactation for lactating women. Fruits are also used in treatment of cancer, pain, ulcer, fever, pectoral cough, asthma and other bronchial disorders. In many countries, this plant has been used traditionally as a single treatment for diabetes mellitus possess immunosuppressive, antitumour, antiviral, antiproliferative and anti-HIV activities. This study is an attempt to compile an up-to-date and comprehensive review of *Lagenaria siceraria* that covers its traditional and folk medicinal uses, phytochemistry and pharmacology profile.

**KEYWORDS:** *Lagenaria siceraria*, Cucurbitaceae, Traditional uses.

### INTRODUCTION

Cucurbitaceae family is commonly known as gourd, melon and pumpkin family. This family is composed of 118 genera and 825 species which are widely distributed in the warmer region of world<sup>1</sup>. Among all the plants of 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 now it is known as *Lagenaria siceraria*. *Lagenaria siceraria* (Molina) standley (family Cucurbitaceae) commonly known as lauki (Hindi) and bottle gourd (English) is a medicinal plant<sup>2</sup>. The plant is widely available throughout India. It is a climbing or trailing herb, with bottle- or dumb-bell shaped fruits. Both its aerial parts and fruits are commonly consumed as a vegetable. Traditionally, it is used as medicine in India, China, European countries, Brazil, Hawaiian island, etc. for its cardiotoxic, general tonic and diuretic properties<sup>3</sup>. The cultivated form of *L. Siceraria* is considered to be of African and Asian origin. *Lagenaria siceraria* is a popular vegetable, grown almost all the year round, particularly in frost free areas. It can be cultivate in all kinds of soil, but thrives best in heavily manured loams. It requires warm humid climate or plenty of water when grown during dry weather. Seeds may be sown in nursery beds and seedlings transplanted when they have put forth 2-3 leaves. They may be also sown directly, 4-5 seeds together, in manured beds or pits 5-6ft. Apart; the strongest among the seedlings is retained, while others are removed and transplanted. Seedling transplantation is where an early crop is desired, generally two crop raised in India; the summer crop is sown from the middle of October to the middle of March and the later crop, from the beginning of March to the Middle of July. Round fruit types are usually sown for the early crop and bottle-shaped types for the second crop. Vines are allowed to trail on the ground or

trained over walls. Trees, or other support trailing over to give high yield of fruit<sup>4</sup>.

### TAXONOMICAL CLASSIFICATION<sup>5</sup>

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Cucurbitales
Family	Cucurbitaceae
Genus	Lagenaria
Species	L. siceraria

### SYNONYMES<sup>5</sup>

Sanskrit	Alabu, Tumbi Ishavaaku, Katutumbi, Tiktaalaabu, alaabu
Bengali	Laus, Lokitumbi
English	Bottle Gourd
Gujrati	Dudi, Tumbadi
Hindi	Lauki, Ghia
Kannad	Isugumbala, Tumbi
Malyalam	Chorakka, Churan, Choraikka, Piccura, Tumburini, Cura, Tumburu
Marathi	Phopla
Punjabi	Tumbi, Dani
Tamil	Shorakkai, Surai, Suraikkai
Telugu	Sorakaya, Anapakaya
Urdu	Ghiya, Lauki

### Characteristics of *Lagenaria siceraria*

Transverse section of upper epidermis of *Lagenaria siceraria* leaf consists of elongated parenchymatous cells, covered by cuticle. It shows few stomata, which are of anisocytic type, palisade cells at upper and hexagonal to polygonal at lower epidermis. Thin walled contains colourless cells, which are may be water storing. Mesophyll is made up of 3-4 layered chloroplast containing, compactly arranged, oval to circular cells. It is interrupted by vascular bundles of various sizes. Vascular bundles are surrounded by 2-3layered

sclerenchyma. They are conjoint, collateral and closed. Xylem is placed towards lower epidermis lower epidermis contains elongated wavy walled parenchymatous cells covered by cuticle. Number of covering and collapsed trichomes is present, while very few glandular trichomes are also present<sup>6</sup>.

#### Phytoconstituents of *Lagenaria siceraria*

Analysis of edible portion of the fruit gave following values: moisture, 96.3; protein, 0.2; fat (ether extract), 0.1; carbohydrates 2.9; mineral matter 0.5; calcium 0.02; and phosphorus < 0.01%. Other mineral elements reported to be present are: iron (0.7 mg/ 100g.), sodium (11.0 mg./100g.), potassium (86.0 mg/100g.) And iodine (4.5 mcg/ kg.). Glucose and fructose have been detected. The amino acid composition of the fruit is as follows: leucines 0.8; Phenylalanine 0.9; valine 0.3; tyrosine 0.4; alanine 0.5; threonine 0.2; glutamic acid 0.3; serine 0.6; aspartic acid 1.9; cystine 0.6; cysteine 0.3; arginine 0.4; and proline 0.3mg/g. The fruit is a good source of B vitamins and a fair source of ascorbic acid. Bitter fruits yield 0.013% of solid foam containing cucurbitacins B, D, G and H, mainly cucurbitacin B; these bitter principles are present in the fruit as aglycones. Leaves contain cucurbitacin B and roots, cucurbitacins B, D and E<sup>7</sup>. Phytochemical screening of the fruit revealed two steroids were isolated from the petroleum ether fraction and they were identified as fucosterol and campesterol<sup>8</sup>. Sugar and phenolic content of the fresh product were assayed, providing a partial nutritional characterisation of this vegetable. Glucose and fructose (about 1:1 ratio) and traces of sucrose were found; in Addition, a small amount of unidentified mono- and dicaffeoylquinic Acid derivatives was detected<sup>9</sup>. Flavonoid complexes occurring in the medicinal plants *Lagenaria siceraria* were found to be flavone Cglycosides<sup>10</sup>. Four new D:C-friedooleanane-type Triterpenes isolated, 3b -O-(E)-feruloyl-D:Cfriedooleana-7,9(11)-dien-29-ol, 3b -O-(E)-Coumaroyl-D:Cfriedooleana-7,9(11)-dien-29-ol, 3b-O-(E)-coumaroyl-D:Cfriedooleana-7,9(11)-dien-29-oic acid, and methyl 2b,3b - dihydroxy-D:C-friedoolean-8-en-29-oate<sup>11</sup>. A water-soluble polysaccharide, isolated from fruiting bodies of *Lagenaria siceraria*, is composed of methyl- $\alpha$ -D-galacturonate, 3-O-acetyl methyl- $\alpha$ -D-galacturonate, and  $\beta$ -D-galactose in a ratio of nearly 1:1:1. This polysaccharide showed cytotoxic activity in vitro against human breast adenocarcinoma cell line (MCF-7)<sup>12</sup>. Seeds are reported to contain saponin. Analysis of seed kernels (68% of seed wt.) Gives following values: moisture, 2.47; protein,30.72; oil,52.54; carbohydrates,8.3; fiber, 1.58; ash,4.43; cao,0.11; and P2O3 , 2.46%. The oil obtained from seed kernels is clear and pale yellow. Kernels from ripe seeds gave 45% of oil with the following characteristics: n40d , 1.4711; sap.equiv., 301.6; iodine value ,126.5; free fatty acids,0.54%; and unsaponified matter , 0.67% . The components of free fatty acids are: linoleic acids 64.0; oleic, 18.2; and saturated fatty acids, 17.8%<sup>2</sup>. Seeds are reported to contain Lagenin<sup>13</sup>. Atriterpene bryonolic acid an antiallergic compound was reported from callus culture of *lagenaria siceraria* roots<sup>24</sup>. Bitter fruits yield 0.013% of a solid form containing cucurbitacins B,D,G and H mainly cucurbitacin B. These bitter principles are present in the fruit of agalycones. The leaves contain cucurbitacins B,D and traces of E. The fruit juice contains beta -glycosidase (elasterase)<sup>14</sup>.The mucilage is also present in the fruit, which can be extracted by microwave assistant extraction<sup>15</sup>.

#### Pharmacological Activity

##### Antidiabetic activity

*Saha et al.,(2011)*, evaluated the methanolic extract of *Lagenaria siceraria* aerial parts for antidiabetic activity ,using streptozotocin induced diabetes in rats and proved that the aerial part of the *Lagenaria siceraria* posses potent antihyperglycemic activity which is probably attributable to its rich flavanoid content and concluded that MELS (methanolic extract of *Lagenaria siceraria*) supplementation is quite beneficial in controlling the blood glucose level, without producing hypoglycemia; additionally, it improves lipid metabolism and represents a protective mechanism against the development of atherosclerosis, and prevents diabetic complications from lipid peroxidation by improving the antioxidant status in experimental diabetic rats<sup>17</sup>.

##### Antihyperlipidemic activity

*Nainwal et al.,(2011)*, evaluated the juice of fresh fruits of *Lagenaria siceraria* for antihyperlipidemic activity by evaluating the blood cholesterol level of atherogenic diet rat and proved that juice of the fresh fruits of *Lagenaria siceraria* have the potent effect to cause a blood cholesterol lowering effect and the serum biochemistry changes may suggest that the juice extract has a tonic effect on the kidneys and the liver and their organs play central role in drug metabolism<sup>16</sup>.

*Ghule et al.,(2009)*, evaluated antihyperlipidemic effect of the methanolic extract from *Lagenaria siceraria* fruit in hyperlipidemic rats and proved that at the 30<sup>th</sup> day most significant reduction in lipid levels in the LSFE treated rats as compared to the rats fed with high-fat diet at the 0<sup>th</sup> day and shows that the increase in weight in rats administered with LSFE was less when compared to rats fed with high-fat diet.<sup>18</sup>

*Mohane et al.,(2008)*, evaluated the fruits of *Lagenaria siceraria* for antihyperlipidemic activity of isolated constituent using the solvents according to the polarity in ascending order i.e. by using chloroform, acetic acid, methanol, pyridine and water. Thin layer chromatography used active fraction obtained by column chromatography for further isolation .four spots were obtained and were named as LSN-1, LSN-2 ,LSN-3 and LSN-4and TLC isolated compound were tested for antihyperlipidemic activity and compound has shown significant result. The study exhibited that evaluated levels of blood cholesterol, triglycerides, LDL were significantly reduced and decreased HDL was significantly increased by the administration of fraction of *Lagenaria siceraria* fruit juice<sup>19</sup>.

*Ghule et al.,(2006)*, evaluated the antihyperlipidemic effect of four different extract via. petroleum ether, chloroform, alcoholic and aqueous extracts from the *Lagenaria siceraria* in triton induced hyperlipidemic rats and their hypolipidemic rats and proved that chloroform and alcoholic extract exhibited more significant effect in lowering total cholesterol, triglycerides and low density lipoprotein along with increase in HDL as compared to other<sup>20</sup>.

##### Diuretic activity

*Ghule et al.,(2007)*, evaluated the vacuumed dried juice extract and methanolic extract of the fruit of *Lagenaria siceraria* for diuretic activity using total urine volume and urine concentration of electrolyte method in albino rats and proved that the vacuum dried juice extract and methanolic

extract showed higher urine volume when compared to respective control.<sup>21</sup>

#### Analgesic activity

Shah and Seth (2010), evaluated methanolic and aqueous extract of *Lagenaria siceraria* for analgesic activity, using tail immersion method in rats and proved that methanolic extract posses moderate analgesic activity, while the aqueous extract shows significant analgesic activity.<sup>22</sup>

#### Central nervous system activity

Pawar et al., (2010), evaluated the crude petroleum ether , chloroform , and methanolic extract of leaves of *Lagenaria siceraria* for analgesic and central nervous system activity using writhing , hot plate , tail flick method in rat and proved that the petroleum ether , methanol , and chloroform extract shows significant analgesic activity but petroleum ether extract shows maximum analgesic activity among them<sup>23</sup>.

#### Hypertensive activity

Mali et al.,(2010), evaluated the antihypertensive activity of *Lagenaria siceraria* fruit powder in dexamethasone induced hypertension in rats and proved that the *Lagenaria siceraria* pretreatment partially reversed dexamethasone induced hypertension where as *Lagenaria siceraria* reduced mean arterial blood pressure and heart rate and concluded that *Lagenaria siceraria* fruit powder pretreatment for 51 days partially reverse dexamethasone induce hypertension in rats<sup>24</sup>.

#### Anticancer activity

Saha et al., (2010), Evaluated the methanolic extract of *Lagenaria siceraria* (Mol.) Standley aerial parts for anticancer activity using Enrich' Ascites carcinoma model in mice and proved that the *Lagenaria siceraria* possess significant anticancer activity which may be due to its cytotoxicity and antioxidant activity<sup>25</sup>.

#### CNS depressant activity

Ananga et al.,(2010), Evaluated the aqueous fruit extract of *Lagenaria siceraria* for pharmacological activity in vitro and in vivo and proved that the *Lagenaria siceraria* have been shown to certain potent bioactive compound with potent analgesic effect and non specific C.N.S depressant activity , among other and may be of value in psychotherapy as narcoleptic agent and also confirmed some of the folkloric uses<sup>26</sup>.

#### Antioxidant and hepatoprotective activity

Saha et al., (2011), Evaluated the methanolic extract of the aerial parts of the *Lagenaria siceraria* for antioxidant and hepatoprotective activity using DPPH, nitric oxide, superoxide, hydrogen peroxide and total phenolic and flavanoid content estimation method in rats and proved that methanolic extract of aerial parts show the significant in vitro antioxidant and potent hepatoprotective activity<sup>27</sup>.

#### Cardioprotective activity

Fard et al., (2008), evaluated the cardioprotective effect of *Lagenaria siceraria* fruit powder against the cardiotoxicity of doxorubicin in wistar male . and proved that the *Lagenaria siceraria* possessed cardioprotective effect against doxorubicin induced cardiotoxicity in rats<sup>28</sup>.

#### USES

It is used as medicine in India, China, European countries, Brazil, Hawaiian island, etc. for its cardiogenic, general tonic and diuretic<sup>21</sup> properties. Further, the antidiabetic<sup>17</sup>, antihyperlipidemic<sup>18-20</sup>, antihepatotoxic, analgesic<sup>22</sup>, CNS activity<sup>23</sup>, hypertension<sup>24</sup>, anticancer<sup>25</sup>, CNS depressant<sup>26</sup>, Cardioprotective<sup>28</sup>, antiinflammatory, antihyperglycemic,

immunomodulatory and antioxidant<sup>27</sup> activities of its fruit extract have been evaluated . A novel protein, lagenin, has also been isolated from its seeds and it possesses antitumor, immunoprotective and antiproliferative properties<sup>13</sup>. Although extensive studies have been carried out on its fruits and seeds, the pharmacology of the aerial parts of *L. siceraria* has not been studied yet. In many countries, this plant has been used traditionally as a single treatment for diabetes mellitus<sup>29</sup>.

#### Traditional uses

Cooked lauki is cooling, calming and acts as diuretic. It makes you relax after eating. But don't eat the vegetable raw as it can harm the stomach and intestines. It plays a very important role in treating urinary disorders. Prepare a glass of fresh juice by grating lauki and then mixing it with limejuice. Drink it once a day to combat the burning sensation caused by the high acidity of urine. It can be had along with sulphha drugs to treat urinary infection as it acts as an alkaline diuretic. Lauki juice is an excellent remedy for excessive thirst caused by diarrhea, over consumption of fatty or fried foods, and diabetes. Drink a glass of this juice with a little salt added to it to treat this condition. A glass of lauki juice with a little salt added to it prevents excessive loss of sodium, satiating thirst and keeping you refreshed in summer. If you are on a low calorie diet, suffering from digestive problems, are diabetic or convalescing, then lauki is must for you as it is easily digestible and low in calories<sup>30</sup>.

#### REFERENCES

1. Rahman A.S.H.,(2003) "Bottle Gourd (*Lagenaria siceraria*) A vegetable for good health", Natural Product Radiance, 2(5): 249-250.
2. Sirohi P S., and sivakami N.,(1991) "genetic diversity in cucurbits", Indian hort ,36:45-463.
3. Saha P, Mazumder U.K., Haldar P.K, Islam A, and Kumar R.B.S.,(2011), "evaluation of acute and subchronic toxicity of lagenaria siceraria aerial parts", IJPSR Vol. 2(6): 1507-1512
4. Kubde M.S., Khadabadi S.S., Farooqui I.A., and Deore S.L.,(2010) "*Lagenaria siceraria*: Phytochemistry, pharmacognosy and pharmacological studies" report and opinion ,2(3):91-98.
5. Government of India Ministry of Health & family welfare Development of Indian system of Medicine & Homoeopathy, new Delhi. The Ayurvedic pharmacopoeia of India; 1(3):215-216.
6. Shah B.N. and Seth A.k.,(2010), "Pharmacognostic studies of the *Lagenaria siceraria* (Molina) standley", Int.J.Pharm. Tecnol. Res.,2:121-124.
7. The Wealth of India(2004), "A ", CSIR, New Delhi III :16-19.
8. Shirwaikar A.,(1996), " Chemical investigation and antihepatotoxic activity of the fruits of *Lagenaria siceraria*", Indian Journal of Pharmaceutical Sciences; 58(5): 197-202.
9. Calabrese N.,(2000), "Technological and qualitative aspects of calabash gourd, *Lagenaria siceraria* (Molina) Standley for processing", ISHS Acta Horticulturae 492: I International Symposium on Cucurbits .
10. Baranoswka K.M.,and Cisowski W.,(1994), "HPLC determination of flavone-C glycosides in some species of Cucurbitaceae family", J. Chromatogram A;675:240-243.
11. Chiy-Rong Chen. et al.,(2008), "D: C-Friedooleanane-Type Triterpenoids from *Lagenaria siceraria* and Their Cytotoxic Activity", Chem. Pharm. Bull.; 56(3): 385-388.
12. Kaushik Ghosh et al.,(2009), " Structural identification and cytotoxic activity of a polysaccharide from the fruits of *Lagenaria siceraria* (Lau)", Carbohydrate Research; 344(5): 693-698.
13. Wang H.X. and Ng T.B.,(2000), " Lagenin, a novel ribosome inactivating protein with ribonucleic activity from bottle gourd (*Lagenaria siceraria*) seeds", Life Sciences; 67 : 2631-2638.
14. Khare C.P.,(2004),"Indian Herbal Remedies: Rational Western Therapy, Ayurvedic and other traditional usage",1<sup>st</sup> edition, springer publisher, New York, ISBN-10:3540010262 pp:522
15. Shah B.N. Seth A.K. and Nayak B.S.,(2010), "Microwave assisted isolation of mucilage from the fruits of *Lagenaria siceraria*", Der Pharmacia Lett; 2:202-205.
16. Nainwal P. Damija K. and Tripathi S.,(2011), "Study of Antihyperlipidemic effect of the juice of the fresh fruits of *lagenaria*

- siceraria*”, International journal of pharmacy and pharmaceutical sciences, vol3(1) :88-90.
17. Saha P. Mazumdar U.K. Haldar P.K. Sen S.K. and Naskar S.,(2011), “Antihyperglycemic activity of *Lageraria Siceraria* aerial parts on streptozotocin induce diabetes in rats”, Original research article, vol40(2):49-50
  18. Ghule B.V.Ghante M.H. Saoji A.N. and Yeole P.G.,(2009) “Antihyperlipidemic effect of the methanoli extract from *Lageraria siceraria* fruit in hyperlipidemic rats”, Jethopharmacol, vol 15:333.
  19. Mohale D.S. Dewani A.D. Saoji A.N. and Khadse C.D., “Antihyperlipidemic activity of isolated constituents from the fruits of *Lageraria siceraria* in albino rats”, International journal of green pharmacy , vol2(2) :104-107.
  20. Ghule B.V. Ghante M.H. Saoji A.N. and Yeole P.G.,(2006), “Hypolipidemic and antihyperlipidemic effect of *Lageraria siceraria* fruit extract”, Indian journal of experimental biology , vol 4 :905-909.
  21. Ghule B.V. Ghante M.H. Yeole P.G. and Saoji A.N.,(2007), “Diuretic activity of *Lagenaria siceraria* fruit extracts in rats”, Indian journal of pharmaceutical sciences;69(6):817-819
  22. Shah B.N. and Seth A.K.(2010), “ Screening of *lagenaria siceraria* fruits for their analgesic activity”, rom. J. Biol. – plant biol; 55(1):23–26.
  23. Jayashree C. Khairnar P.P., and Chaudhary S.R.,(2010), “Central nervous system activity of different extracts of *Lagenaria siceraria* (MOL) standl. Leaves parts”, International journal of pharmaceutical and research and development ;2(7).
  24. Mali V.R. and Bodhankar S.L. (2010), “Effect of *Lagenaria siceraria* (LS) powder on dexamethasone induced hypertension in rats” International Journal of Advances in Pharmaceutical Sciences ; Vol 1( 1)
  25. Saha P. Sen S.K. Bala A. Mazumder U.K. and Haldar P.K.,(2011), “Evaluation of anticancer activity of *Lagenaria siceraria* aerial parts”, International Journal of cancer research; 7(3):244-253.
  26. Anaga, A.O., Ezeja, M.I and Amuzie, C.J.,(2011), “ Investigation of the aqueous fruit extract of *Lagenaria siceraria* for pharmacological activities in vitro and in vivo”, International Journal Of Current Research;8(2).
  27. Saha P. U. Mazumder U.K. Haldar P.K. Gupta M. Sen S.K. and Islam A.,(2011), “Antioxidant and Hepatoprotective Activity of *Lagenaria siceraria* Aerial parts”, Pharmacognosy Journal (Phcog J); 3 (22).
  28. Fard M.H. Bodhankar S.L. and Dikshut M.,(2008), “Cardioprotective activity of fruit of *Lageraria siceraria* (molina) standley on Doxorubicin induced cardiotoxicity in rats”, International Journal of pharmacology ;volume 4(6):466-471.
  29. Duke J.A.,(1992), “Handbook of biologically active phytochemicals and their activities”, Boca Raton, FL: CRC Press.
  30. Sanjana.,(2008), “ Bottle gourd-gourd against diseases”, Nutrihealth.