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REVIEW ARTICLE.....!!!

## AN UPDATED REVIEW ON MEDICINAL PROPERTIES OF

### *Lagenaria siceraria*

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#### ABSTRACT

#### KEYWORDS:

*Lagenaria siceraria*,  
Nutritional value,  
Pharmacological activity,  
Guidelines, Bitter bottle  
guard.

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The *Lagenaria siceraria* (Molina) Standley is one of humankind's first domesticated plants, providing food, medicine and a wide variety of utensils and musical instruments. It belongs to family cucurbitaceae, commonly known as bottle guard or calabash in English. Indian traditional medicine claims that bottle gourd acts as a nerve tonic and can help to improve obsessive-compulsive disorder. Bottle guard is considering one of the best way for weight loss. The fruit has been reported to contain many vitamins, protein, minerals, dietary and phytochemical constituent like flavonoids terpenoids etc and fruits of *Lagenaria siceraria* also contain highest amount of choline known till date in plants, which can act as a precursor for neuro-transmitter acetylcholine which could be used in various neurological disorder. Scientifically various part of plant like root, fruit, leaves and flower has been evaluated for its various activity like antioxidant, anthelmintic, cognitive enhancer, anticancer, antianxiety, antidepressant, antihyperlipidemic, fibrinolytic cardio and hepatoprotective etc. This emphasized high therapeutic value of this miracle herb, and must be consider to be consumed as daily nutrition.

**INTRODUCTION:**

Cucurbitaceae or cucurbit family (also known as the gourd, melon, or pumpkin family) is a major source of medicinal agents since ancient times. It is a medium sized plant family comprising some 118 genera and 825 species of wide distribution in the warmer regions of the world. Herbal medicines are now being preferred over synthetic drug as they less or no side effect. The bottle gourd belongs to the genus *Lagenaria* that is derived from lagena, meaning, the Latin name for a Florence flask (bottle) referring the fruit. The species name siceraria probably also refers to the fruit which is useful when it is mature and dry (siccus). *Lagenaria vulgaris* (Common), or *Lagenaria leucantha* (White flowered gourd) but it is now generally agreed that the correct name is *Lagenaria siceraria* (Mol) Standl.

The Cucurbitaceae family is tropical and sub-tropical in origin, and does not tolerate cold soils or cool growing temperatures. Geographically it occurs throughout India and is now cultivated worldwide. It is generally accepted that *Lagenaria* was indigenous to Africa and that it reached temperate and tropical areas in Asia and the Americas about 10,000 years ago.



Figure 1 : Plant of *Lagenaria siceraria*

**PLANT DESCRIPTION:**

- **Botanical name :** *Lagenaria siceraria* (Mol.) Standl.
- **Family :** Cucurbitaceae
- **Vernacular name**

|                                     |                              |
|-------------------------------------|------------------------------|
| Hindi : Lauki, ghia, Doodhi Bhopala | Telugu: Sorakaya, anpaka     |
| English : Bottle gourd, calabash    | Marathi: Kadoo               |
| Tamil : Sorakkai                    | Panjabi: Tumbi, dani         |
| Karnataka: Sorekayi                 | Kerala: Churakka             |
| Assam: Atilao.                      | Andhra Pradesh: Sora kaaya   |
| : Alaba, tumbi ,Iksuaku, katutumbi  | Sanskrit Urdu: Ghiya, lauki. |

➤ **Classical name:**

Ayurveda: Laghu, Ruska, isalabu, alabu, labu

Quran name: Yaqtin (As-Saaffat, Chapter # 37, Verse # 14)

➤ **Classification<sup>1</sup>:**

Kingdom : Plantae- plants

Subkingdom : Tracheobionta- Vascular plant

Superdivision : Spermatophyta- Seed plant

Division : Magnoliophyta- Flowering plants

Class : Magnoliopsida- Dicotyledons

Order : Cucurbitales

Genus : Lagenaria

➤ **Therapeutic uses<sup>1</sup>:**

Jwara- Fever

Kasa- Cough

Visa roga- Disease due to poison

Svasa- Dyspnea

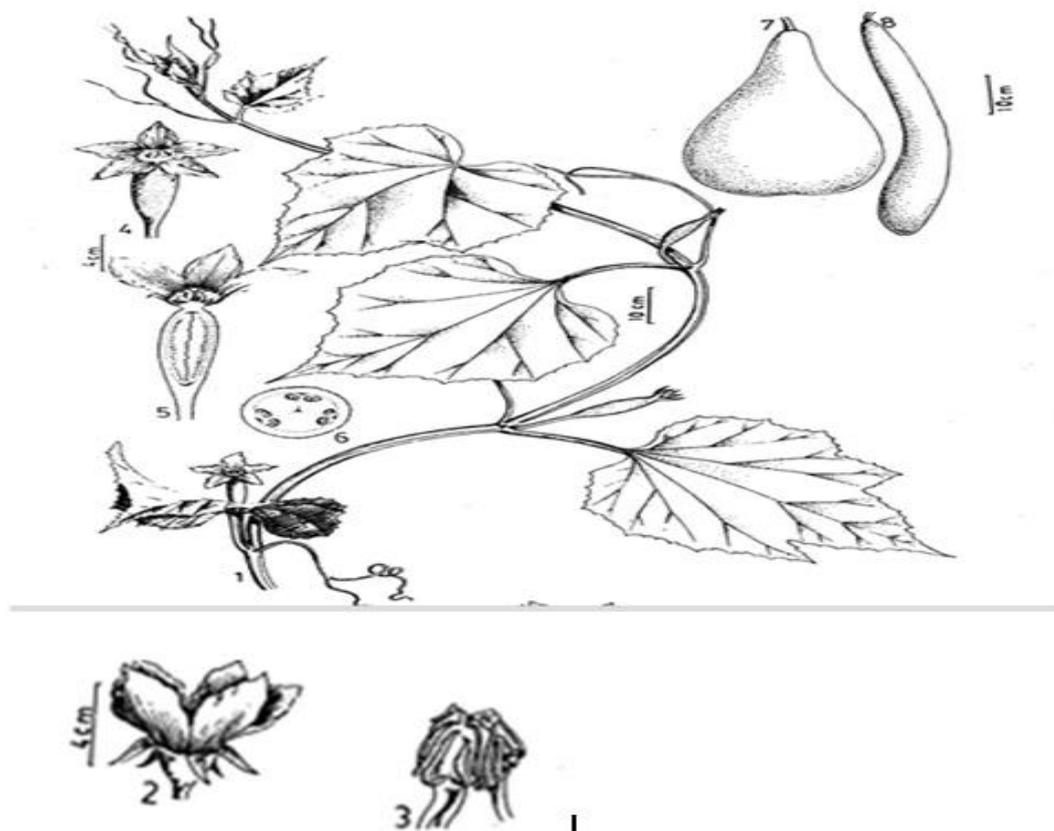
Sopha- Inflammation

Vrana- Injury

➤ **Part used:** Fruit, root, leaves and seed oil.

**HABITAT:**

Plant is considered to be of African and Asian origin. *L. siceraria* is one of the 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 manure loams. It required warm humid climate or plenty of watering when grown during dry weather. Seeds may be sown in nursery beds and seedlings transplanted when they have put forth 2-3 leaves. It 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. Vines are allowed to trail on the ground or trained over walls, trees, or other support; trailing over give high yield of fruit.



**Fig 3.17 :** *Lagenaria siceraria* (Molina) Standley. 1 -Habit ; 2- Male flower; 3 -Stamens; 4 - Female flower; 5- Female flower(L.S); 6 ovary (TS); 7-8 Fruits.

#### **CHEMICAL CONSTITUENT:**

The different parts of *Lagenaria siceraria*; fruit, and seed, contains various chemical constituents, which includes:

- **Fruits:** 4-C-glycosylflavone, 7-O-glucosyl-6-C-glucoside apigenin, 6-C-glucoside apigenin, 6-C-glucoside luteolin, and 7,4'-O-diglucosyl-6-C-glucoside apigenin, isovitexin, isoorientin, saponarin, and saponarin 4'-O-glucoside<sup>2</sup>, quercetin,
- **Seeds:** Seeds contains Vitamin C:1.950mg/100g, Vitamin B<sub>1</sub> :0.210mg/100g, Vitamin B<sub>3</sub>:0.320 mg/100g; The seeds contain steroidal moieties like avenasterol, codisterol, elesterol, isofucasterol, stigmasterol, sitosterol, compesterol, spinasterol; and sugar moieties including rhamnose, fructose, glucose, sucrose, raffinose<sup>3</sup> and saponin. Seed kernels are rich in iron, potassium, sulfur, and magnesium and particularly rich in copper (28.3 ppm)( 04 05). lagenin, is isolated a novel ribosome-inactivating protein with ribonucleolytic activity, from seeds of the plant<sup>4,5,6</sup>

**Nutritional value of fruit (g/100g) on dry basis:**

The constituents of *Lagenaria siceraria* contained; **Total sugar** ( 5.870 ), **Reducing sugar** ( 5.220 ), **Non reducing sugar** ( 0.650 ), **Starch** ( 1.310 ), **Curd fiber** ( 4.450 ), **Neutral detergent fiber** (22.710 ), **Acid detergent fiber** ( 16.260 ), **Hemicellulose** ( 6.450 ), **Cellulose** ( 16.070 ), **Lagenin** ( 0.193), **Vitamin C** (1.900 mg/ 100 gm), **Vitamin B<sub>1</sub>** ( 0.029 mg/100gm), **Vitamin B<sub>2</sub>** ( 0.022mg/100 gm), **Vitamin B<sub>3</sub>** ( 0.320mg/100gm), **Vitamin B<sub>6</sub>** ( 0.040mg/100gm ), **Vitamin B<sub>12</sub>** ( 0.152mg/100gm), **Vitamin A** ( 16IU ), **Folate total** ( 6mcg ), **Tryptophan** ( 0.003 g/100gm ), **Threonin** ( 0.018 g/100gm ), (0.018 g/100gm), **Isoleucine** ( 0.033 g/100gm), **Leucine** ( 0.033 g/100gm ), **Methionine** ( 0.004 g/100gm), **Phenylalanine** ( 0.015 g/100gm ), **Valine** ( 0.027 g/100gm ), **Arginine** ( 0.14 g/100gm ), **Iron** ( 11.87mg/100gm), **Phosphorous** ( 240.33mg/100gm ), **Potassium** (3320.00 mg/100gm )<sup>7</sup>, **Choline** ( 16.02/g on dry basis )<sup>8</sup>

These nutritional values of *Lagenaria siceraria* help to prevent the oxidation of cholesterol. LS a good source of vitamin A, B and an excellent source of vitamin C (ascorbic acid). The extract and fruit juice of *Lagenaria siceraria* contains, alkaloids, glycosides, flavonoids, carbohydrates, saponins, terpenoids, and steroids.

**PHARMACOLOGICAL PROPERTIES OF LAGENARIA SICERARIA:****1. Anthelmintic activity:**

Anthelmintic efficacy of four plants of the cucurbitaceae family were evaluated against *Hymenolepis nana* (tapeworm) and *Aspicularis tetraptera* (pinworm) infections in mice. Piperazine citrate was used as a reference substance for comparison. The ethanolic extracts of the seeds of *Cucumis sativus*, *Cucurbita maxima* and *Lagenaria. Siceraria* were shown to exhibit a potent activity against tapeworms which was comparable to the effect of piperazine citrate<sup>9</sup>.

**2. Cardioprotective activity:**

Fruit powder of *L. siceraria* showed good cardioprotective effects. *L. siceraria* at 200 mg kg<sup>-1</sup>, p.o. for 18 days were studied against Doxorubicin induced cardiotoxicity in rats. The *L. siceraria* prevents the alteration in endogenous antioxidants such as superoxide dismutase, reduced glutathione and lipid peroxidation which are the markers of cardiotoxicity . Further the LS powder also showed the protection against histopathological alteration and changes in ECG induced by doxorubicin. Ethanolic extract of *L. Siceraria* fruits also showed increased in force of contraction and decrease in rate of contraction (from 66 to 44) in isolated frog heart when perfused with normal ringer solution<sup>10,11</sup>.

**3. Hepatoprotective activity:**

In-vivo study of antitubercular drugs alone and in combination with fruit ethanolic extract of *Lagenaria siceraria*. Combined treatment of Ethanolic extract of *Lagenaria siceraria* and anti-

tubercular drugs showed significant reduction in oxidative stress [SOD & MDA,  $p < 0.001$ ] as compared to anti tubercular drug alone. Histopathological examination of liver showed grade I & grade 0 changes in combination group while grade IV changes in group receiving anti tubercular drugs alone. Thus concluded that ethanolic extract of *Lagenaria siceraria* fruit possesses significant hepatoprotective and antioxidant activity in antitubercular drugs induced hepatotoxicity in rats <sup>12</sup>.

#### **4. Antioxidant activity:**

Free radical scavenging activity of the fruit was observed. Fruits were collected and the mesocarp, epicarp, and pulp containing seeds were separated out. Each part of fruit is extracted with different solvents in increasing order of polarity. All extracts were assessed by 1,1-dphenyl-2-picrylhydrazyl (DPPH) assay. Maximum antioxidant activity in this study was observed for the acetone extract of the fruit epicarp. Free-radical scavenging activity may be due to presence of tanin, ellagitannins in the epicarp of acetone extract. The effect of ethanolic extract of *Lagenaria siceraria* fruits against various disorders where free radicals play a major role in pathogenesis, were found to very effective as a hepatoprotective, antioxidant, antihyperglycemic, immunomodulatory, antihyperlipidemic, and cardiogenic agent <sup>13</sup>.

#### **5. Antimicrobial:**

In this in- vitro study antimicrobial effect of leaf extracts of *Lagenaria siceraria* (Molina) Standl using different solvent was evaluated on bacterial strains like *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Bacillus subtilis* and *Candida albicans*. Result revealed that acetone, alcoholic and distilled water leaf extracts exhibit significant activity against all test organisms. The petroleum ether extract in this study showed least activity against test bacterial strains. Antimicrobial activity of the extract was compared with standard antibiotic Cephlexin. The extracts showed better antifungal activity than antibacterial activity and Gram negative bacteria were more susceptible than Gram positive bacteria. The peel showed lowest MIC and MBC values indicating the therapeutic value of agro waste material <sup>14</sup>.

#### **6. Antidepressants :**

In-vivo Antidepressant activity of methanolic extract of *Lagenaria siceraria* (Molina) Standley fruits (MSLF) at dose of (50, 100, and 200 mg/kg, p.o.) showed to possess dose-dependent significant reduction in duration of immobility ( $p < 0.01$ ) in behavior despair test in rats. The phytochemical screening revealed the presence of phytoconstituents, such as flavonoids, saponins, and sterols in the fruits. The results of the study proved that the plant possesses antidepressant activity, confirming the traditional claims<sup>15</sup>. Phytochemical screening of MSLF revealed presence of flavonoids, saponins, sterols, proteins, tannins and carbohydrates. Moreover triterpenoids (steroidal compounds) are present in the fruits, those are able to cross blood brain barrier (BBB) due to their lipophilic nature

and so it can be assumed that such steroidal compounds might also be responsible to elicit antidepressant and other neuropharmacological activities at molecular level in CNS (brain)<sup>16,17</sup>.

### 7. Antianxiety:

In-vivo study was done to characterize the anti-OCD (anti-compulsive disorder) activity of the methanolic extract of the fruits of *Lagenaria siceraria* (Molina) Standley (LS) using the marble-burying behavior in mice. i.p administration of 25 and 50 mg/kg of LS extract significantly ( $P < 0.001$ ) decreased the total number of buried marbles. The effect was comparable to that of the fluoxetine (10 mg/kg, i.p.). Fluoxetine and LS fruit extract in this study do not produce any overt motor dysfunction [18]. Methanolic extract of *Lagenaria siceraria* may have an identical effect to SSRI or some inhibitory effect on serotonergic neurotransmission. Phytochemical screening on fruits of *Lagenaria siceraria* revealed the presence of flavonoids, steroids, saponins, terpenes and phenolic compounds, the mechanism of anti-compulsive action of *Lagenaria siceraria* may be due to involvement of any of these phytoconstituents in serotonergic neurotransmission. Moreover, triterpenoids (steroidal compounds), which are able to cross blood brain barrier (BBB) due to their lipophilic nature<sup>19</sup>.

Pharmacological screening of *Lagenaria siceraria* in another study was done to evaluate CNS parameters such as gross behavior, effects on mood, anxiolytic profile, exploratory behavior and memory. Aqueous extract of *Lagenaria siceraria* was given orally in the dose of 200 mg/kg bid (twice a day) for a period of 30 days in mice and 45 days in rats. The anxiolytic effect of *Lagenaria siceraria* on light/dark box activity was observed. The effect of *Lagenaria siceraria* on light/dark box activity indicates that the *Lagenaria siceraria* has an anxiolytic potential, the percentage of time spent in light box was increased by *Lagenaria siceraria* to a highly significant extent<sup>20</sup>.

### 8. Memory and learning :

Aqueous extract of *Lagenaria siceraria* for a period of 30 days in mice and 45 days in rats to study its memory enhancing effect. The effect of *Lagenaria siceraria* on stationary rod activity and water maze was observed. The effect of *Lagenaria siceraria* on stationary rod and water maze activity indicates that the fruit of *Lagenaria siceraria* is a very excellent memory enhancer. This effect of *Lagenaria siceraria* on water maze and stationary rod activity was thought to be due to its effects on neurotransmitter levels, especially acetylcholine (Ach)<sup>20</sup>.

### 9. Anticancer:

The study was carried out to evaluate the anti-cancer activity of methanol extract of *Lagenaria siceraria* (Mol.) Standley aerial parts (MELS) on Ehrlich's Ascites Carcinoma (EAC) model in mice. After inoculation of EAC cells into mice, treatment with MELS (200 and 400 mg kg<sup>-1</sup>) and standard drug, 5-Fluorouracil (20 mg kg<sup>-1</sup>) were continued for 9 days. Evaluation of the effect of

drug response was made by the study of tumor growth response including increase in life span, study of hematological parameters, biochemical estimations and antioxidant assay of liver tissue. Experimental results revealed that *L. siceraria* possesses significant anticancer activity which may be due to its cytotoxicity and antioxidant properties. The anticancer activity of methanolic extract was assumed probably due to its flavonoids content <sup>21</sup>.

#### **10. Cytotoxic effect:**

The n-hexane extract of flowers of *Lagenaria siceraria* was screened for antitumor properties using brine shrimp lethality bioassay. A reputed cytotoxic agent vincristine sulphate was used as a positive control. The LC<sub>50</sub> values of n-hexane extract found to be 99.167 µg/ml. The positive control vincristine sulphate showed LC<sub>50</sub> at a concentration of 0.563 µg/ml. Results of the brine shrimp lethality bioassay shows that the n-hexane extract possess cytotoxic activity. Comparison with positive control vincristine signifies that cytotoxicity exhibited by the n-hexane extract might has mild antitumor and pesticidal activity <sup>22</sup>.

#### **11. Diuretic:**

In vivo study about diuretic activity of vacuum dried juice extract and methanol extract of the fruits was evaluated in albino rats. Rats treated with vacuum dried juice extract and methanol extract (100 -200 mg/kg; p.o.) furosemide (20 mg/kg; i.p.) was taken as standard. Different parameters such as total urine volume, urine concentration of electrolytes such as sodium, potassium, and chloride were evaluated. Rats showed higher urine volume compared to respective controls. Both vacuum dried juice extract and methanolic extract exhibited dose-dependent increase in the excretion of electrolytes when compared to controls. The result conclude that elevated diuretic potentials of juice and methanol extract were statistically significant and comparable to that of the standard diuretic agent furosemide <sup>23</sup>.

#### **12. Immunomodulatory:**

Immunomodulatory effects of n-butanol-soluble and ethyl acetate soluble fractions of successive methanolic extracts of the fruits were evaluated in rats. Oral administration of these fractions at doses 100 -500 mg/kg significantly inhibited delayed-type hypersensitivity reaction in rats. A dose-dependent increase in both. Administration of methanolic extract of *Lagenaria siceraria* fruits increased the total WBC count, which was lowered by cyclophosphamide. Oral administration of methanolic extract enhanced the carbon clearance rate from circulation in rats significantly compared to animal of control groups. High performance thin layer chromatography was performed to further separate components from different fractions of methanolic extract of *Lagenaria siceraria* fruits. TLC fingerprint profile was established in this study for the varied fractions of bioactive methanolic extract. Phytochemical screening of this plant has shown the presence of flavonoids,

saponins and carbohydrates. Saponins and flavonoids have long been recognized to possess a wide variety of biological activities including immunomodulatory property. Result conclude methanolic extract of *Lagenaria siceraria* fruits augments humoral immune response, activates macrophage induced phagocytosis myelosuppression. and prevents cyclophosphamide-induced myelosuppression<sup>24</sup>.

#### 1.2.13. Anti ulcer:

The methanol extract of *lagenaria siceraria* fruit have been used to study antiulcer activity in rats. The antiulcer activity was evaluated by four methods,

1. Pylorus ligation: ( Ulcer is due to auto digestion of gastric mucosa).
2. Ethanol induced ulcer: ( Ethanol stimulate the formulation of leukotriene C4(LTC4).
3. NSAIDs (Asprin) induced: (Cause mucosal damage by interfering prostaglandin synthesis)
4. Cold resistance stress induced method (CRS): ( Stress play an important role induce duodenal ulcer).

The methanol extract of *lagenaria siceraria* show gastro protective activity, all these type ulcers can treated by methanol extract of bottle gourd<sup>25</sup>.

#### 14. Anti-hyperlipidemic :

In-vivo antihyperlipidemic activity was performed in this study by inducing hyperlipidimia in rats by administration of Triton WR 1339 (iso-octyl polyoxy ethylene phenol), the increased level of cholesterol and triglycerides were effectively prevented by administration of extract 100and 200mg/kg, the efficacy of extract was compared with simvastatin as standard<sup>26</sup>.

#### 15. Antidiabetic:

In-vivo antidiabetic activity of *Lagenaria* extract was studied. Hyperglycemia was induced by alloxan monohydrate at the dose of 150mg/kg i.p( as single dose), the hyperglycemia induced rats were treated with *Lagenaria* extract then they were observed for reduced blood glucose level. The extract was administered as 100 and 200mg/kg dose it shows similar activity with glibenclamide (standard) (5mg/kg)<sup>27</sup>.

#### 16. Analgesic and Anti-inflammatory:

The analgesic activity of *Lagenaria siceraria* juice extract was evaluated on acetic acid writhing and formalin. pain test in mice. Dose (100-300mg/kg) dependent inhibition of writhing and also showed a significant ( $P < 0.001$ ) inhibition of both phases of the formalin pain test. The anti-inflammatory activity was done in rats and mice, inflammation induced by ethyl phenyl propionate induced ear edema, carrageenan and arachionic acid induced hind paw edema and also the albumin-induced paw edema in rats at same dose . Thus this effect was prevented by *Lagenaria* fruit juice<sup>35</sup>.

**17. Nephrotoxicity:**

In vivo studies revealed the presence of flavonoids, tannins (ellagitannins), saponins, polyphenols, triterpenes, lagenin (protein) in extract. *Lagenaria siceraria* was found to be potent diuretic which causes excretion of sodium and potassium. Gentamicin was used as a inducer. Gentamicin was administrated intraperitonealy at a dose of 80mg/kg body weight for 9 days. The biochemical parameters viz. serum creatinine, blood urea nitrogen (BUN) and serum uric acid was found to be significantly increased whereas serum total protein was decreased. Histopathological sections showed marked glomerular, peritubular and blood vessel congestion. These increased levels of biochemical parameters and extent of renal damage were decreased by the methanolic and aqueous extracts *Lagenaria siceraria* seeds at a dose of 250mg/kg, Cystone tab. (500mg/kg) was used as reference standard to compare with the toxicant and test group animals <sup>28</sup>.

**18. Anti-urolithiatic:**

Anti-urolithiatic effect of *Lagenaria siceraria* fruit powder (LSFP) was evaluated against sodium oxalate (NaOx) induced urolithiasis in rats. Increased severity of microscopic calcium oxalate (CaOx) crystals deposition along with increased concentration in the kidney was seen after 7 days of NaOx (70 mg/kg, i.p.) pre-treatment. LSFP (500 mg/kg, p.o.) and standard marketed formulation Cystone (500 mg/kg, p.o.) caused a significant reversal of NaOx-induced changes in ion excretion and urinary CaOx concentration in 7 days treatment. results, conclude that LSFP showed beneficial effect against urolithiasis by decreasing CaOx excretion and preventing crystal deposition in the kidney tubules <sup>29</sup>.

**19. Atherosclerosis:**

Treatment of rats with ethanolic extract of fruits of *Lagenaria siceraria*(LSEE) significantly lowers the risk of atherosclerosis by lowering percentage plaque area in aorta and grade of atheromatous lesions in hypercholesterolemic rats and also serum cholesterol, triglyceride, LDL-c, VLDL-c and increased HDL-c levels as well. The extract also induced lipoprotein lipase activity and significantly decreased cholesterologenesis in liver by reducing HMG-CoA reductase activity in hypercholesterolemic rats. It can be concluded from the study that administration of LSEE (200 and 400 mg/kg) caused a significant amelioration in the atherosclerotic lesions (28.90%) as evidenced by significant reduction in the plaque size up to 13.61 and 9.3%. ethanolic extract of fruits of *Lagenaria siceraria* contains active components which ameliorates the atheromatous lesions in rat aorta and lowers the risk of atherosclerosis in hypercholesterolemic rats <sup>30</sup>.

**20. Fibrinolytic:**

Isolation of flavonol, kaempferol, from the fruits of *Lagenaria siceraria* as a sole compound and to explore the fibrinolytic potential of the methanolic extract of the fruits of *L. siceraria* and the isolated

compound using their in vitro activity was performed. The fibrinolytic activity in terms of percentage of plasma clot liquefaction was determined by plasma clot lysis at 37°C in 24 h. The fibrinolytic activity of both substances was compared to the thrombolytic agent streptokinase (30,000 IU). The percentage of fibrinolytic activity of the extract and isolated compound were found to be  $54.72 \pm 0.7210$  and  $77.37 \pm 1.3010$ , respectively. Streptokinase was considered as the standard fibrinolytic enzyme for comparative purposes and had  $91.46 \pm 0.7625\%$  fibrinolytic activity. Result of this study after testing the hypothesis by experimental procedures is that in vitro fibrinolytic activity on plasma clots is an inherent property of kaempferol isolated from the fruits of *Lagenaria siceraria*<sup>31</sup>.

### **21. Antithyroidal, Antiperoxidative, and Glucose inhibitory potential :**

In another in-vivo study three different concentrations of peel extract was selected .The most effective safe dose for regulation of hepatic LPO, thyroid function, and glucose metabolism was estimated. Out of 50, 100, and 200 mg/kg of peel extract of this plant , 100 mg/kg was found to be safest and most effective , as it could inhibit the levels of serum thyroxine, triiodothyronine, and glucose as well as hepatic LPO. Finally the antithyroidal, antiperoxidative, and glucose inhibitory potential of the peel extract were tested in T-4induced hyperthyroid animals. After 21 days of treatment with extract , reductions in concentrations of serum thyroid hormones, glucose, and hepatic LPO were observed, with parallel increases in antioxidants such as superoxide dismutase, catalase, and glutathione, indicating the efficacy of the peel in hyperthyroidism, hyperglycemia, and hepatic LPO<sup>14</sup>.

### **22. Dyslipidemia in humans:**

Effects of *Lagenaria siceraria* fruit extract in human subjects with dyslipidemia along with subjects of normal health was evaluated. 200 mL of freshly prepared *Lagenaria siceraria* fruit extract was administered daily on empty stomach for 90 days. Significant reductions ( $p < .01$ ) were found in triglycerides and total cholesterol levels in blood. Cardiac risk ratio, atherogenic coefficient, and atherogenicity index of plasma were observed to be improved. Appreciable reductions in body mass index ( $p < .01$ ) and blood pressure (systolic  $p < .01$ , diastolic  $p < .05$ ) along with a significant reduction ( $p < .05$ ) in fasting blood glucose levels were also observed in these subjects. *Lagenaria siceraria* fruit extract exhibited significant antioxidant activity in dyslipidemic subjects as evident from elevations in SOD ( $p < .05$ ) and GSH levels ( $p < .01$ ) with marked improvement in catalase ( $p < .01$ ) and TBARS levels ( $p < .05$ ). Phytochemical screening confirmed the presence of saponins, glycosides, flavonoids, terpenoids, and phenolic compounds. *Lagenaria siceraria* fruit extract serves as dietary adjunct in treatment of human dyslipidemia and cardiovascular disease<sup>32</sup>.

**COMMERCIAL APPLICATION:**

The bottle gourd, otherwise known as the calabash plant, was prehistoric man's most useful plant. It is believed to be the first cultivated plant in the world, and may have been domesticated even earlier than food crops and livestock. Its' hard-skinned fruit was used to make water bottles, spoons, pipes, containers, musical instruments, and ornaments. They were also used to make pontoons in ancient Egypt, swimming aids by the Romans, birdhouses by Native Americans, and more recently as motorcycle helmets in Nigeria<sup>33</sup>.

**Case reports on consumption of bitter bottle gourd<sup>34</sup>**

Three deaths were reported, one from Delhi and two of them was from Uttar Pradesh 28.3.2007 and 23.6.2010 after consumption of extremely bitter bottle gourd juice. Three persons who died after consumption of freshly prepared bottle gourd juice or juice mixed with bitter gourd (karela) juice were over 59 years of age and had diabetes(T2DM: type 2 diabetes mellitus ) since last 20 years. This juice was reported to be extremely bitter by these patients.

Twenty six persons were admitted to various hospitals of the country on complaint of abdominal pain and vomiting following consumption of freshly prepared bottle gourd juice. Diarrhoea and vomiting of blood was reported in 18 (69.2%) and 19 (73.1%) patients, respectively.

Biochemical investigations revealed elevated levels of liver enzymes. More than 50 per cent patients was suffering with hypotension.

Endoscopic findings showed profusely bleeding stomach with excessive ulceration seen in distal oesophagus, stomach and duodenum in most of the cases. Bottle gourd contains the toxic tetracyclic triterpenoid compounds called cucurbitacins which are responsible for the bitter taste. There is no known antidote for this toxicity and clinicians treat such cases .

**Guideline for the use of bottle gourd to public and physicians<sup>34</sup>**

Public should be aware of and have to take following step:

- a) Bitter tasting bottle gourd juice should not be small piece should be tasted first
- b) Bottle gourd juice should not mix with any other juice.
- c) In case of any discomfort (nausea, vomiting, diarrhea) patient after consumption immediately taken to nearby hospital.

**For physicians :** Patients coming with symptoms (discomfort, nausea, vomiting, diarrhoea, gastrointestinal bleeding after consumption of juice) should immediately be attended by them and general supportive care should be provided, i.e

- a) IV fluids/crystalloids/blood products/ fresh frozen plasma to maintain the haemodynamics and electrolyte balance;

b) Ryle's tube to be put in for gastric lavage and to assess gastrointestinal (GI) bleed- aspirate to be preserved;

c) Proton pump inhibitors should be given for management of GI bleed and appropriate treatment for other complications should to be given.

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