

Medicinal and nutritional importance of *Lagenaria siceraria* (Lauki)

Munahira Mehboob¹, Irum Naureen², Aisha Saleem^{1*}, Ayesha Amanat¹

¹M.phil Researcher, School of Zoology Minhaj University Lahore, Pakistan

²Assistant Professor, School of Zoology Minhaj University Lahore, Pakistan

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*Corresponding author: Aisha Saleem

M.phil Researcher, School of Zoology Minhaj University Lahore, Pakistan

Abstract

Lagenaria siceraria (Lauki) belong to the *Cucurbitaceae* family. It is also known as calabash or white flowered gourd and locally kado. There are 118 general and 825 species. It is found in many countries Pakistan, India, Sri-Lanka, and Africa. The fruit is the rich source of the ascorbic acid, beta carotene and a good source of vitamin B complex. The seeds of *L. siceraria* contain amino acids, proteins, lignin, and iron. The leaves contain carbohydrates, phytoestrols, saponins, phenolic compounds, tennis, proteins, amino acids and flavonoids. *Lagenaria siceraria* seed oil has cooling effects and can be applied in migraine type headache. The fruit of the *L. siceraria* help to reduce the inflammation on the liver and the juice of the *L. siceraria* on empty stomach in morning is the best remedy liver disease, heart disease, urinary problems and depression. The juice also helps to change the concentration of the urea and uric acid in kidney. The fruit is used for the treatment of the jaundice, diabetes, and ulcer, piles, hypertension and skin disease. It may be the best gift for the mankind.

Key words: *Legeneria siceraria* fruit, *Legeneria siceraria* juice.

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INTRODUCTION

Lagenaria siceraria (lauki) belongs to the *Cucurbitaceae* family. It is also known as calabash or white flowered gourd and locally kado. There are 118 general and 825 species. *Lagenaria* consists of five other wild species, namely *LaGuardia breviflora*, *Lagenaria Rufa*, *Lagenaria sphaerica*, *Lagenaria Abyssinia*, and *Lagenaria guineensis*. In which *Lagenaria siceraria* spp mostly cultivated. Within the species of bottle gourd has been recognized *Lagenaria siceraria* ssp [1]. *Siceraria* and *Lagenaria siceraria* ssp *asiatica*, cultivation of the crop started from around 9-10,000 BP (Before present) in the America (new world), 6-10, 000BP in East Asia and 4-5000BP in Africa. Bottle gourd is said to be one of the first species domesticated by human. Bottle gourd is an annual herbaceous plant with a prostrate type growth habit [2]. The leaves are alternate and variable, and tendrils are almost present flowers of *L.siceraria* are monoecious in nature, male and female flowers are found on different plant axis of the same plant. So cross pollination is highly favorable [3].

Dioecious and andromonoecious sex from Bering hermaphrodite flowers also exist in wild or non-cultivated types. Sex ratio of bottle gourd is very high. The proportions of male and female flowers have been shown to affect yield significantly [4]. The calabash or bottle gourd is extensively cultivated in the plains of Pakistan all the year round for its young and tender fruits eaten as popular domestic vegetable called *Lauki* or *Kaddu*. *L. siceraria* is (previously known as *L. vulgaris* Ser.) [5]. Fruits are known to float in the sea for many months without the seeds losing their viability. Independent domestications from wild populations are believed to have occurred in both the Old and New Worlds. African and American land races (subsp. *siceraria*) are morphologically distinct from Asian land races [6]. The shell of the old fruits are often used as water bottles and for making ladles, pipes, blowing, horns, snuff boxes etc. The dry shells are also used in musical instruments like Sitar and Bia. The pulp has cooling and antibilious effect. The seed oil is applied externally in headache [7-9].

Lagenaria siceraria is widely cultivated in tropical and subtropical areas at elevations ranging from near sea level to 2500 m [10]. It is often found as an escapee especially along riversides and ruderal areas. It can be found growing in alluvial sandy soils, flat areas and moderate slopes, rocky ridges, riverbanks, dry riverbeds, riverine thickets, woodland and savannahs

[11]. It is also common in disturbed sites, secondary forests, ruderal areas near villages and along roadsides. *L. siceraria* is well adapted to tropical moist and wet climates, but also tolerates dry and arid conditions and can thus be found growing in dry thickets, arid steppes and deserts [12].

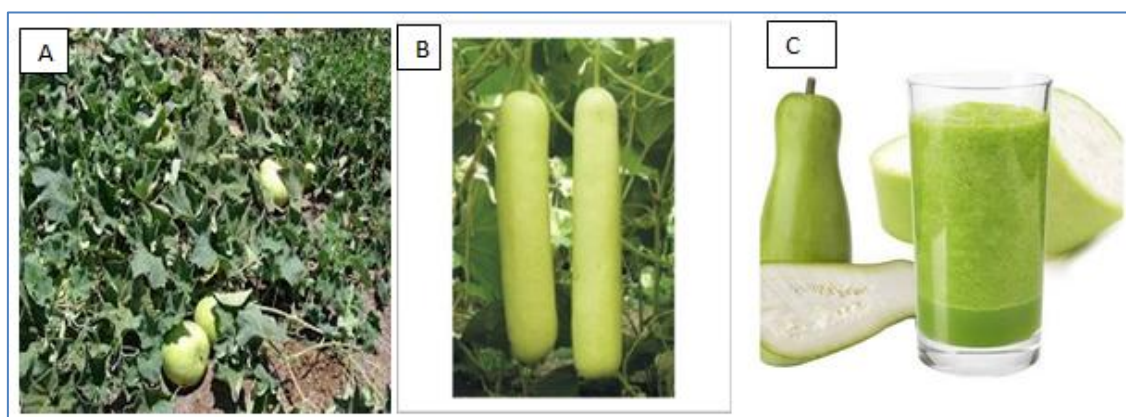


Fig-1: (A) *Lagenaria siceraria* Plant (B) *Lagenaria siceraria* Fruit (C) *Lagenaria siceraria* Juice [23, 24]

Composition of the *Lagenaria siceraria*

Fruit: The edible portion of fruits is fair source of ascorbic acid, beta carotene and good source of vitamin B complex, pectin dietary soluble fibers and contains highest source of choline level-a lipotropic factor, a healer of mental disorders, along with required metabolic and metabolite precursors for brain function, amongst any other vegetable known to man till date [13]. 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-elasterase enzyme. [14].

Two sterols were identified and isolated from petroleum ether fractions of ethanol extract of dried fruit pulp of *Lagenaria siceraria* namely Fucosterol and campesterol [15]. The HPLC analysis of extract of flowering plant of *Lagenaria siceraria* shows presence of flavone-C glycosides. The effect of semi purified dietary fibers isolated from the fruit of *Lagenaria siceraria* effects on fecal steroid excretion was reported [16]. It is also reported to have content 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 predominant component of soluble fibers in *Lagenaria siceraria* fruits [17].

Peroxidase and polyperoxidase activity in relation to its blanching period and total enzymatic inactivation of blanched sample (i.e., residual peroxidase activity is less than one) is also reported in

180 sec [18]. In addition, small amount of unidentified mono- and di-caffeoylquinic acid derivative was detected. 30% inhibition of superoxide formation in xanthine and xanthine-oxidase medium by methanolic extract ($500 \mu\text{g mL}^{-1}$) from fruit of *Lagenaria siceraria* is also reported [19].

Seed: The seeds considered as the least importance are having prime role in the human nutrition due to encapsulation of innumerable phytochemicals, vitamins, minerals, amino acids along with saponin and essential fixed oils especially of unsaturated type [19]. A ribosome inactivating protein, Lagenin was isolated from lyophilized water extracts of seeds, the biological actions of which include antiproliferative, immunosuppressive and antifertility (Wang and Ng, 2000). Iron is the most abundant microelement in the plant seed. The iron content of whole seed (57.40 mg/100g) shows no significant difference ($p > 0.05$) when compared to dehulled seed (57.45mg/100g); however, seed coat has significant lower ($p < 0.05$) iron content. The values were found to be higher than oil bean seeds (5.628mg/100g) [20].

Leaves: The leaves of the *L. siceraria* contain carbohydrates, phytoesters, saponins, phenolic compounds, tannis, proteins, amino acids and flavonoids [21].

Roots: The roots contain cucurbitacins B, D and E and the triterpene bryonolic acid [22, 23].

Table-1: Carbohydrates and dietary constituents of bottle gourd (g/100g dry weight basis) [24]

Attributes	With peel	Without peel
Total sugar	5.870	8.290
Reducing sugar	5.220	7.290
Non- reducing sugar	0.650	0.290
Starch	1.310	1.570
Curd fiber	4.450	3.400
Neutral detergent fiber	22.710	21.160
Acid detergent fiber	16.260	15.670
Hemicelluloses	6.450	5.580
Cellulose	16.070	16.400
Lignin	0.193	0.167

Table-2: Minerals content of bottle gourd (mg/100 g dry weight basis)[25,48]

Attributes	With peel	Without peel
Iron	11.87	2.33
Phosphorus	240.33	187.33
Potassium	3320.00	3356.67
Zinc	3.77	3.47
Magnesium	162.33	146.33
Copper	0.19	0.24
Sodium	27.88	36.68
Manganese	0.26	0.31

Table-03: Amino acids and vitamins content of *Lagenaria siceraria* fruit and seed [24]

Items	Fruit	Seed
Amino acids(g)		
Tryptophan	0.003	0.431
Theronin	0.018	0.903
Isolucine	0.033	1.264
Leucin	0.036	2.079
Methionin	0.004	0.551
Cystine		0.301
Phenylalamine	0.015	1.222
Valine	0.027	1.972
Arginine	0.014	4.033
Histidine	0.004	0.681
Vitamins (mg)		
Vitamin C	10.100	1.900
Thiamin	0.029	0.210
Riboflavin	0.022	0.320
Niacin	0.320	1.745
Vitamin B6	0.040	0.224
Pantothenic acid	0.152	0.339
Vitamin E	16.02/g	1.000

Seeds are also used in dropsy, worm infection and as nutritive. Ripe seeds are having a 45% yield of clear limbed oil. Seed oil has cooling effect and can be applied in migraine type headache [22]. A poultice of boiled seeds has been used in the treatment of boils, taken with *Acchrynthus* species the seeds are used to treat the toothache and gums. In many parts of China

three grams per day of this species (the report does not say what part of the plant) has been used as a single treatment for diabetes mellitus. The leaves contain cucurbitacins B, D and traces of E. The fruit juice contains beta-glycosidase [25]. The mucilage is also present in the fruit, which can be extracted by microwave assistance extraction [26].

Nutritional composition and medicinal use of different parts of *Lagenaria siceraria*

Parts of Tree	Medicine use	Nutritive use	References
Pulp	The fruit pulp is used for the curing of the jaundice, diabetes, ulcer, piles, and colitis. The pulp is also used for an emetic, sedative, purgative, cooling, diuretic, antibilious, and pectoral.	The fruit also contains 15.8µg/g retinol. The amino acid composition of the fruit is as follows: leucines, 0.8mg, phenylalanine, 0.9mg, valine, 0.3mg, tyrosine, 0.4mg, alanine, 0.5mg threonine, 0.2mg, glutamic acid, 0.3mg serine, 0.6mg aspartic acid, 1.9mg, cystine, 0.6mg cystiene, 0.3mg, arginine, 0.4% and proline, 0.3 mg/g.	[28, 29]
Flower	The flowers are an antidote to poison.	The flower of the <i>L.siceraria</i> is rich source of calcium and minerals.	[30, 31]
Leaf juice	Leaf juice is widely used for baldness. Leaves with salt or coconut oil are often used as poultices for mange, skin irritation, and tumors.	The leaf of <i>legeneria</i> is rich nutrients of the carbohydrates, phosphorous, iron, calcium, moisture; fibers, minerals and fats. Leaves contain cucurbitacin B, carbohydrates, phytosterols, saponins, phenolic compounds, tannins, proteins, amino acids, and flavonoids.	[32]
Fruit Juice	The juice of fruit and sesame oil on scalp gives beneficial results in baldness (hair loss). The juice also shows better effects in the treatment of insomnia, epilepsy, and other nervous diseases. Moreover it helps break up calculus (stones) in the body. In summer or hot conditions, LS juice prevents excessive loss of sodium, satiating thirst, and giving a cooling effect.	The fruit is to be a good source of vitamin-B complex and choline as well as a fair source of vitamin-C and B-carotene. the fruit of <i>Lagenaria siceraria</i> revealed that it contains 0.2% of protein, 0.1% of fat, 2.9% of carbohydrates, 96.3% of moisture, 0.5% of mineral matter, <0.01% of phosphorus, and 0.02% of calcium. Earlier studies reported that a number of mineral elements are present: iron 0.7 mg, sodium 11.0 mg, potassium 86.0 mg, and iodine 0.45 µg per 100 g. Fructose and glucose have also been found.	[33, 34]

Effect of bottle guard on liver

Lauki juice that is bitter in taste can be extremely toxic and also be fatal in some cases. Fruits that are grown under stressful conditions like high temperatures, wide temperature swings, too little water, uneven watering practises, low soil fertility and acidic soil are more likely to contain large quantities of cucurbitacins. Another study published in the Journal of Clinical and Diagnostic Research [35] says that the plant produces cucurbitacins as a defence mechanism against insects and herbivores.

They often increase the permeability of capillaries causing your blood pressure to drop suddenly, accumulation of fluid in the peritoneal cavity and excess fluid buildup around the lungs [37]. Evidence of Gastrointestinal bleeding in the form of hematemesis (vomiting of blood) hypotension (low blood pressure) and elevated liver enzymes are seen in a large number of peoples falling ill after consuming bitter bottle gourd juice. It may be easily confused with other illness like gastrointestinal sepsis, which has similar presentation. Bitter bottle gourd juice may be fatal, especially in persons with pre-existing illness [36].

The fruit *Lagenaria siceraria* help to reduce inflammation of the liver. It can also help in maintaining the good liver health. The juice of the bottle gourd in empty stomach in the morning is

considered a remedy for diabetes, heart disease, urinary problems and liver disease urinary problems and depression. Liver function markers were assessed by the estimation of decrease in urea level with a considerable improvement in uric acid level. [38]

Effect of *Lagenaria siceraria* on the kidney

The juice of the fruit of the bottle gourd can affect the kidneys. Kidney function was monitored by studying the changes in urea and uric acid by using uricase /PAP method. Liver function markers were assessed by the estimation of decrease in urea level with a considerable improvement in Uric acid level [37, 48].

Pharmacological Activities**Analgesic and Anti-inflammatory activity**

Lagenaria siceraria Stand fruit juice extract (LSFJE) was studied for its analgesic effect using acetic acid induced writhing and formalin induced pain. Juice extract of *Lagenaria siceraria* also shows anti-inflammatory activity against acute inflammatory models i.e. ethyl phenyl propionate-induced ear edema, carrageenan and arachidonic acid-induced hind paw edema and also the albumin induced paw edema in rats. LSFJE elicited significant [38].

Cardio-protective activity

The fruit powder of *L. siceraria* also showed good cardio-protective effects. The drug was studied

against Doxorubicin induced cardio-toxicity in rats at 200mg/kg, p.o for 18 days. L.S prevents the alteration in endogenous antioxidants (superoxide dismutase, reduced glutathione) and lipid per oxidation whereas markers of cardio-toxicity i.e. CK-MB and LDH were significantly reduced. Further the L.S powder also showed the protection against changes in ECG and histopathological alteration induced by doxorubicin [39]. Ethanol extract of *L. Siceraria* Fruits also showed increased in force of contraction and decrease in rate of contraction from 44 to 66 isolated frog heart when perfused with normal ringer solution [40].

Diuretic activity

Diuretic activity Vacuum dried extract and methanol extract of *Lagenaria siceraria* fruit was evaluated for its diuretic activity by. Diuretic activity was assessed by measuring different parameters like total urine volume, urine concentration of sodium, potassium and chloride and found that both the extracts (100- 200 mg/kg, p.o.) showed higher urine volume and exhibited dose dependent increased in excretion of electrolytes when compared with respective control [41].

Anthelmintic activity

Bottle gourd seeds showed *in vitro* anthelmintic activity against *Pheretima posthuma*. Seed extracts were tested in the bioassay, which involved determination of time of paralysis and time of death of the worms. Piperazine citrate (10 mg/ml) was included as standard reference and distilled water as control. All the extracts, those using methanol and benzene showed significant paralysis, and also caused death of worms especially at the higher concentration of 100 mg/ml, compared to standard [42].

Anticancer Activity

Anticancer activity of methanol extract of *Lagenaria siceraria* aerial parts has also been reported. Evaluation of the effect of drug response was made by the study of tumor growth response including increasing in life span, study of haematological parameters biochemical estimation 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 [43, 44].

Antimicrobial Activity

Antimicrobial activity of methanolic extracts of the leaves, seeds, and fruit-flesh of *L. siceraria* using the agar-well diffusion method. Results revealed LS extract to show activity against *Pseudomonas aeruginosa* and *Streptococcus pyogenes*, but not against clinical isolates of *S. aureus* and *Escherichia coli*. Thus LS can be used to treat various skin disorders [45].

Medicinal Uses of *Lagenaria siceraria*

The fruits are edible and traditionally used in the treatment of jaundice, diabetes, ulcer, piles, colitis, insanity, hypertension, congestive cardiac failure, and skin diseases. It is used as an emetic, purgative, cooling, sedative, antibilious, and pectoral. Its pulp, boiled in oil is used to treat Rheumatism [46, 47].

CONCLUSION

Lagenaria siceraria is well-known plant which presents most of the Asian countries. Recently *Lagenaria siceraria* fruit has cultivated in Pakistan, India, Sri-Lanka, China, and many other countries for its culinary and medicinal uses. The fruit of the *Lagenaria siceraria* is used for the curing of the many diseases. Chemically the fruit contains various biologically active phyto-constituents including flavonoids, saponins, triterpene and volatile principles. The juice of the *Lagenaria siceraria* which causes inflammation in the liver and juice of the *Lagenaria siceraria* causing decrease in the urea level. The juice of *Lagenaria siceraria* gives animals an empty stomach in the morning curing heart disease, liver disease, urinary problem and depression. It may be considered an important gift to mankind.

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