

Review Article

A review of pharmacognostical, phytochemical and pharmacological properties of *Lagenaria siceraria*: A miracle herb

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Abstract

Lagenaria siceraria (Bottle gourd) class Magnoliopsida family Cucurbitaceae is an excellent fruit in the nature consisting of all the essential constituents that are necessary for normal and good health of human beings. *Lagenaria siceraria* is official in Ayurvedic Pharmacopoeia. Traditionally, *Lagenaria siceraria* fruits had been used as a general tonic, cardiogenic, and cardioprotective drug. In addition, it had also been used as aphrodisiac, diuretic, antidote to certain poisons, scorpion stings, and alternative purgative. *Lagenaria siceraria* is also used to relieve pain, ulcers and fever. Scientific researches have shown that *Lagenaria siceraria* possesses anthelmintic, antibacterial, antifungal, immunomodulatory, anti-allergic, analgesic, anti-inflammatory, antioxidant, free radical scavenging, cytotoxic, antihyperlipidemic antidiabetic, hepatoprotective, anxiolytic and memory enhancing properties. In this review article we have tried to provide a detailed survey of the literature on the scientific researches of pharmacognostical, phytochemical and pharmacological properties of this wonderful herbal drug.

Keywords: *Lagenaria siceraria*, Cucurbitaceae, Herbal drugs, Anxiolytic and memory enhancing, Antioxidant, Antidiabetic

1. Introduction

Traditional herbal drugs have proven to be a better choice when compared to modern synthetic drugs. These drugs have a few or no side effects and are claimed to be safer ones¹. Our traditional literature of Unani and Ayurvedic medicine contains a vast knowledge and information about these herbal drugs. The Charaka Samhita (1000 B.C.), one of such ancient literatures, contains the medical information about 2000 herbal drugs. Some of the very important life saving drugs have been obtained from these herbs². The people of the world believe that herbal remedies are safer and less damaging to the human body than modern drugs. That is why the researchers of the world are actively busy in screening of plants for bioactivities with therapeutic usefulness. The selection of the plants for such a study is based on the traditional therapeutic claim. The treatment of many of the diseases is mentioned in the traditional medical system. The Ayurveda has emphasized the importance of food in the management of diseases. It has been seen that the practitioner of the modern system encourages the use of dietary items in the management of chronic diseases³. In American health care, herbal drugs are a major component. There has been an exponential increase in the sales of herbal medicines. Worldwide sales of herbal medicines have exceeded a staggering US dollars 40 billion per annum⁴. Herbal drugs are easily available in the local market and these drugs are being prescribed by local practitioners who are part of the community so the patient feels very comfortable in the presence of these practitioners. A large number of our modern medicines descend directly or indirectly

from higher plants. No doubt, there has been a great advancement in the field of modern medicines but herbal drugs are still in practice of modern practitioners. Pakistan has a very rich tradition in the use of medicinal plants for the treatment of various ailments. Different medicinal plants come from different important plant families. Out of these important families, one is Cucurbitaceae. The common names for Cucurbitaceae family are the gourd, pumpkin or melon family. Cucurbitaceae consists of one hundred eighteen (118) genera and eight hundred twenty five (825) species. These species are widely distributed in the world. Many of them are economically important domesticated species and many of these have nutritional and therapeutic potential⁵. *Lagenaria siceraria* (Bottle gourd) is an important member of the Cucurbitaceae family. It is a warm-season fruit vegetable. *Lagenaria siceraria* is cultivated throughout Pakistan and India. The fruits of *Lagenaria siceraria* are available the whole year in the market. *Lagenaria siceraria* also known as doodhi, lauki (Hindi), kadoo (Marathi) is official in Ayurvedic Pharmacopoeia. *Lagenaria siceraria* is an excellent fruit in the nature consisting of all the essential constituents that are necessary for normal and good health of human beings⁵. There are two varieties of this herbal drug viz. sweet variety and bitter variety. Both varieties belong to *Lagenaria* genus. Generally, the sweet variety of plant is used for vegetable purpose, while the wild bitter variety is preferably used in medicines. Earlier bitter variety was found wild in many areas but now only in some hot regions. However, these days, the sweet and edible variety is also used for the medicinal purpose because of difficulty in procuring and losing the interest of cultivating of the bitter variety⁶. When we see the traditional uses of *Lagenaria siceraria*, we find that the fruits had been used as a general tonic, cardiogenic, and cardioprotective drug. In addition, it had also been used as aphrodisiac, diuretic, antidote to certain poisons, scorpion stings, and alternative purgative. *Lagenaria siceraria*, is also used to relieve pain, ulcers and fever. Tender fruits in the form of syrup are used to treat bronchial disorders such as pectoral cough and asthma⁶⁻⁸. Vitamin B-complex, ascorbic acid and beta-carotene are present in the edible portion of the fruits. The fruit is rich with choline level-A lipotropic factor, a healer of mental disorders. Bottle gourd contains rich amounts of carbohydrates, dietary constituents and minerals⁹, vitamins and amino acids¹⁰. It is also reported that the bitter principle of Cucurbitaceae such as triterpenoid cucurbitacins, B, D, G, H and 22-deoxycucurbitacin are also present in the fruit. In addition, beta glycosidase elasterase, an enzyme, is contained within the fruit juice^{8,11}. *Lagenaria siceraria* leaves have emetic activity. Leaf juice is taken as emetic agent. Leaf juice is also used in jaundice. Baldness and the headache are also treated with application of crushed leaves on the head. There are certain reports showing that flowers may be antidote in certain types of poisons⁸. From the medicinal point of view, the seeds are considered as the least important. However, they are a rich source of amino acids, vitamins, minerals, saponin and essential fixed oils of unsaturated type that is why the seeds have a great significance in human nutrition^{5,12}. Lagenine is a protein having ribosome inactivating activity. It was isolated from lyophilized water extracts of the seeds of *Lagenaria siceraria*. Biologically, lagenine has immunosuppressive, antifertility and antiproliferative actions¹³. Dropsy and worm infection are also treated with *Lagenaria siceraria* seeds. Clear limbid oil (up to 45%) is obtained from the ripe seeds¹². Migraine type headaches can be alleviated by applying seed oil. Traditionally, boils had been treated with a poultice of boiled seeds. Three grams per day of *Lagenaria siceraria* has been used as a single treatment for diabetes mellitus in various parts of China⁸.

2. Classification

According to the Ayurvedic pharmacopoeia of India, 1 (3): 215-216 bottle gourds have following taxonomical classification.

Kingdom:	Plantae
Division:	Magnoliophyta
Class:	Magnoliopsida
Order:	Cucurbitales
Family:	Cucurbitaceae
Genus:	<i>Lagenaria</i>
Species:	<i>L. siceraria</i>
Parts used:	Fruit, root, leaves and seed oil ¹⁴

The family Cucurbitaceae consists of one hundred eighteen (118) genera and eight hundred twenty five (825) species. These species are widely distributed in the world. Many of them are economically important domesticated species

and many of these have nutritional and therapeutic potential⁵. There are six species in genus *Lagenaria*. There is a general belief that *Lagenaria siceraria* (previously known as *Lagenaria vulgaris*) is indigenous to Africa. It reached temperate and tropical areas in Asia and the America about 10000 years ago, as a wild species whose fruits had floated across the seas or probably with human help.

3. Derivation of Name

The word *Lagenaria* has been derived from the Latin word *Lagena*, which means Florence flask. While the word *siceraria* refers to the fruit, which is useful, when it is mature and dry (*siccus*).

4. Cultivation and Habitat

Lagenaria siceraria has both wild and cultivated forms. The latter is native to Africa and Asia. *Lagenaria siceraria* is cultivated throughout the year. All types of soil are suitable for cultivation but the best yield is obtained in heavily manured soil. The herb grows best in warm and humid climate. If *Lagenaria* is cultivated during dry weather then plenty of watering is required. *Lagenaria siceraria* seeds are sown in two different ways. At first, the seeds can be sown in nursery beds, and when there appear two to three leaves on seedlings then they can be transplanted. Secondly, four to five seeds together are sown directly. The transplantation of seeds is done where there is a desire for early crops. In India, two types of crops are obtained. From mid October to mid March the summer crop is sown whereas the other crop is sown from the beginning of March to the mid of July. In the early crop, round fruits are sown while for latter crop bottle shaped fruits are sown. Then the vines are allowed to trail on the ground, walls, trees or other support. Trailing over give high yields of fruit¹⁵.

5. Pharmacognostical Properties

5.1. Macroscopy: *Lagenaria siceraria* (Bottle gourd) is a pubescent plant. It is a climbing or trailing plant with five angled stems. The tendrils are bifid. *Lagenaria* has petioled, long leaves with three to five lobes. The fruits can be as long as 1.8 m. The fruits are fleshy and with many seeded pepo. The shape of the fruit is like a bottle. When the fruit is ripe then the epicarp becomes hard like a shell. The fruits contain a large number of smooth seeds, which are white in color. The seeds are 1.6 - 2.0 cm long. As the seeds are horizontally compressed, so they show marginal groove. *Lagenaria* flowers are solitary, unisexual and chalky white in color. Male flowers have five lobes, five petals and three stamens. Male flowers are short lived because they remain open only for a few hours, afterward the petals are withered. Female flowers have thick style with three bilobed stigmas⁶. As far as the opening of the flowers is concerned, both the male and female flowers open at the same time. When we come to the pollination, cross-pollination takes place in bottle gourd because it is a monoecious crop. Honey bees are the major pollinators¹⁶⁻¹⁸.

5.2. Microscopy: Microscopy of transverse section of bottle gourd revealed following characteristics: parenchymatous cells of elongated shape are present in upper epidermis. The cells are covered with cuticle. Parenchymatous cells of elongated shape with wavy walls are present in lower epidermis. A large number of collapsed trichomes are present but glandular trichomes are very few in numbers. The stomata at upper epidermis are also few in numbers. The cells of the mesophyll are circular in shape and they contain chloroplast and arrange themselves in a compact manner forming three to four layers. Vascular bundles are of different sizes and two to three layers of sclerenchyma surround them^{1,19-20}.

6. Phytochemical Properties

6.1 Fruits: Phytochemicals screening of the edible portion of the fruit of *Lagenaria siceraria* 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. Reports show that following mineral elements are also present. The values are per 100 g of the herb: iron 0.7 mg, sodium 11.0 mg, potassium 86.0 mg, and iodine 4.5 mcg/ kg. Fructose and glucose have also been found. Per gram amino acid composition of the fruit is found to be: phenylalanine 0.9 mg, leucines 0.8 mg, valine 0.3 mg, tyrosine 0.4 mg, alanine 0.5 mg, glutamic acid 0.3 mg, serine 0.6 mg, aspartic acid 1.9 mg, cystine 0.6 mg, cysteine 0.3 mg, arginine 0.4 mg, proline 0.3 mg and threonine 0.2 mg. Vitamin B-complex and Vitamin C (ascorbic acid) have also been detected in the fruit contents. Bitter fruits also contain bitter principles in the form of aglycones. These principles include cucurbitacins B, D and E¹⁵. The analysis shows that two types of steroids are present in fruit. These steroids are campesterol and fucosterol²¹. The fresh fruits also contain glucose and fructose in 1:1 ratio. Sucrose was also found in trace amounts. A small amount of unidentified mono- and dicaffeoylquinic acid derivative was detected²². As far as the flavonoid complexes are concerned,

Lagenaria siceraria contains flavone C-glycosides²³. In addition, this medicinal plant also contains 3b-O-(E)-feruloyl-D:C-friedooleana-7,9(11)-dien-29-ol, 3b-O-(E)-coumaroyl-D:C-friedooleana-7,9(11)-dien-29-ol, 3b-O-(E)-coumaroyl-D:C-friedooleana-7,9(11)-dien-29-oic acid, and methyl 2b,3b-dihydroxy-D:C-friedoolean-8-en-29-oate, D:C-friedooleanane-type triterpenes²⁴. The fruiting bodies of *Lagenaria siceraria* contain a water-soluble polysaccharide, which is composed of 3-O-acetyl methyl- α -D-galacturonate, methyl- α -D-galacturonate, and α -D-galactose in a ratio of 1:1:1. The polysaccharide possesses cytotoxic activity *in vitro* against human breast adenocarcinoma cell line (MCF-7)²⁵.

6.2 Seeds: Reports show that saponins are present in the seeds. The analysis of the seed kernels showed following values: 30.72% of protein, 8.3% of carbohydrates, 2.47% of moisture, 52.54% of oil, 4.43% of ash, 1.58% of fiber, 2.46% of P₂O₃, and 0.11% of CaO. The color of oil obtained from seed kernels is clear and pale yellow in appearance. Ripe seed kernels gave 45% of the oil. This oil has following features: iodine value 126.6, sap. equivalent, 301.7, 0.55% of free fatty acids and 0.68% of unsaponified matter. Free fatty acid components found to be 18.3% of oleic, 64.1% of linoleic acids and 17.9% of saturated fatty acids¹⁵. Reports show that seeds also contain Lagenin¹³.

6.3 Leaves: Leaves contain cucurbitacin B, carbohydrates, phytosterols, saponins, phenolic compounds and tannins, proteins and amino acids and flavonoids¹.

6.4 Roots: The roots contain cucurbitacins B, D, and E and triterpene bryonolic acid²⁶.

7. Pharmacological Properties

7.1. Anxiolytic and memory enhancing activity: The aqueous extract of *Lagenaria siceraria* was evaluated for anxiolytic and memory enhancing effect. In the study, the anxiolytic activity was assessed by using head dip test and the light/dark box test whereas the memory enhancing effect of the drug was assessed by using water maze and the stationary rod test. In this research, the investigators used the mice and the rats as the study animals. The extract was administered to the animals through oral route at the dose of 200 mg/kg two times a day. The mice received the drug for 30 days and the rats received the drug for 45 days. The investigators have also studied the exploratory and locomotor activities. The open field test and the cage-crossing test were used to study the exploratory and locomotor activities. The results were calculated by comparing all values with control values by taking the mean of all of them. The student t-test was used to determine the significance of the difference between the mean. The values of $P < 0.05$ were considered as significant. The percentage of time spent in light box was increased in highly significant extent and the time taken to reach the platform in stationary rod activity and water maze was significantly reduced after the administration of the drug. The exploratory and locomotor activities were also decreased. On the basis of above observations, it was concluded that aqueous extract of *Lagenaria siceraria* possesses both anxiolytic and memory enhancing activity²⁷.

7.2. Anti-asthmatic and anti-allergic activity: The anti-asthmatic and anti-allergic activity of the aqueous extract of *Lagenaria siceraria* leaf (LSA) was evaluated in different animal models. The histamine and acetylcholine induced bronchoconstriction model in Guinea pigs, compound 48/80 induced mast cell degranulation model in rats and paw edema model in mice were used. The drug was given through intraperitoneal (i.p.) route. The results of the study revealed a significant bronchodilator activity by LSA at the doses of 150 and 300 mg/kg. LSA at the concentrations of 10, 20 and 30 μ g/ml significantly inhibited. The anti-inflammatory activity was observed at the doses of 50, 75 and 100 mg/kg (i.p.) against compound 48/80 induced paw edema in rats. These results prove the traditional claim of the drug in the treatment of asthmatic disorders. There is also a report that a triterpene bryonolic acid an anti-allergic compound was isolated from callus culture of the roots of *Lagenaria siceraria*^{26,28}.

7.3. Antihyperglycemic activity: The antihyperglycemic activity of methanol extract of aerial parts of *Lagenaria siceraria* (MELS) was evaluated in hyperglycemic rats. For the induction of hyperglycemia, streptozotocin at the dose of 50 mg/kg i.p. was used in rats. MELS was given at doses of 200 and 400 mg/kg p.o. for a period of 14 days. The standard drug used in this study was glibenclamide at the dose of 500 μ g/kg. Fasting blood glucose (FBG) was measured on 0th, 4th, 8th and 15th day after giving MELS treatment. There occurred significant reduction ($P < 0.001$) in FBG levels. The research showed the potent antihyperglycemic activity of MELS, which is probably attributable to its rich flavonoid content²⁹.

7.4. Antiulcer activity: Methanol extract of fruits of *Lagenaria siceraria* at the doses of 100 and 200 mg/kg p.o. was evaluated for antiulcer activity. Four different models namely pylorus ligation induced ulcer model, ethanol induced ulcer model, aspirin (NSAIDs) induced ulcer model, and cold restraint stress (CRS) induced ulcer model were used for the

assessment of the study. Ranitidine (H_2 receptor antagonist) at the dose of 50 mg/kg bid p.o. was used as a standard drug. Methanol extract exhibited significant antiulcer activity in a dose dependent manner by providing significant percentage protection against ulcers in all four models³⁰.

7.5. Anthelmintic, antibacterial and antifungal activity: The hydroalcoholic and aqueous extracts of the leaves of *Lagenaria siceraria* were evaluated for anthelmintic activity against *Hymenolepis nana* (tapeworm) and *pheritima Posthuma* (earthworm) by using the method of Mali. Piperazine citrate (25, 50, 100 mg/ml) was used as a reference substance. The hydroalcoholic extract (25, 50, 100 mg/ml) and aqueous extract (25, 50, 100 mg/ml) of *Lagenaria siceraria* exhibited potent activity against tapeworms and earthworms. This was comparable to the effects of piperazine citrate. The extracts also exhibited moderate antibacterial and antifungal activity against *E.coli*, *Pseudomonas aeruginosa*, *Klebsiella aeruginosa* and *Staphylococcus aureus* and *Aspergillus's niger* and *Candida albicans*. The standard drugs used for comparison were ciprofloxacin for bacterial strains and griseofulvin for fungal strains³¹.

7.6. Antioxidant activity: Natural antioxidants have been widely obtained from the fruits of *Lagenaria siceraria*. Currently the interest is being taken in the commercial development of plants as sources of antioxidants to enhance health. It is reported that the incidence of human disease has an inverse relationship with dietary intake of antioxidant rich foods. It is a well established fact that reactive oxygen species (ROS) are implicated in more than hundred (100) diseases, such as heart disease, stroke, arteriosclerosis, malaria, acquired immunodeficiency syndrome (AIDS), diabetes, and cancer. It is, therefore, very important for the researchers go in search of the natural antioxidant sources. Such effects are credited to antioxidant components for instance plant phenolics, such as phenylpropanoids and flavonoids³². The DPPH radical scavenging activity of ethyl acetate (EA) and n-butanol (Bt) extracts of fresh and dried fruits of *Lagenaria siceraria* was assessed³³. Gallic acid was used as a reference antioxidant compound. The samples showed appreciably high DPPH radical scavenging effect at all concentrations. However, the ethyl acetate extract of fresh fruits (EA fresh fruits) was more active than the rest of the samples. The ethanol extract of fruits of *Lagenaria siceraria* was also evaluated for antioxidant activity. The results obtained in this study also indicated that the fruits of *Lagenaria siceraria* are a potential source of natural antioxidants³⁴.

7.7. Cytotoxic and free radicals scavenging activity: The fruiting bodies of *Lagenaria siceraria* contain a water-soluble polysaccharide, which is composed of 3-O-acetyl methyl- α -D-galacturonate, methyl- α -D-galacturonate, and α -D-galactose in a ratio of 1:1:1. The polysaccharide possesses cytotoxic activity *in vitro* against human breast adenocarcinoma cell line (MCF-7)³⁵. It is the antioxidant potential of *Lagenaria siceraria* which accounts for cytotoxic activity. Maximum antioxidant activity against *in vitro* model was shown by acetone extract of *Lagenaria siceraria* fruit epicarp. In this model 1, 1-diphenyl-2-picrylhydrazyl (DPPH) assay was used³⁶⁻³⁷. The fresh fruit juice of *Lagenaria siceraria* has also shown radical scavenging activity^{34,38}. Literature shows that cardiovascular disorders (CVD) are also associated with generation of free radicals and oxidative stress³⁹⁻⁴¹. Generally, it is believed that the occurrence of CVD can be prevented by scavenging excessive free radicals. Studies have shown that the ethanol extract and fresh juice of the fruit of *Lagenaria siceraria* are responsible for the prevention of CVD.

7.8. Antihyperlipidemic activity: Traditionally the fruits of *Lagenaria siceraria* had been used, in the management of hyperlipidemia and atherosclerosis. The fruits had been thought to possess cardioprotective and cardiotonic potential. The effects of methanol extract of *Lagenaria siceraria* were investigated in experimentally induced hyperlipidemia in rats. Methanol extract of *Lagenaria siceraria* fruits (LSFE) at the dose of 100, 200 and 300 mg/kg p.o. was given to the high fat-diet-induced hyperlipidemic rats for duration of one month to evaluate its antihyperlipidemic potential⁴². The standard drug used was atorvastatin at the dose of 10mg/kg p.o. The results of the study exhibited that the methanol extract from the fruits of *Lagenaria siceraria* has a definite antihyperlipidemic potential. In the study petroleum ether, chloroform, alcoholic and aqueous extracts of *Lagenaria siceraria* were evaluated for antihyperlipidemic activity. Out of the four different extracts only petroleum ether extract did not show antihyperlipidemic activity while the other extracts showed good antihyperlipidemic activity⁴³. Isolated constituents from *Lagenaria siceraria* fruit juice extract also demonstrated antihyperlipidemic activity⁴⁴.

7.9. Immunomodulatory activity: The immunomodulatory effects of n-butanol soluble and ethyl acetate soluble fraction of the successive methanol extract of *Lagenaria siceraria* have been evaluated and the promising immunomodulatory effects were reported in the results of the experiments. The fractions were administered through oral route at the doses of 100, 200 and 500 mg/kg. There occurred significant inhibition in the delayed type hypersensitivity reaction in rats. The

method of Doherty was used to induce delayed type hypersensitivity response in rats⁴⁵.

7.10. Cardioprotective activity: *Lagenaria siceraria* fruit is traditionally used for its cardioprotective effect^{19,46}. Cardiovascular disorder is claimed to be relieved following regular intake of bottle gourd juice for about 4-6 months⁴⁷. The cardioprotective activity of *Lagenaria siceraria* fruit was investigated. The investigators used doxorubicin induced cardio toxicity model in rats. The animals, male Wister rats weighing 250-300 g, were divided into three groups. The group I was a control group and it received gum acacia 2%, Group II was doxorubicin group and it received doxorubicin 10 mg/kg, and Group III was doxorubicin with *Lagenaria siceraria* and it received *Lagenaria siceraria* fruit powder 200 mg/kg for a period of 18 days. The results of the study showed that after administration of *Lagenaria siceraria* there occurred significant decrease in QT ($p < 0.01$) and in ST ($p < 0.05$) whereas there was a non-significant increase in heart rate, significant decrease in serum creatinekinase-MB isoenzyme, aspartate aminotransferase ($p < 0.001$) and lactate dehydrogenase ($p < 0.05$) as compared to doxorubicin group⁴⁸. The cardioprotective efficacy of *Lagenaria siceraria* fruit in isoproterenol-induced myocardial infarction was also investigated in albino rat models. The results of this study showed that *Lagenaria siceraria* fruits possess cardioprotective activity on experimentally induced cardio toxic myocardial infarcted rats⁴⁹.

7.11. Central nervous system (CNS) depressant and analgesic activity: Three extracts of leaves of *Lagenaria siceraria* namely crude petroleum ether extract, chloroform extract and methanol were evaluated for central nervous system (CNS) depressant activity and analgesic activity. Various experimental models were used for measurement of the analgesic activity. Acetic acid induced writhing model was used for chemically induced pain, while hot plate, tail flick test were used for thermally induced pain. The results of the study suggest that all three extracts, petroleum ether, methanol and chloroform extract possess significant analgesic activities but petroleum ether extract has maximum analgesic potential out of the three extracts. The findings of the study indicated that CNS active ingredients are present in the leaves of *Lagenaria siceraria*. Nociception induced by acetic acid was significantly reduced in a dose dependent manner by petroleum ether and methanol extracts. There was a more significant action exerted by methanol and petroleum ether extracts in the hot plate and the tail flick test than chloroform extract. As far as the study of the CNS-depressant effect is concerned, it was observed that the methanol extract, in comparison to petroleum ether extract, significantly reduced spontaneous motor activity at higher doses. Motor coordination, the fall off time, was also decreased. Methanol extract exerted a sedative effect due to which pentobarbitone-induced sleep was potentiated. Analgesic and CNS-depressant activity shown by petroleum ether extract and methanol extract may be due to the presence of different chemical compounds⁵⁰. Perception of pain is centrally modulated. The modulation involves various complex processes such as dopaminergic, opiate, serotonergic and descending noradrenergic pathways⁵¹⁻⁵². Centrally mediated antinociception can be studied via tail flick and hot plate tests. These tests selectively focus on the changes taking place above the level of the spinal cord⁵³⁻⁵⁴. Both tests are used to study the ligands acting via opoid receptors. Out of three, two extracts of *Lagenaria siceraria* viz. petroleum ether extract and methanol extract caused an increase in mean basal latency. This was an indication that the extracts act through a central mechanism of action. It is well known that the analgesic activity of narcotic analgesics is due to inhibition of both peripheral and central mechanisms of pain perceptions. Unlike narcotic analgesics, nonsteroidal anti-inflammatory drugs (NSAIDs) exert inhibition only at the peripheral level⁵⁵. The observations of *Lagenaria siceraria* are suggestive of the fact that the extracts can be placed in narcotic analgesics class because they exerted inhibition at both peripheral and central levels. There are reports that the dual inhibition of pain exerted by the extracts could not only be due to presence of opioids and/or opiodiomimetic agents rather it may be due to steroidal constituents and/or phenol constituents of the plant⁵⁶. Peripherally mediated antinociception can be studied via acetic acid induced abdominal constriction method. This method selectively focuses on changes taking place below the level of the spinal cord⁵⁷. It is reported that the writhing induced by acetic acid is due to levels of PGF₂ α and PGE₂⁵⁸. Consequently, analgesic activity of methanol extract and petroleum ether extract may be due to inhibition of synthesis or action of prostaglandins (PG's). Nonetheless, the exact mechanism of this activity is yet to be investigated in the future. The sedative actions of drugs in animals may be studied via measuring pentobarbital sleeping time⁵⁹⁻⁶⁰. Prolongation of pentobarbital sleep induction by extracts is a good indicator of central nervous system depressant effect⁶¹. There are the findings that the intraperitoneal injections of methanol extract given to mice produce sedative effects in the animals. On the other hand, it is well known that some of the compounds that interfere with the biotransformation of pentobarbital, as Cytochrome P450 complex, could induce CNS depression; as a result, this test could give false results⁶². Accordingly, the spontaneous locomotion test was performed to confirm the depressive effect of the extracts. In this test, spontaneous motor activity was significantly reduced by methanol extract. Reduction in locomotion is indicative of a depressive activity of CNS drugs⁶³. Reduction in motor activity might be associated with sedation ensuing

depression of the CNS. Whatsoever, it is a clue about the level of excitability of the CNS⁶⁴⁻⁶⁵. Phytochemical screening of the plant has shown that it contains a number of important chemical compounds such as steroids, tannins, flavonoids, saponins and alkaloids in the extract of the plant. It may be that one and/or more of these constituents are responsible for the CNS depressant effect of the extracts of the plant. In another study, the fruit juice extract of *Lagenaria siceraria* was evaluated for the analgesic activity and anti-inflammatory activity. Study results showed that the extract possesses both activities⁶⁶.

8. Conclusion

Herbal drugs are gaining worldwide popularity as complementary medicines. A number of drugs have been obtained directly from herbs, while the others have been obtained as chemically modified natural products. Pharmacological and toxicological research carried on *Lagenaria siceraria* has confirmed the pharmacotherapeutic potential and safety profile of this wonderful natural herb.

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