Lagenaria siceraria: Phytochemistry, pharmacognosy and pharmacological studies).

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ABSTRACT: Many herbal remedies have been employed in various medical systems for the treatment and management of different diseases. The plant Lagenaria siceraria has been used in different system of traditional medication for the treatment of diseases and ailments of human beings. The plants contain tri terpenoid, cucurbitacins, flavones, C-glycosides beta glycosides 1, vitamin B, and a fair source of ascorbic acid in fruits. The edible portion contains thiamine, riboflavin, niacin. The oil obtained from seed contains free fatty acids. The fruit is rich in pectin 2. The plant contains saponin and fatty oil 3. It has been reported as Cardio tonic, Hepato protective, Immunomodulatory, Antihyperglycemic, Antihyperlipidemic, Analgesic and Anti-Inflammatory, Antibacterial and Diuretic properties. The current study is therefore carried out to provide requisite phytochemical and pharmacological detail about the plant. The plant is cultivated in different parts of India on a small scale at present. However, systematic information on different aspects of this species is not available. In this review, an attempt has been made to present this information.

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Key words: Lagenaria siceraria, phytochemical constituents, pharmacological action.

INTRODUCTION

There exists a plethora of knowledge and information and benefits of herbal drugs in our ancient literature of Ayurvedic and Unani medicine. One of the earliest treatises of Indian medicine, the Charaka Samhita (1000 B.C.) mentions the use of over 2000 herbs for medicinal purpose. According to the WHO survey 80% of the populations living in the developing countries rely almost exclusively on traditional medicine for their primary health care needs. Exploration of the chemical constituents of the plants and pharmacological screening may provide us the basis for developing the leads for development of novel agents. In addition, herbs have provided us some of the very important life saving drugs used in the armamentarium of modern medicine [4]. There is a worldwide belief that herbal remedies are safer and less damaging to the human body than synthetic drugs. Therefore laboratories around the world are engaged in screening of plants for biological activities with therapeutics potential. One major criteria for the selection of plant for such a study is traditional healer's claim for its therapeutics usefulness. The traditional Indian medicinal system mentions herbal remedies for the treatment of variety of diseases. The ayurveda has emphasized importance of food in the management of diseases. Even practitioner of modern system has realized the significance of dietary items, in the form of nutraceutical elements, in the treatment of chronic diseases [5]. *Lagenaria siceraria (Molina) Standley* syn. *L. leucantha Rusby*; *L. Vulgaris Ser.* (Family: Cucurbitaceae) are commonly known as Bottle gourd, an excellent fruit in the nature having composition of all the essential constituents that are required for normal and good health of humans. It cures pain, ulcers, fever, asthma, and other bronchial disorders [6]. It also cures pain, ulcers, fever, and used for pectoral cough, asthma and other bronchial disorders.[7] *L. siceraria* fruit is traditionally used for its cardioprotective, cardiotonic, general tonic, aphrodisiac and acts as alternate purgative, diuretic [8,9] Cardivascular disorder is claimed to be relieved following regular intake of bottle gourd juice for about 4-6 months [10]. The fruits are edible and considered as good source of vitamin C, β-carotene, vitamin B-complex, pectin and also contain highest choline level- a lipotropic factor [3, 6,11]. Modern phytochemical screening methods showed the presence of triterpenoid cucurbitacins B, D, G, H [11, 12,13], and reported to contain saponins, essential fixed oils, vitamins[3, 6]. Decoction of leaves, mixed with sugar given in jaundice. Seeds are nutritive and diuretic, are used in dropsy and as anthelmentic; roots also in the treatment of dropsy [14]. The seeds (wt of 100 seeds, 15 gm) are edible. In china, they are boiled in salt water and eaten as an appetizer. The seed oil is applied in headache [2]. A decoction of *L. siceraria* is employed in the treatment of anasarca, ascites and beriberi [15]. Lagenin- a novel ribosome inactivating protein has been isolated from the lyophilized water extract of seeds which is known to possess immunosuppressive, antitumour, antiviral, antiproliferative and anti-HIV activities [2, 16].

Taxonomical Classification [17]:

Kingdom: Plantae

Division: Magnoliophyta

Class: Magnoliopsida

Order: Cucurbitales

Family: Cucurbitaceae

Genus: *Lagenaria*

Species: *L. siceraria*

Part used: Fruit, root, leaves and seed oil [14].

Botanical description:

Lagenaria is a larg pubescent, climbing or tailing herb with stout 5- angled stems and bifid tendrils, found throughout India, either wild or cultivated. Leaves are long, petioled, 3-5 lobed, 7-10* 10-12 cm, hirsute; Fruits are large, up to 1.8m. Long, fruit bottle shaped with a hard shell- like epicarp when ripe; numerous seeds, long, white, smooth, 1.6- 2.0 cm long, horizontally compressed with marginal groove [2]. Flowers are white, solitary, axillary unisexual. Male flowers posses botanical description of calyx and campanulate, tube narrow, lobes 5, linear; petals 5, free, white; stamens 3, Female flowers posses botanical description of calyx and carola as in male flowers. overy densely villous, style thick , stigmas 3, bilobed [7].

MICROSCOPY

Transverse section of *Lagenaria siceraria* leaf showed following features- upper epidermis consists of elongated parenchymatous cells, covered by cuticle. Lower epidermis- contains elongated wavy walled parenchymatous cells covered by cuticle. Number of Covering and collapsed trichomes are present, while very few glandular trichomes are also present. Upper epidermis shows few stomata,

which are of anisocytic type. Palisade cells are present at upper and lower epidermis. It shows hexagonal to polygonal, large, thin walled colourless cells, and 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 - Vascular bundles are surrounded by 2-3 layered sclerenchyma. They are conjoint, collateral and closed. Xylem is placed towards upper epidermis and phloem towards lower epidermis [8].

Habitat:

The cultivated form of *L. siceraria* is considered to be of African and Asian origin. *L. siceraria* 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 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. They may be also sown directely, 4-5 seeds together, in mannured 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 o give high yield of fruit (Golan , 87; Milne et al.,107-08 ; Roberts and Karter Singh , 374 ; Purewal,73;Singh and Sikka, loc,cit)[2].

Synonames [17]:

Sansk: Alabu, Tumbi Ishavaaku,
Katutumbi,Tiktaalaabu, alaabu.
Beng: Laus, Lokitumbi,
Eng: Bottle Gourd
Guj : Dudi, Tumbadi
Hindi: Lauki, Ghia
Kan: Isugumbala, Tumbi
Mal: Chorakka, Churan, Choraikka, Piccura, Tumburini, Cura, Tumburu
Mar: Phopla
Punj: Tumbi, Dani
Tam: Shorakkai, Surai, Suraikkai
Tel: Sorakaya, Anapakaya
Urdu: Ghiya, Lauki

Ayurvedic Description [17]

Properties and action:

Rasa: Madhura;

Guna: Snigdha;

Virya: Sita;

Vipaka: Madhura;

Karma: Pittahara, Kaphahara, Bhedaka, Rucikara, Hradya,Vrsya.**Therapeutic uses**: Jwara, Kasa, Svasa, Visa roga, Sopha, Vrana, Sula.

Phytochemistry

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 [2]. Phytochemical screening of the fruit revealed two steroids were isolated from the petroleum ether fraction and they were identified as fucosterol and campesterol [18]. 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 di-caffeoylquinic acid derivatives was detected [19]. Flavonoid complexes occurring in the medicinal plants *Lagenaria siceraria* were found to be flavone C-glycosides [20]. 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 [21]. A water-soluble polysaccharide, isolated from fruiting bodies of *Lagenaria siceraria,* is composed of methyl-α-d-galacturonate, 3-*O*-acetyl methyl-α-d-galacturonate,

and β-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) [22].

Seed: Seeds are reported to cotain saponin. Analysis of seed kernals (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 P_2O_3, 2.46%. The oil obtained from seed kernals is clear and pale yellow. Kernels from ripe seeds gave 45% of oil with the following characteristics: n^{40}_d , 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% [2]. Seeds are reported to contain Lagenin[16].

PHARMACOLOGY

Antihyperglycemic activity

Deshpande J.R. et al.[23] (2008) has been reported antihyperglycemic activity of *Lagenaria siceraria* (EELS) fruit. Hyperglycemia was induced in rats by alloxan monohydrate (150mg/kg, ip single dose). Rats in which hyperglycemia (blood glucose level above 260 mg/dl) was induced after 48 hr of alloxan administration were divided into 5 groups of 6 rats each. Group l served as the normal control and Group 2 as a hyperglycemic control to which saline solution was administered. Animals in Group 3 and 4 were hyperglycemic and treated with EELS (100 and 200 mg/kg po) for 14 days. Group 5 was treated with glibenclamide (5mg/ kg po) for 14 days. Plasma level of glucose were analysed on 0,7and 14^{th} day of treatment, the percentage reduction by glibenclamide was 57.8 and 64.3% on 7^{th} and 14^{th} days respectively. Alloxan elevated serum lipid levels of total cholesterol (TC), trigycerides (TGL), low density lipoprotein (LDL-C) and very low density lipoprotein cholesterol (VLDL-C) and reduced that of high density lipoprotein cholesterol (HDL-C). Administration of ethanolic extract of *Lagenaria siceraria* (EELS) (100 and 200 mg/kg) effectivelly prevent these changes.

Antioxidant activity

The antioxidant activity of *Lagenaria siceraria* has been studied by many researchers. P Erasto [24] (2009) established the antioxidant activity .The fruits of *Lagenaria siceraria Standl.* (Cucurbitaceae) are widely used for medicinal and nutritional purposes in Africa. The health promoting ability of the fruits might be related to antioxidant properties of its constituents. In this study the antioxidant effect of fresh and dried fruits of *L. siceraria* was evaluated by comparing the 2,2-diphenyl-1,1-picrylhydrazyl (DPPH) radical scavenging and reducing capacity of ethyl acetate and n-butanol extracts of fresh and dried fruits. The comparison was further emphasized by high performance thin layer chromatography (HPTLC) analysis. S. L.Deore[25] (2009) has been studied antioxidant activities of different concentrations of ethanol extracts of fruits of *Lagenaria siceraria,* were determined by the four assay techniques i.e. DPPH radical scavenging assay, the antioxidants react with the stable free radical DPPH and convert it to 1, 1-diphenyl-2-picryl hydrazine with decoloration. The scavenging effects of extract increased with their concentrations to similar extents. The percentage inhibition of concentration 20, 40, 60 mg/ml are about 79.12, 87.34 and 91.23 % respectively as shown in table no. 1. The standard vit. C presented a scavenging effect of 96.12 % at the concentration of 60 mg/ml .Reducing power ability, the reducing power of the LS ethanolic extracts increased with their concentrations. At 20, 40 and 60 mg/ml, reducing powers of both extracts were around 0.12, 0.17 and 0.22, respectively, while a solution of 40 mg/ml of vit. C, the positive control used in this test, had a reducing power value of 0.3. Hydrogen peroxide scavenging assay, The ethanol extracts of fruits of *Lagenaria siceraria* showed strong H_2O_2 scavenging activity with 0.219 mg/ml IC_{50} value whereas that of the standard, vit. C was 0.152 mg/ml. thiocyanate method, FTC assay revealed that extracts of *Lagenaria siceraria* carry the antioxidative potential for chain-breaking inhibition of lipid per oxidation and for free radical scavenging as extract has shown 72, 81 and 93% inhibition at 10, 20, 30 mg/ml concentration respectively. Ethanol extract of fruits of *Lagenaria siceraria* has shown effective antioxidant activity in all assay techniques. The results obtained in the present study indicate that the fruits of *Lagenaria siceraria* are a potential source of natural antioxidants.

Antihyperlipidemic effect

A.N. Saoji et al.[26] (2009) has been studied methanolic extract of *Lagenaria siceraria* fruits (LSFE) (100, 200 and 300 mg/kg; p.o.) was administered to the high fat-diet-induced hyperlipidemic rats for 30 days to evaluate its antihyperlipidemic activity. Atorvastatin (10 mg/kg;

p.o.) was used as a standard drug. At the 30th day, most significant reduction in lipid levels in the LSFE treated rats as compared to the rats fed with high-fat diet at the 0th day were: total cholesterol 290.14±18.42 mg/dl vs. 228.58±16.38 mg/dl, low-density lipoprotein cholesterol 195.14±8.86 mg/dl vs. 120.57±8.11 mg/dl, triglyceride 232.41±15.22 mg/dl vs. 181.79±15.68 mg/dl, very low-density lipoprotein cholesterol46.48±3.04 mg/dl vs. 36.35±3.13 mg/dl ($P < 0.0001$). Conversely, high-density lipoprotein cholesterol levels were significantly ($P < 0.0001$) increased from 48.52±6.52 to 71.66±5.14 mg/dl. The increase in weight in rats administered with LSFE was less when compared to rats fed with high-fat diet.

Cardio protective activity

M.Hassanpour Fard et al.[27] (2008) investigated the Cardio protective activity of *Lagenaria siceraria* (LS) fruit powder against doxorubicin induced cardio toxicity in rats. Male wister rats (250-300 g) were randomly divided into three groups. Group 1 was control (gum acacia 2%), Group 2- doxorubicin (10 mg kg^{-1}), and Group 3- doxorubicin with LS (200 mg kg-1 for 18 days). *Lagenaria siceraria* (LS) administration significantly decreased QT ($p<0.01$) and ST ($p<0.05$) while non significant increased in heart rate, significant decreased in serum creatinekinase-MB isoenzyme, aspartate aminotransferase ($p<0.001$) and lactate dehydrogenase($p<0.05$) as compared to Doxorubicin group. While, there was significant increase in the level of glutathione ($p<0.05$) and non significant increased in superoxide dismutase, there was lipid per oxidation ($p<0.01$) was inhibited as compared to Doxorubicin group. Histopathological study of *Lagenaria siceraria* (LS) treated group showed protection against myocardial toxicity induced by doxorubicin.

Immunomodulatory effects

Rana A.C.et al.[28] (2008) has been studied the immunomodulatory effect of n-butanol soluble and ethyl acetate soluble fractions of successive Methanolic extract of *Lagenaria siceraria* fruits in rats. Oral administration of the fractions at doses 100, 200 and 500 mg/kg significantly inhibited delayed type hypersensitivity reaction in rats. Delayed type hypersensitivity response was induced in rats by the method of Doherty. Groups of six rats per treatment were immunized by injecting 20 El of Sheep red blood cells suspension (5x109 SRBC/ml) subcutaneously into right hind foot pad. Seven days later they were challenged by injecting 20 El of Sheep red blood cells suspension (5x109 SRBC/ml) intradermally into the left hind foot pad. The day of immunization was referred to as day 0. Blood samples were collected from all the animals separately by retro orbital puncture on day +7 (before challenge) for primary antibody titre and on day +14 for secondary antibody titre. Antibody levels were determined by the method described by Shinde et al. Serum (25 El) of each rat was taken in microtitre plates. To serial two –fold dilutions of pooled serum (made in 25 E l normal saline) was added 25 El of 1% v/v Sheep red blood cells suspension in normal saline. The microtitre plates were kept at room temperature for 1 hour and then observed for haemagglutination (until control wells showed unequivocally negative pattern). The value of the highest serum dilution showing haemagglutination was taken as the antibody titre. The extracts were fed orally once daily, starting with 7 days prior to sensitization till the challenge (-7,-6,-5,-4,-3,-2,-1,0,+1,+2,+3,+4,+5,+6,+7). n-butanol and ethyl acetate soluble fractions of successive methanolic extract of *Lagenaria siceraria* fruits dose dependently and significantly inhibited Sheep red blood cells induced delayed type hypersensitivity reaction response as indicated by decrease in foot pad thickness of rats compared to control group . Both the fractions, significantly increased haemagglutination antibody titre in dose dependent fashion , Both the fractions, significantly increased total WBC, neutrophil and lymphocyte counts, while insignificant change were observed in monocyte, eosinophil and basophil counts. A dose-dependent increase in both primary and secondary antibody titre was observed. The results suggest that test fractions possess promising immunomodulatory activity.

Analgesic and Anti-Inflammatory activities

B.V. Ghule et al [29]. (2006) investigated analgesic and anti-inflammatory effects of *Lagenaria siceraria* (Molina) Stand. Fruit juice extract (LSFJE) in rats and mice. LSFJE was studied for its analgesic effect on acetic acid-induced writhing and formalin pain tests in mice. The anti-inflammatory effects were investigated employing the acute inflammatory models, i.e. ethyl phenylpropionate-induced ear edema, carrageenin- and arachidonic acid-induced hind paw edema, and also the albumin-induced paw edema in rats. LSFJE (150-300 mg/kg, p.o.) exhibited a dose-dependent inhibition of writhing and also showed a significant ($P<0.001$) inhibition of both phases of the formalin pain test, but with a less intense effect on the first than on the second phase. The effects of the extract were significantly ($P<0.01$) lower than those produced by morphine (10 mg/kg) and aspirin (300 mg/kg) in the same tests. LSFJE

elicited significant (P<0.05) inhibitory effect on the ear edema formation at 30 min, 1 h and 2h after EPP-injection. In other acute inflammatory models, the extract significantly inhibited carrageenin- and arachidonic acid-induced hind paw edema. LSFJE also caused inhibition of albumin-induced paw edema over a period of 90 min. The extract did not produce mortality in dose up to 4.2 g/kg, p.o. and 0.29 g/kg, i.p. The results obtained suggest marked analgesic and anti-inflammatory activity of the LSFJE. The effect of LSFJE on acetic acid induced writhing is demonstrated. The LSFJE (150 and 300 mg/kg, p.o.) showed the significant (P<0.01) reduction in the number of writhes induced by acetic acid in a dose-dependent manner. Aspirin (300 mg/kg, p.o.) exhibited inhibitory effect on writhing response. There was a significant, dose-dependent inhibition of both phases of the formalin induced pain response in mice, with a more potent effect on the second than the first phase. Anti-inflammatory studies the activity of LSFJE on EPP-induced ear edema in rat is shown in. The LSFJE dose-dependently elicited significant (P<0.05) inhibitory effect on the edema formation at 30 min, 1 h, 2 h after EPP injection. Phenyl butazone, a COX – inhibitor, at a dose of 1 mg/kg also showed significant reduction of ear edema. The result of LSFJE against carrageenin-induced paw edema. The result shows the LSFJE (150-300 mg/kg, p.o.) gave the significant (P<0.01) reduction of rat paw edema at all assessment times. Aspirin, a COX-inhibitor at the dose of 300 mg/kg, p.o. significantly reduced the paw edema. The activity of the LSFJE on arachidonic acid-induced hind paw edema in rats. LSFJE (150 and 300 mg/kg, p.o.) and also phenidone (60 mg/kg), a dual blocker of cyclooxygenase and lipooxygenase, exerted significant reduction of the paw edema whereas aspirin (300 mg/kg) did not show any effect .The effect of LSFJE on egg albumin-induced hind paw edema in rats. The result showed that the LSFJE caused dose-dependent inhibition of albumin-induced edema over a period of 90 min.

Diuretic activity

Ghule,et al.[30] (2007) evaluated *Lagenaria siceraria* for its diuretic activity in albino rats. The rats treated with vaccum dried *Lagenaria siceraria* juice extracted (LSJE) and *Lagenaria siceraria* methanol extract (LSME) (100-200 mg/kg; p.o.) showed higher urine volume when compared to the respective control. Dose–response studies showed the maximal activity at 200 mg/kg, *p.o.* by LSME and LSJE. The excretion of sodium, potassium and chloride has also been significantly increased. The elevated diuretic potential of LSFE and LSME was statistically comparable to that of the standard diuretic agent furosemide (20 mg/kg; i.p.). The result obtained in the study indicate that LSJE and LSME act as effective hyper natremic , hyperchloremic and hyper kalemic diuretics (increased Na^+ ,K^+ and Cl^- excretion volume).

Cytotoxic Activity

Chiy- Rong Chen et al.[21] (2008) reported D: C-Friedooleanane-Type Triterpenoids from *Lagenaria siceraria* showed Cytotoxic Activity. Air-dried pieces of the stems of *L. siceraria* (19.4 kg) were extracted three times with methanol at room temperature (7 d each). The MeOH extract was evaporated in vacuum to give a black residue, which was suspended in H2O and then partitioned sequentially using EtOAc and n-BuOH. The EtOAc fraction (195 g) was chromatographed over silica gel, using mixtures of n-hexane and EtOAc of increasing polarity as eluents. Twenty-two fractions were collected .The cytotoxicity of compounds 1-9 was measured using the MTT [3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazoliumbromide] colorimetric method based procedure. Compounds 3b -O-(E)-coumaroyl-D: C-friedooleana-7, 9 (11)-dien-29-oic acids and 20-epibryonolic acid showed significant cytotoxic activity against the SK-Hep 1 cell line with IC50 values of 4.8 and2.1m g/ml, respectively.

Hepato protective activity

Shirwaikar A et al.[31] (1996) reported hepatoprotective activity was assessed by examining the influence of the ethanolic extract of *Lagenaria siceraria* (EELS) (in doses 100 and 200 mg/kg) on hepatotoxicity induced by administration of CCl_4 (30% in liquid paraffin). Sylamarin (100 mg/ kg, po) was use as standard. Blood was collected from retro-orbital plexus under light ether anesthesia on 15th day for analysis of level of serum glutamate oxaloacetate transminase (SGOT), serum glutamate pyruvate transminase (SGPT), alkaline phosphatase (ALP). Acid phosphatase (ACP) and bilirubin. Histopathalogy of the hepatic cell was carried by using hematoxylin-eosin dye to stain the cells of rats sacrificed under light ether anesthesia. Protein content, lipid per oxidation, superoxide dismutase, and glutathione peroxidase was determined by homogenizing the remaining hepatic tissue in 0.1 M PBS (ph 7.4). Administration of the ethanolic extract of *Legenaria siceraria* fruit (EELS) orally to different groups of rats reduced the level of SGOT, SGPT, ALP, ACP enzymes, all fractions were tested, in a dose of 250 mg/kg showed significant activity, with the petroleum ether fraction exhibiting comparatively higher activity and this was attribute to fucosterol and camp sterol isolated from the petroleum ether fraction.

Hyperthyroidism, Hyperglycemia and Lipid Peroxidation

Yamini Dixit et al.[32] (2008) reported the study of *Lagenaria siceraria* Peel Extract in the Regulation of Hyperthyroidism, Hyperglycemia and Lipid Peroxidation in Mice. In an *in-vitro* study the quenching potential of the peel extract (5-100 µg/ml) on the 1, 1-diphenyl-2-picrylhydrazyl (DPPH)-dependent free radicals was examined. Antioxidative potential was also studied in carbon tetrachloride (CCl_4) - and hydrogen peroxide (H_2O_2)-induced lipid peroxidation (LPO) in liver tissues. In another experiment, an *in-vivo* study was performed considering three different concentrations of the test peel extract to select its most effective and safe dose for the regulation of hepatic lipid peroxidation (LPO), thyroid function and glucose metabolism. Out of 50, 100 and 200 mg/kg of the peel extract, 100 mg/kg was found to be the most effective and safe concentration, as it could inhibit the levels of serum thyroxine (T_4), triiodothyronine (T_3) and glucose as well as hepatic Lipid Peroxidation (LPO). Considering this dose, finally the antithyroidal, antiperoxidative and glucose inhibitory potential of the peel extract were tested in T_4-induced hyperthyroid animals. After 21 days of treatment, a decrease in the concentrations of serum thyroid hormones, glucose as well as in hepatic lipid peroxidation (LPO) with a parallel increase in antioxidants such as superoxide dismutase (SOD), catalase (CAT) and glutathione (GSH) indicated the efficacy of the test peel in the amelioration of hyperthyroidism, hyperglycemia and hepatic lipid peroxidation.

CONCLUSION

Medicinal plants are the local heritage with the global importance. World is endowed with a rich wealth of medicinal plants. Medicinal plants also play an important role in the lives of rural people, particularly in remote parts of developing countries with few health facilities. The present review reveals that *Lagenaria siceraria* is utilized for the treatment of some common disease. In the present review we have congregated information pertaining to botanical,phytochemical, pharmacological studies. The plant has been studied for their various pharmacological activities like antioxidant, antihyperglycemic ,antihyperlipidemic, cardio protective , immunomodulatory effects , hepato protective , in hyperthyroidism, hyperglycemia and lipid peroxidation , analgesic and anti-Inflammatory , diuretic , cytotoxic activity studies have also been studied. Therefore it is necessary to exploit its maximum potential in the field of medicinal and pharmaceutical sciences for novel and fruitful application.

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