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Research Article

Antimicrobial Activity of *Lagenaria siceraria* Fruit Extract Against Pathogenic Bacterial Strains

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Abstract

Herbal remedies have been employed in various medical systems for the treatment and management of different diseases. The plant *Lagenaria siceraria* belonging to family *Cucurbitaceae* and it has been used as traditional medication for the treatment of diseases. The aqueous, methanolic and ethanolic extract of *Lagenaria siceraria* was screened for antimicrobial activity against a wide range of both gram-positive and gram-negative bacteria by the disc diffusion method. The results obtained were compared with standard antibiotic amoxicillin. All three aqueous extract, methanolic extract, ethanolic extract showed significant antimicrobial activity against *E. coli*, *Pseudomonas, Klebsiella, Serratia* but methanolic extract shows marked antibacterial action on above species.

Keywords: *Lagenaria siceraria; Antimicrobial Activity; E. coli; Pseudomonas; Klebsiella; Serratia*

Introduction

The medicinal plants find application in pharmaceutical, cosmetic, agricultural and food industry. The use of the medicinal herbs for curing disease has been documented in the history of all civilizations [1]. Our present study was designed to determine the antimicrobial activity of *Lagenaria siceraria* with aqueous, methanolic and ethanolic extract. Lagenaria consist of fruit can either be harvested young and used as a vegetable or harvested mature of plant known as "*Lagenaria vulgeris*" belonging to family "*Cucurbitaceae*" [2].

The Pumpkin family is medium sized generally a climbing plants family composing 118 genera and 825 species having a wide distribution in the warmer regions of the world. The bottle gourd is one of humankind's first domesticated plants, providing food, medicine and a wide variety of utensils and musical instruments. It is used as medicine in Bangladesh, India, China, European Countries, Brazil, Hawaiian island etc. for its cardiotonic, general tonic and diuretic properties. Further, the antidiabetic [3], antihyperlipidemic [4], antihepatotoxic [5], analgesic [6], CNS activity [7], anticancer [8], cardio protective [9], anti-inflammatory [10], immunomodulatory and antioxidant activities of its fruit extract have been evaluated. In many countries, this plant has been used traditionally as a single treatment for diabetes mellitus. The usable parts are pulp, fruit, shoots, leaves, seeds. For this study fruit were investigated.

(a) Fruit of Lagenaria siceraria *(b) Diagram Lagenaria siceraria*

Figure 1: *Fruit part of Lagenaria siceraria.*

Material and Methods

Apparatus and reagents

Filter paper disc, Petri dishes, Inoculating loop, Sterile cotton, Sterile forceps, Spirit burner, Micropipette, Screw cap test tubes, Nose mask and Hand gloves, Laminar air flow hood, Autoclave, Incubator, Refrigerator, Nutrient Agar Medium, Ethanol, Chloroform.

Collection and identification

Fresh fruits of *Lagenaria siceraria* was collected from Kolkata (W.B). The fruits of the plant were collected followed by thorough washing with water several times. The plant sample was authenticated by the Botanical Survey of India (BSI), Prayagraj (U.P).

Drying and grinding

The collected plant parts (fruit) were washed with water, separated from undesirable materials. They were air-dried under shade to protect from sunlight for one week after cutting into small pieces. The plant parts were ground into a fine powder with the help of a hammer mill. The fine powder was stored in an airtight container and kept in a cool, dark and dry place until analysis commenced [12].

Preparation of methanolic extract

About 200 gm of powdered material was taken in a clean, flat bottomed glass container (2 litres) and soaked in 1000 ml of 90% methanol. The container with its contents was sealed and kept for days accompanying occasional shaking and stirring. The whole mixture then underwent a coarse filtration by a piece of clean, white cotton material. Then it was filtered through Whatman filter paper and the filtrate thus obtained was concentrated by using traditional spontaneous natural vaporization method at room temperature [11].

Preparation of ethanolic extract

200 gm of powdered material was taken and soaked in 1000 ml of 90% ethanol. The container kept for 5 days. After 5 days mixture underwent a coarse filtration through Whatman filter paper and the filtrate thus obtained was concentrated at room temperature [11].

Preparation of aqueous extraction

200 gm of powdered material was taken and soaked in 1000 ml of water. The container kept for 5 days. After 5 days mixture underwent a coarse filtration through Whatman filter paper and the filtrate thus obtained was concentrated at room temperature [11].

Test organisms

E. coli, Pseudomonas, Serratia and *Klebsiella* were taken from culture collection center, department of microbiology, ITM University, Gwalior (M.P).

Antimicrobial screening

The antimicrobial screening which is the first stage of antimicrobial drug research is performed to ascertain the susceptibility of various bacterial strains. This test measures the ability of each test sample to inhibit the *In-vitro* bacterial growth [12]. Any of the following three methods may estimate this ability [13]:

1. Disc diffusion method
2. Serial dilution method
3. Bio-autographic method

Disc diffusion method: Media specific for each strain were prepared and on each labeled plate that contains the medium, was inoculated 40 µl of standardized broth culture of the bacteria. The spreader was used to ensure uniform distribution of the microorganisms on surface of plates. This method disc diffusion was described by Kirby-Bauer. Normally, this method is used for testing the effect of chemical drugs on bacteria; therefore the same method was used in order to compare the effectiveness of different extracts from fruits, obtained by using water, methanol and ethanol as solvents [14]. Filter paper discs were prepared and sterilized, these discs were then soaked in different concentration of extract, and then they were aseptically placed over the media with specific bacteria. The plates were incubated in an upright position at 37°C for 24 hours. The diameters of inhibition zones were measured in mm [15].

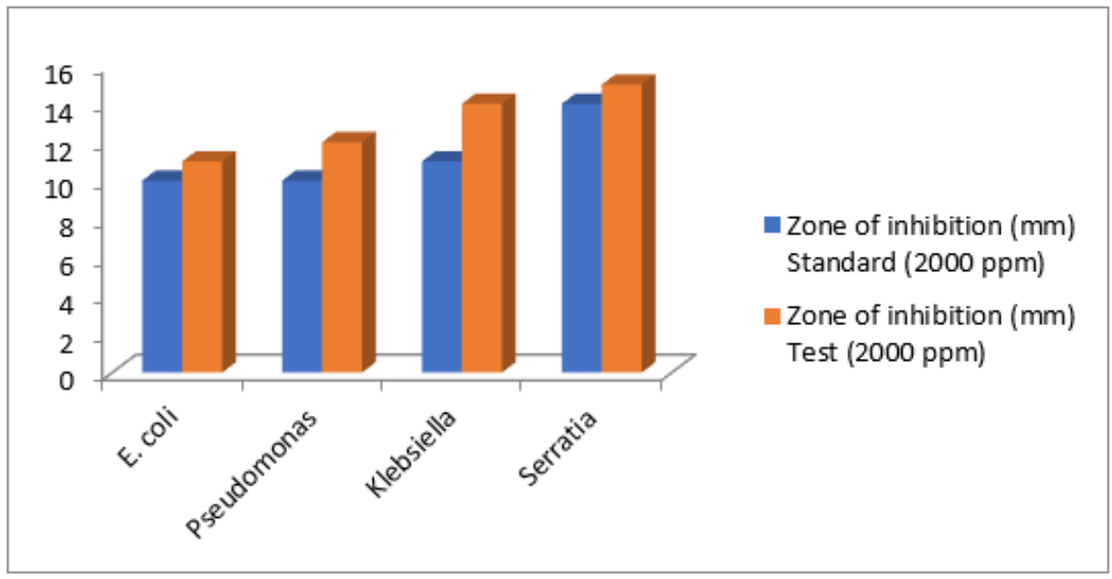
Results

All extracts of medicinal plants showed good antibacterial property (Table 1-3). The ethanolic extract of *Lagenaria siceraria* exhibited maximum antimicrobial potential against *E. coli* (11 ± 0.31 mm), *Pseudomonas* (12 ± 0.39), *Klebsiella* (10 ± 0.44) and *Serratia* (15 ± 0.26 mm) while the aqueous extract exhibited maximum activity against *E. coli* (11 ± 0.31 mm), *Pseudomonas* (12 ± 0.39), *Klebsiella* (14 ± 0.44) and *Serratia* (15 ± 0.26). The methanolic extract *Lagenaria siceraria* exhibited maximum antimicrobial potential against *E. coli* (16 ± 0.27 mm), *Pseudomonas* (12 ± 0.32), *Klebsiella* (16 ± 0.42) and least towards *Serratia* (11 ± 0.16 mm).

Name of Organism	Zone of inhibition (mm)	
	Standard (2000 ppm)	Test (2000 ppm)
E. coli	10 ± 0.24	11 ± 0.31
Pseudomonas	10 ± 0.34	12 ± 0.39
Klebsiella	11 ± 0.36	14 ± 0.44
Serratia	14 ± 0.32	15 ± 0.26

Table 1: *Antimicrobial activity of aq. extract of Lagenaria siceraria against bacterial pathogens.*

Values are mean ± SD of three replicates.

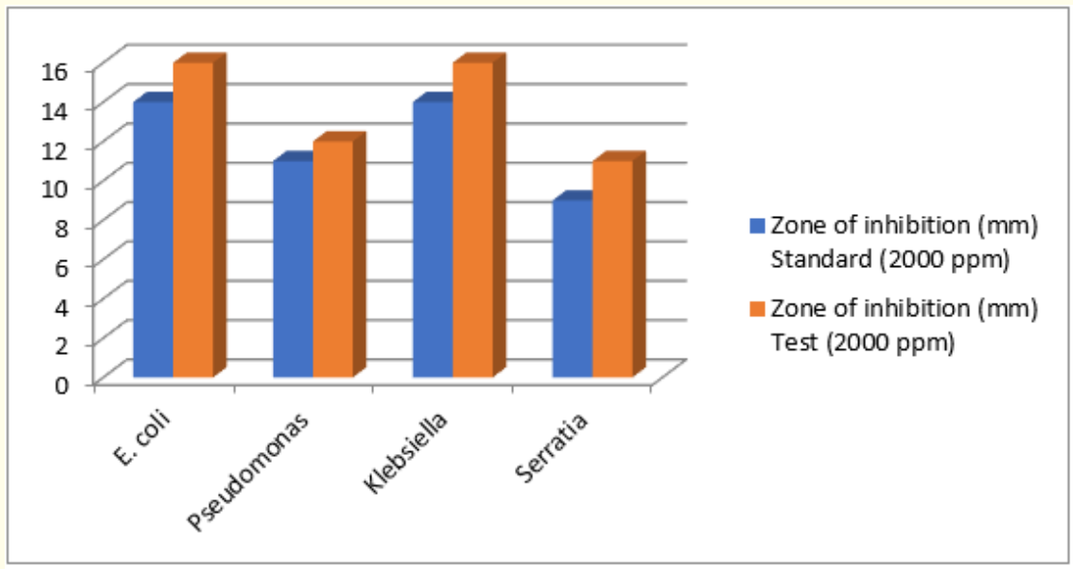


Graph 1: *Antibacterial activity (in mm) of methanolic extract and amoxicillin (standard).*

Name of Organism	Zone of inhibition (mm)	
	Standard (2000 ppm)	Test (2000 ppm)
E. coli	14 ± 0.23	16 ± 0.27
Pseudomonas	11 ± 0.26	12 ± 0.32
Klebsiella	14 ± 0.31	16 ± 0.42
Serratia	09 ± 0.24	11 ± 0.16

Table 2: *Antimicrobial activity of methanolic extract of Lagenaria siceraria against bacterial pathogens.*

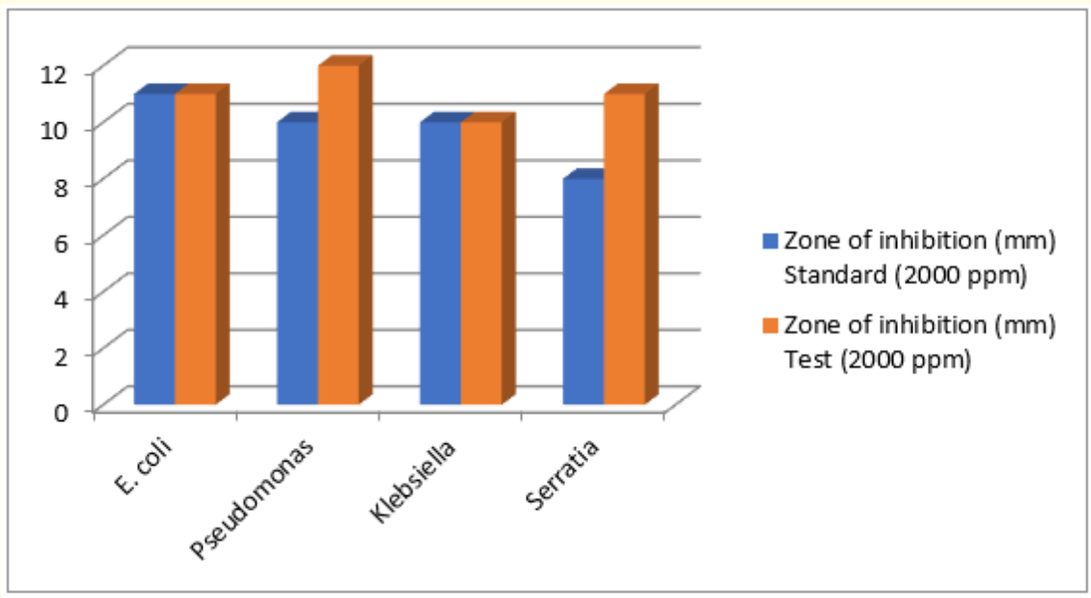
Values are mean ± SD of three replicates.



Graph 2: *Antibacterial activity (in mm) of aq. extract and amoxicillin (standard).*

Name of Organism	Zone of inhibition (mm)	
	Standard (2000 ppm)	Test (2000 ppm)
E. coli	11 ± 0.12	11 ± 0.11
Pseudomonas	10 ± 0.19	12 ± 0.18
Klebsiella	10 ± 0.25	10 ± 0.24
Serratia	08 ± 0.29	11 ± 0.29

Table 3: *Antimicrobial activity of ethanolic extract of Lagenaria siceraria against bacterial pathogens. Values are mean ± SD of three replicates.*



Graph 3: *Antibacterial activity (in mm) of ethanolic extract and amoxicillin (standard).*

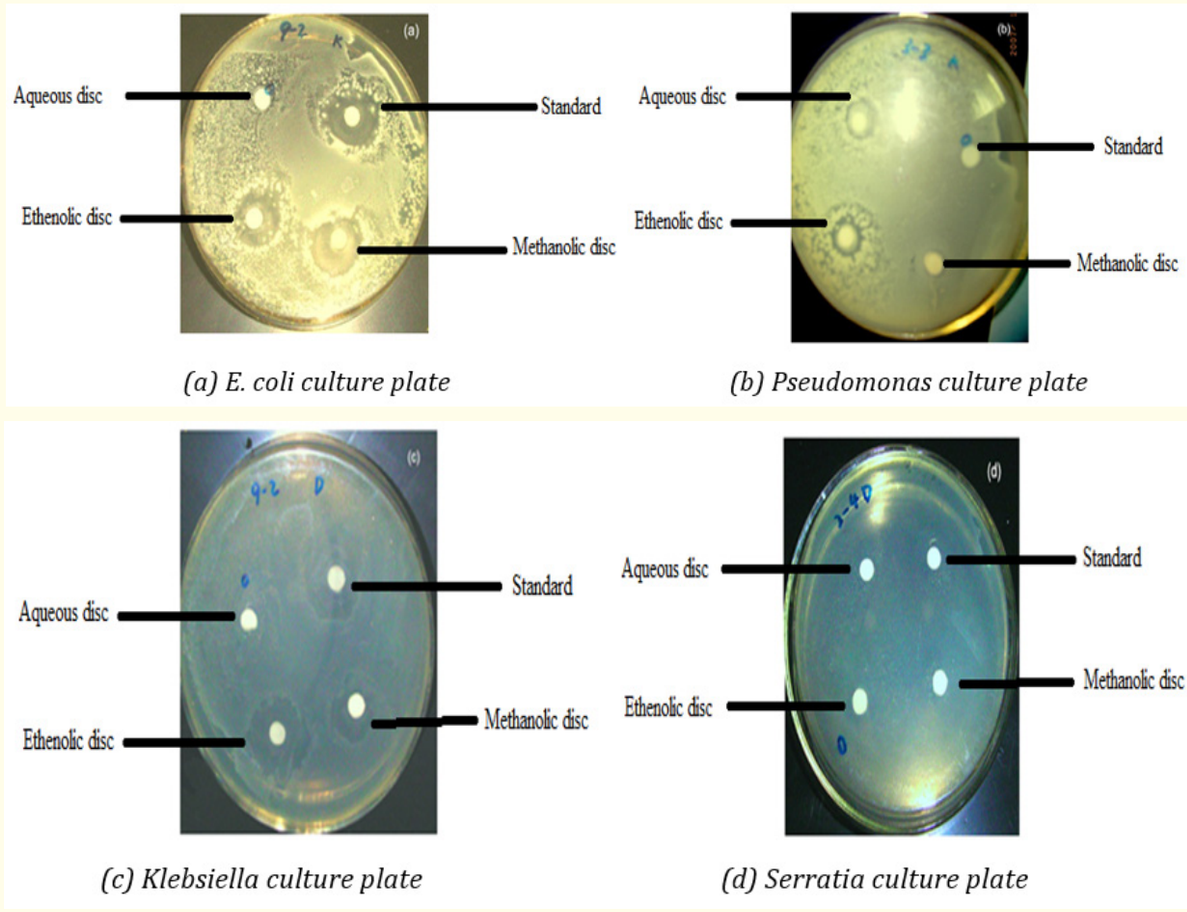


Figure 2: *Different culture plates with test and standard drugs.*

Discussion

Infectious diseases are the cause of major deaths world-wide. The treatment is becoming difficult due to emergence of multi drug resistance amongst the pathogens. It is therefore imperative to search for natural compounds exhibit potent antimicrobial property. The medicinal plants are drawing increasing attention all over the world. The active component present in these plant extracts can be formulated for drug preparation. Antibacterial substances can easily destroy the bacterial cell wall and cytoplasmic membrane and result in a leakage of the cytoplasm and its coagulation, damage protein, interfere with the enzymatic activities inside cell, affect synthesis of DNA and RNA, affect electron transport and nutrient uptake, leakage of cellular components, impair the energy production inside cell, change fatty acid and phospholipid constituents. The medicinal plants investigated in the present study showed good antimicrobial potential and were found to be most effective against gram-negative bacteria. The possible reason could be that they have less rigid and more porous cell wall as compared to that of gram-positive bacteria. The maximum antimicrobial potential was exhibited by methanolic and aqueous extract of *Lagenaria siceraria*. The methanolic extract of *Lagenaria siceraria* exhibited maximum antimicrobial potential against *E. coli* (16 ± 0.27 mm) and least towards Serratia (11 ± 0.16 mm) while the aqueous extract exhibited maximum activity against Serratia (15 ± 0.26 mm) and least towards *E. coli* (11 ± 0.31 mm). The ethanolic extract of *Lagenaria siceraria* exhibited maximum antimicrobial potential against *Klebsiella* (13.3 ± 0.47 mm) and least towards Pseudomonas (10.6 ± 0.12 mm).

Conclusion

On the basis of results obtained it can be concluded that *Lagenaria siceraria* fruit possess alkaloids and flavonoids and have potent antioxidant and antibacterial activities. Further the potential of this plant can be explored more and more, in order to develop an alternative therapy for treatment of various diseases. The present study also suggests that the use of this medicinal plant may be exploited for health supplements.

Conflict of Interest

None.

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