

Antimicrobial Activity of Folk Medicinal Plants

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ABSTRACT

The antimicrobial activity of the Indian botanical medicinal plants *Azadirachta indica* and *Aloe vera* was investigated using the agar disc diffusion method against clinical bacteria such as *Escherichia coli* and *Staphylococcus aureus*, as well as phytopathogenic bacteria such as *Xanthomonas vesicatori* and *Xanthomonas citri*. *Escherichia coli* is used to test the antimicrobial activity of *Azadirachta indica* (Neem), *Aloe vera*, and Garlic against common endodontic pathogens such as *Staphylococcus mutans*, *Enterococcus faecalis*, and *Staphylococcus aureus*. The goal of this research is to look at the antibacterial characteristics of plants that are often utilised in traditional medicine. Plant-derived products have the ability to limit microbial development in a variety of situations, including disease therapy. *Aloe vera* is a well-known medical plant that has a variety of uses. It is naturally made up of a variety of beneficial substances that can be used to cure a variety of ailments. Because of its antibacterial, antimalarial, and antifungal qualities, neem is considered a medicinal plant. Its anti-fungal and anti-bacterial properties help to keep harmful bacteria and fungi at bay, protecting the skin and preventing skin diseases. The antibacterial activity of natural plant extracts with various solvents was tested using the disc diffusion method in this study.

KEYWORDS:

Plants extract (Neem and *Aloe vera*), disc diffusion method, solvents, clinical disease causing bacteria, antimicrobial assay.

INTRODUCTION:

India has a diverse flora that may be found all around the country. In traditional systems such as Ayurveda, unani, and siddha, herbal remedies have been used to treat and cure a variety of diseases and physiological problems. The use of medicinal plant leaves for the treatment of infectious disease, wounds, and other ailments is well recognised and has been used since the Second World War. Many components are synthesised by the plants, which function as defensive agents against the microbe and provide protection against infection and other predators. Those chemicals are bioactive and, depending on the circumstances, can be therapeutic, intoxicating, or toxic[2]. Plants produce a diverse spectrum of bioactive chemicals, making them a valuable source of various medications.

The current advancements in drug discovery technology have augmented the efforts for exploring leads from Ayurveda the traditional system of medicine in India. Ayurvedic system of medicine has its long history of therapeutic potential[3]. Antimicrobial capabilities of medicinal plants have been reported more frequently in recent years from various parts of the world. Plant extracts with target sites other than those used by antibiotics are expected to be effective against drug-resistant microbial pathogens[4]. More than 80% of the world's population, according to the World Health Organization (WHO), rely on traditional medicine for their primary healthcare requirements. In Asia, the use of herbal remedies reflects a long history of human interactions with the natural world[5]. Plants generate therapeutic compounds, thus they've been utilised to cure a variety of illnesses for a long time. Plants have low or negligible adverse effects on humans, which is why they are so beneficial. Antimicrobial substances are a class of chemical compounds created synthetically or biosynthetically that kill or inhibit the growth and metabolism of a wide range of microorganisms[6]. Plants are an alternative source of antimicrobial that is safe, natural, inexpensive, and has a long shelf life when compared to other antibiotics. Many people are aware that many plants have therapeutic properties, and for a long time, humans have used plants to treat a variety of ailments such as skin disease, asthma, dysentery, malaria, and other infections. Plants have piqued attention as phytomedicines in both Eastern and Western countries as herbal treatments from 2000BC[7].

Traditional medicine plants include a wide range of chemicals that can be utilised to treat both chronic and infectious disorders. The presence of antibacterial activity in medicinal herbs used in traditional folk medicine in India was investigated. The demand for more and more drugs derived from plants is steadily rising. As a result, comprehensive evaluation of medicinal plants for diverse illnesses used in traditional medicine is required[8]. A large variety of medicinal plants have been identified as good sources of natural antibacterial substances that may be useful in the treatment of bacterial infections that are difficult to treat[9]. Garlic (*Allium sativum* L.) has been used as not only a food, but also as a remedy for several diseases, such as cardiovascular diseases and cancer[10]. Louis Pasteur first described the antibacterial activities of garlic juice[11]. Ginger is "generally recognized as safe" by the Food and Drug Administration. Ginger contains monoterpenoids, sesquiterpenoids, phenolic compounds, and its derivatives, aldehydes, ketones, alcohols, esters, which provide a broad antimicrobial spectrum against different microorganisms and make it an interesting alternative to synthetic antimicrobial[12].

Medicinal plants, according to the World Health Organization (WHO), are the best source of a variety of medications [13]. Plant pathogenic bacteria and fungi produce a wide range of agricultural diseases, resulting in economic losses and compromising food quality and safety. Antimicrobial drugs currently employed to address plant diseases have unintended consequences for consumers and the environment, owing to their toxicity and low biodegradability [14].

Table 1: Indian medicinal plants used for medicines

<i>Abutilon indicum</i>	Whole plant	The plant is used to treat impotency, rheumatism, menorrhoea, polyuria, gout and hemorrhagic diseases
<i>Acacia nilotica</i>	Bark	Bark is used to treat cough,

		<i>acute gonorrhoea dysentery, diarrhoea, cancers, syphilitic affections and genitourinary affections</i>
<i>Justicia zeylanica</i>	<input type="checkbox"/> <i>Leaf</i>	<i>Leaf of the plants are used in microbial infections, bronchitis, asthma, fever and arthritis</i>
<i>Woodfordia fruticosa</i>	<i>Flower</i>	<i>Flowers are used to treat ulcer, wounds, cough and small pox</i>

MAJOR GROUPS OF ANTIMICROBIAL COMPOUNDS FROM PLANTS

Plants can synthesise an almost infinite number of aromatic compounds, the majority of which are phenols or their oxygen-substituted derivatives. The majority are secondary metabolites, of which at least 12,000 have been identified, accounting for less than 10% of the total. These compounds are often used by plants to protect themselves from microbes, insects, and herbivores. Plant odours are provided by some, such as terpenoids, while plant pigment is provided by others (quinones and tannins). Plant flavour is caused by a variety of molecules (for example, the terpenoid capsaicin found in chilli peppers), and some of the same herbs and spices used to season food also contain therapeutic components.

Major classes of antimicrobial compounds from plants:

- 1)phenolic:Epicatechin,Cinnamic acid,Hypericin,
- 2)Alkaloids:Berberine,Piperine
- 3) Lectins and polypeptides:Mannose-specific agglutinin,Fabatin [15].

EXAMPLE OF ANTIMICROBIAL COMPOUND OF PLANT:

- 1]NEEM: azadirachtin,nimbolinin,nimbin,nimbidin,sodium nimbinat,grdunin etc[16].
- 2]Aloe vera:p-coumaric acid,ascorbic acid,pyrocatechol and cinnamic acid[17].
- 3]Garlic:allicin,thiosulfinate with two allyl groups as carbon chains[18].
- 4]Ginger:Paradol,Shogoal,Zingerone, Zerumbone etc [19].

MATERIAL AND METHODS

Collection of sample:

In this study, sample of fresh medicinal plant leaves like Neem(*Azardica indica*) and Aloe vera ,Garlic,Ginger plants leaves collected from the botanical garden from our farm during 2020-2021.The plants were identified by our botany professor.The fresh leaves were washed throughly 2-4 times with tap water[7].

Preparation of plant extracts:

- 1)NEEM extract:The neem leaves were collected and first washed with tap water and then dried at room temperature for one week.The dried leaves were crushed with mortar and make powder of it.About 25 g of powder is accurately weighed and transferred to the conical flask containing 200 mL distilled water and shaken well and powder mixed properly in water[20].

2)ALOE VERA extract: Mature, healthy and freshly collected leaves of Aloe vera were washed with clean tap water, then cut in small pieces and colourless aloe gel was taken out carefully using a sterile knife without the green fibres. The collected plant gel that weighed 790g was grinded and mixed with 100ml of ethanol, then left for 24 hours. The crude extract was then filtered through Whatman filter paper No.1 and evaporated. 18.40g of the ethanol extract obtained was stored in the refrigerator at 4°C until when required[21].

3)Garlic extract: The dry peel involving the bulbs was removed. Aqueous garlic extract was prepared by using 100 g of fresh rootless bulbs and 100 ml of distilled/deionized water, which were ground in a blender for 10 min. The resulting extract was filtered in a paper filter and sterilized through 0.2 µm membrane filter by using a vacuum pump. All residues were weighed and the concentration of the final solution was considered to be 25% (w/v) or 250 mg [22].

Test microorganisms:

Human disease causing bacteria like *Escherichia coli* and *Staphylococcus aureus* and plant pathogenic bacteria *Xanthomonas citri* were collected from different samples. The sample for *E. coli* was sewage sample, for *staphylococcus* was air sample and for *Xanthomonas citri* was spoilage lemon surface. All the test bacterial species were maintained on nutrient agar media[23].



Fig 1: test microorganisms(*Xanthomonas*, *Staphylococcus*, *E. coli*)

Anti-bacterial activity assay:

An antimicrobial activity of pure plant extract was determined by disc diffusion method on nutrient agar medium. The inoculum with 50 µl test microorganisms are spread on nutrient agar plate. After that the cups are made in nutrient agar by sterile cup borer. In one disc distilled water fill as a control and other contains a plant extract. The plates were incubated for 24h at 37°C. Observe the zone of inhibition around any wells and were measured in millimeter. Each treatment repeated twice. The Minimum Inhibitory Concentration (MIC), which was determined as the lowest concentration of inhibiting the growth of organism, was determined based on the readings.



Fig 2: antimicrobial activity of garlic



Fig 3: antimicrobial activity of Neem

RESULT AND CONCLUSION:

The ethanobotanical efficiency of various solvent extracts of NEEM ,ALOE VERA,GARLIC,GINGER against both human and plant pathogenic bacteria showed varied level of inhibition by measuring zone of inhibition and also antimicrobial activity check by the MIC(Minimum Inhibitory Concentration).

In the present study, plant extract with different compounds showed antimicrobial activity.Hence,they can be used as a new source for an antibacterial substances[10].

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Conflicts of interest

The authors declare no conflicts of interest.

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