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Antimicrobial Activity of Herbal Extract Review Article

Pathare Mansi[1], Thombare Swati[2], Gachale Prajakta[3], Shinde Rinku[4], Ms. Varpe Seema[5]
Students, Bankar Patil College of Pharmacy[1,2,3,4]
Lecturer, Bankar Patil College of Pharmacy, Yeola, India[5]

Abstract: *Many studies have recently been conducted to examine antimicrobial activities in response to rising public concern about hygiene. The antibacterial compounds discovered from medicinal plants have drawn great interest and raised new hope for treating the challenges of antibiotic resistance. This review aimed to summarize the most important and widely used medicinal plants that were reported to have antibacterial activities. The antimicrobial activity of five common India spices namely clove, cinnamon, Ginger, Turmeric, Neem. The use of plant extracts with known antimicrobial properties,can be of great significance in therapeutic treatment*

Keywords: Antimicrobial activity, Medicinal plant. Part of plant

I. INTRODUCTION

Concerns over the sustainability of human life are making it more and more important to resist the harmful effects of microbes. Numerous microbes coexist in biological harmony with the human body and its environs, but unchecked or fast microbial growth can cause some potentially harmful issues. Antimicrobial medications are used to prevent infections in human body, nevertheless they have a variety of negative side effects, particularly if they raise reactive oxygen species levels in the human body (Parham et al., 2020)[1]. Plants have been used for centuries to treat infectious diseases and are considered as an important source of new antimicrobial agents.[2].Antimicrobial drugs derived from microbial or chemical products play important roles in the fight against pathogens. However, with wide usage around the world, they have resulted in widespread drug resistance and side effects. For example, a sharp increase in the proportion and absolute number of bacteria resistant to various chemical antibacterial agents has occurred over the past decade.[3]. Infectious diseases represent an important cause of morbidity and mortality among the general population, particularly in developing countries. Therefore, pharmaceutical companies have been motivated to develop new antimicrobial drugs in recent years, especially due to the constant emergence of microorganisms resistant to conventional antimicrobials. Apparently, bacterial species present the genetic ability to acquire and transmit resistance against currently available antibacterials since there are frequent reports on the isolation of bacteria that are known to be sensitive to routinely used drugs and became multiresistant to other medications available on the market.[4] The antimicrobial resistance (AMR) acquired by pathogenic microbes is projected to reach 10 million by 2050.[5]

II. IMPORTANCE OF SOME PLANT

Sr. No.	Name of plant	Part of plant used	Chemical constituents
1.	Clove	Clove buds	Eugenol
2.	Ginger	Rhizomes	Gingerol
3.	Cinnamon	Bark	Cinnamaldehyde
4.	Turmeric	Rhizomes	Curcumin
5.	Neem	Leaves	Limonoids

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1.1 clove

Fig.1.1 Clove

The Myrtaceae family contains the herb clove (Syzygium aromaticum), which is one of the greatest potent antioxidant and antibacterial plants. The traditional herb is mostly found in Asia and Africa. Using clove's bioactive substances, such as eugenol, eugenylacetate, humulene, and 2-heptanone, and- caryophyllene exhibits numerous pharmacological properties, including those of an anti-inflammatory, antioxidant, antibacterial,anticancer, anti-allergic and antimutagenic, properties .[6]

Method for clove

The clove essential oil (ECO) was provided by Fritzsche S. A. I. C. A. The ECO was dissolved in propylene glycol (PPG) (50% v/v).

This essential oil was chemically evaluated by gas chromatograph (GC). GC analysis was performed on a Varian Star gas chromatograph equipped with detector ADCB using a non- polar DB-5 fused silica capillary column (30 m x 0.25 mm i.d., 0.25 µm film thickness); and total run time was 60 min. The main composition of the essential oil used in this study, was: eugenol (83.13%), β caryophyllene (6.88%), α humulene (2.48%), oxicaryophylene (3.59%), eugenyl acetate (2.41%). Eugenol is primarily responsible for
bacteriocidal/bacteriostatic properties .[7]

1.2 Ginger

Fig.1.2 Ginger

Ginger (Zingiber officinale) has been one of the most commonly consumed herbal medicines for a long time to treat several common diseases. Antibacterial activity, antioxidant properties and many bioactive compounds in ginger have been identified previously, which could be used as an alternative method to treat many infectious diseases.

Methods:

The current study evaluates ginger's biochemical profile using qualitative and quantitative analysis and its bioactive potentials using antioxidant and antimicrobial assays against Streptococcus mutans and selective oral microbes. HPLC analysis was performed for the quantitative analysis. DPPH and disc diffusion assays were used for antioxidant and antimicrobial activities. The antimicrobial activity was checked against Streptococcus

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mutans, Enterococcus faecalis, Staphylococcus spp., and Lactobacillus spp. All solvents were removed by rotary evaporation before testing the dried extracts.[8]

1.1 Cinnamon

Fig.1.3 Cinnamon

Cinnamon (Cinnamomum zeylanicum) has been used in food preparations and in traditional medicine by the Egyptians and the chinese since ancient treatment.

Approximately250 species of cinnamon genus have been identified globally. They are used as a flavoring agent and have some beneficial effects in medicinal, antimicrobial, and antioxidant applications. Cinnamon also acts as a natural food preservative. The medicinal applications of cinnamon include the treatment of diarrhea, flatulent dyspepsia, influenza, cough, bronchitis, angina, palpitations, controlling infections, and reducing blood sugar in diabetics. Cinnamon exhibits anti-inflammatory, antimycotic, insecticidal, and anticancer properties.[9]

Methods

The present study was approved by the Institutional Ethics Committee (Ref. No.GVPIHCMT/IEC/20210204/02), and the study was carried out for 1 month in March 2023 at the Department of Microbiology, Gayatri Vidya Parishad Institute of Health Care and Medical Technology, Visakhapatnam, Andhra Pradesh, India. Six pathogenic bacterial isolates were randomly taken from the routine cultures obtained from patient pus samples of the Surgical Ward, and the antibacterial potential of cinnamaldehyde and eugenol of the cinnamon bark extract diluted in both methanol and ethanol (Cinnamomum zeylanicum) was checked by agar well diffusion, minimum inhibitory concentration (MIC), and minimum bactericidal concentration (MBC).

Cinnamon extracts were prepared in accordance with the Ethiopian traditional way of processing these products for usage. Briefly, cinnamon barks (Figure 1a) were cleaned with deionized water and dried in the sunlight for 2 days. The barks were further dried in an oven (at 40 °C) for 30 minutes and ground into fine powders (Figure 1b). Cinnamon extract was prepared by soaking 10 g of the powder in 50 mL of absolute ethanol and methanol in a 250-mL Erlenmeyer flask. The flask was sealed with aluminum foil and placed on a shaker for 48 hr. at room temperature. Following the incubation, the extract was centrifuged at 3 500 RPM for 20 min and filtered through Whitman filter paper No. 1. The filtrate was dried at 40 °C in a dry oven until a semi-solid substance was obtained and was then further dried in a crucible at 45 °C. The extract was stored at -20 ºC until use. Methanol and ethanol extracts were dissolved in dimethyl sulfoxide (DMSO) to enhance permeability.[9]

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1.4 Turmeric

Fig.1.4 Turmeric

One of the natural medications used traditionally is turmeric (Curcuma longa). Turmeric contains the polyphenolic compound curcumin, which offers it antibacterial and antioxidant effects. Curcumin's shows antioxidant capabilities are owing to its phenolic component. Turmeric's phytochemical components include tumerone, cineole, vitamin C, zingiberene, borneol, d- sabinene, and d phellandrene.[10] Turmeric therapy can reduce plasma malondialdehyde levels while increasing glutathione reductase, plasma albumin, catalase activity and glutathione peroxidase levels. Turmeric's aqueous and ethanol extracts exhibit strong antioxidant properties via boosting antioxidant enzymes, preventing lipid peroxidation and scavenging various free radicals. Turmeric has been shown to prevent hydrogen peroxide production in some in vivo experiments on rats. Via halting the oxidation of lipids in cells. The various turmeric extracts, Strong antioxidant properties can be shown in substances like n-hexane, n-butanol, ethyl acetate, and chloroform. Analysis has shown a strong relationship between scavenging capacity and phenolic content of such excerpts.[11]

1.5 Neem

Fig. 1.5. Neem

Neem has great Antimicrobial activity it contains 35 biological active compounds. Neem leaf juice and twigs are used to clean teeth and used as a tonic and people of India used to place Neem leaves in their beds, books and cupboards to prevent bugs.[12] A number of potent pharmaceutical compounds limnoods and triterpenoids have been isolated from the fruits and bark of neem tree. Neem extracts and its different constituents play essential role in the inhibition of several microbes which includes viruses, fungi and bacteria. The extracts of methanol and hexane chloroform of Azadirachta indica were selected against antibacterial activity on Escherichia coli, Proteus vulgaris, Klebsiella pneumonia,Bacillus subtilis, Micrococcus luteus, Streptococcus faecalis and Enterococcus faecalis. It was revealed that methanol extract was the most effective, chloroform reasonably effective and hexane extract showed little antibacterial activity.[13]

III. CONCLUSION

The biological applications of herbal medicines have been described by numerous researchers. Other chemical antimicrobial agents and antibiotics, such as metal oxide and metal nanoparticles, can stop the development of bacteria,

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but they can also produce ROS and have other unintended consequences. Contrarily, herbal remedies like clove, cinnamon, neem , ginger, turmeric work as free radical scavengers to destroy germs. These herbal remedies have strong antibacterial and antioxidant properties, making them useful for treating various kinds of wounds. The plants have traditionally provided a source of hope for novel drug compounds, as plant herbal mixtures have made large contributions to human health and well being. The use of plant extracts with known antimicrobial properties can be of great significance for therapeutic treatment. The most important factor to consider when evaluating the potential health benefits of herbal medication for people is bioavailability. Herbal medicines are generally favored over synthetic antibacterial drugs since they are less toxic and have fewer adverse effects.

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