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Review Article **Microbiology**

Bioactivities of Medicinal Plants Focused on Targeting Infectious Diseases

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Abstract

Infectious pathologic changes caused by pathogens, which are harmful that enter the body by bacteria, fungus, viruses, and parasites. Infectious-diseases can range in severity from very mild to very dangerous. Numerous human diseases are caused by bacteria such as *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Proteus vulgaris* and *Bacillus subtilis*. Capparis spp. that have anti-bacterial, anti-oxidant and anti-inflammatory properties, including spermidine, carotenoids, quercetin, tocopherol, and rutin by the anti-bacterial, anti-fungal, and anti-leishmanial action. Carrot seed oil (*Daucus carota*) and tea tree oil (*Melaleuca alternifolia*) both exhibit antibacterial action respectively. Curcumin and its derivatives were found to have more potent anti-bacterial activity against several strains of *S. pneumonia*. Oregano oil and carvacrol has revealed that they have anti-viral properties against respiratory-syncytial-virus (RSV), that causes respiratory disease, rotavirus, a frequent condition of diarrhea in theng children, and herpes simplex virus type 1 (HSV-1). Sweet basil extract, which contain ingredients like ursolic acid and apigenin, have powerful antiviral properties against hepatitis B, herpes and enterovirus. Candida infections have fewer severe side effects and less cost load than chemical medications, can be treated with new pharmaceuticals, plant, and herbal items.

Keywords: Carrot seed oil, Curcumin, carvacrol, espiratory-syncytial-virus, herpes simplex virus type 1.

INTRODUCTION

Infectious pathologic changes caused by pathogens, which are harmful that enter the body. Bacteria, fungus, viruses, and parasites are the most common culprits. Typically, infectious-diseases are passed from one person to another, through tainted food or drink, and also through insect bites. Infectious-diseases can range in severity from very mild to very dangerous. Indirect exposure can also spread disease causing organisms. An inanimate objects, like a tabletop, faucet handle or doorknob, can harbor a lot of germs. To spread from host to host, numerous germs depend on insect carriers including ticks, lice, fleas, and mosquitoes. Vectors are the name for these carriers [1-3]. Both the West- Nile-virus and the malaria parasite are spread by mosquitoes. The bacteria which cause Lyme-disease may be carried by deer-ticks. The can get sick from disease causing microorganisms by ingestion of contaminated drink and food. This method of transmission enables the transfer of germs from one source to numerous recipients. For instance, the bacteria E. coli can be found in or on specific foods like raw or undercooked foods, fruits, juices and hamburger [4, 5].

A person can be infected by an infectious-agent through a variety of different ways. Humans must come into contact with an infected carrier, such as food contamination, water, faces, secretions, or animal products, in order to get some diseases. Diseases can be spread through the air when combined with other factors. It is obvious that an infectious-agent's mode of transmission plays a significant role in how fast it can propagate throughout a population. In comparison to an agent which is distributed by direct touch, an agent that may transmit through the air has a higher probability of

infecting a bigger population. The infectious-agent's ability to survive in the environment is yet another crucial aspect in transmission. A virus that can live in the surroundings for hrs, days, or even years will not be able to infect more people than one that can only last a short while between hosts. These elements must be taken into account while assessing the dangers of potential-bioterrorism-agents [6, 7].

A virus is a bit of info (RNA or RNA) enclosed in a defense mechanism (capsid). Viruses cannot replicate on their own because they are considerably smaller than human cells. They enter human cells and then use the machinery inside for replication. Bacteria are single celled microorganisms with a little bit of DNA that contains all of essential instructions. There seem to be everywhere, even on human skin even inside our bodies. Numerous bacteria are beneficial or even harmless, but some of them produce toxins that really can make the ill. Like bacteria, fungus comes in a wide variety. They live on and in our body. The may become ill if there fungus become out of control or if dangerous fungi enter in to their body by their nose, mouth, or by skin injury [8-10].

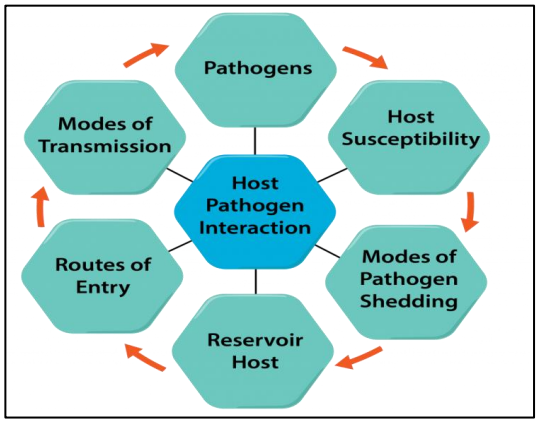

Fig 1: Shows the host and pathogen intercation and their mode of attack

Parasitic Infections

Parasites live and breed on the body of other living creatures. Worms (helminths) and several unicellular organisms are examples of parasites. Prion disorders and transmissible-spongiform-encephalopathies (TSEs). Prions, defective proteins that affect another protein in human body, typically those in human brain, can lead to TSEs. These proteins accumulate in human body because it can neither use them nor get rid of them, which cause illness. An incredibly uncommon source of infectious illnesses is prions [1, 5, 9].

Bioactivities of Medicinal Plants Focused on Targeting Infectious Diseases

The clinical (visible) responses to the initial invasion of a pathogenic bacterium inside the body might range from none at all to varying extents of non-specific reactions to a particular infectious disease. Nevertheless, an immune response that serves as defense always occurs. When a person's immune system is fully effective, there is no evident physical reaction; when it is only half effective, the person experiences symptoms but recovered from an infection; and when it is ineffective, the person may become fatally ill and perish from the invasive infection [11, 12].

In prior ethno botanical investigation, the merchants of the marketplaces mentioned a wide variety of medicinal plant species. In order to perform pharmacologic investigations develop new and innovative treatments, there is a need for a continual registration of the marketed plants due to the impending resistance to antibiotics of many drugs. Determining whether medicinal plants are still sold in these markets is also crucial. A woody shrub with edible-fruit belonging to the rose family is called Pyrus pashia. It is used directly to cure lung, cardiovascular, and the gastrointestinal conditions as well as for laxative purposes. Locals frequently utilize Swertia chirata as a whole plant infusion to cure inflammation, hepatitis and digestive disorders. Other signs include persistent fever, malaria, and skin conditions. Locals have utilized Zanthoxylum armatum as "wood" as a chomping stick to cure mouth ulcers and dental diseases. According to some sources, the plant bark and fruits are also utilized cancer treatments and digestive disorders like dysentery and cholera [13-15].

A significant public health issue is the prevalence of infectious diseases caused by bacteria globally [3, 8]. Numerous human diseases are caused by bacteria such as *Staphylococcus aureus, E. coli, Pseudomonas aeruginosa, Proteus vulgaris and Bacillus subtilis* [9, 10]. A rise in research into the anti-microbial role of plants towards resistant strains is being driven by comparable safety and effectiveness [1] and the current onset of resistance to antibiotics and associated consequence that restrict the use of antimicrobial agents [11]. A wide variety of medicinal plants are naturally grown in Pakistan [12, 13].

Studies on phytochemistry reported the existence of many substances produced from capers (Capparis *spp*.) that have anti-bacterial, anti-viral, anti-oxidant and anti-inflammatory properties, including spermidine, carotenoids, quercetin, tocopherol, and rutin. The anti-bacterial, anti-fungal, and anti-leishmanial action of *Capparis decidua* seed- extracts is due to the presence of glucosinolate and quaternary ammonium [14-19]. Cranberry juice (*Vaccinium macrocarpon*) and b earberry (*Arctostaphylos ura-ursi*) juice is used urinary tract infections treatments, whereas broad spectrum anti-bacterial plants like tea tree (*Melaleuca alternifolia*), lemon balm (*Melissa officinalis*) and garlic, are also proven effective. Alkaloids, tannins, phenolic compounds and

flavonoids are such bioactive substances [20]. These are the crucial raw materials used in the manufacturing of drugs [21]. For defense against invading agents, particularly microbes, the majority of plants contain a number of chemicals having anti-bacterial properties [22].

The most bioactive components from Cameroonian plants that demonstrated substantial anti-bacterial activity are steroids, phenolics, flavonoids, triterpenes, and alkaloids. The plant Croton lechleri (Euphorbiaceae), located in Western Amazonian regions of South America, provided the active ingredient for Fulyzaq (crofelemer, a proanthocyanidin oligomer). The leaves extract of Verbena officinalis and Myrtus communis effectively fought against E. coli, Staphylococcus aureus and Salmonella typhi. Additionally, Myrtus communis exhibited impressive effectiveness against Pseudomonas aeruginosa. Carrot seed oil (*Daucus carota*) and tea tree oil (*Melaleuca alternifolia*) both exhibit antibacterial action against *Helicobacter pylori* and *Mycoplasma pneumoniae* respectively. *E. coli, Klebsiella pneumoniae, Citrobacter koseri, Staphylococcus aureus, and Salmonella Typhi* are all susceptible to the anti-bacterial effects of methanol extracts of *Artemisia vulgaris, Ageratina adenophora, Cinnamomum tamala, and Oxalis corniculata* . Furthermore, high action against S. aureus, Enterobacter cloacae and Enterococcus faecalis, was shown by hydromethanolic extracts of Punica granatum, Cistus monspeliensis, and Berberis vulgaris [12-17].

Hyperenone A, hyperphorin, emodin and hypercalin B were found in an endophytic fungus that was isolated from medicinal plant Hypericum acmosepalum. These compounds have been shown to have anti-bacterial activity against resistant *S. aureus, Pseudomonas aeruginosa, Salmonella enterica, Mycobacterium tubercul, E. coli, and Klebsiella pneumoniae*. The principal constituents of the *Hypericum olympicum's* essential oil components include E-anethole, spathulenol and β-farnesene. Other constituents include E-caryophyllene, terpenes, germacrene D, and a novel form of acylphloroglucinol. The raw methanol extract of Hypericum olympicum demonstrated a wide range of extremely potent anti-bacterial activity, with the maximum activity seen against Klebsiella pneumoniae and Salmonella enteritidis [18-20].

The growth of *C. frundii, S. aureus, E. aerogenes, and E. coli* is inhibited by the extracts of Polygonum persicaria, Rumex dentatus, Polygonum plebejum, Rumex nepalensis, Rumex hastatus, and Rheum australe [23]. There are no anti-bacterial or anti-fungal effects of Calotropis gigantean n-hexane extracts on pathogenic microbes. However, its ethylacetate component inhibits certain microorganisms, with the exception of T. rubrum [24]. Asian pathogenic fungus such Candida albicans, Aspergillus ochraceus, Rizopus oryzae, Aspergillus ustus, and Aspergillus niger are all susceptible to the anti-fungal effects of Calotropis gigantean extracts [21].

In a different investigation, Plumbago zeylanica root ethanolic extract showed good anti-bacterial activity against *Colletotrichum corchori, E. coli, P. aeruginosa, Curvularia lunata, and V. cholerae* [25]. ESBL-producing bacteria like *E. coli, K. pneumonia, Salmonella, methicillin resistant Staphylococcus aureus (MRSA), Pseudomonas, and Proteus* are susceptible to the anti-bacterial effects of aqueous leaf extracts of Erythrophleum suaveolens, Thevetia peruviana and Euphorbia hirta [26-28]. The few investigations that have been done on the hydro alcoholic and aqueous extracts from various plants suggest an anti-bacterial effect on bacteria that produce ESBLs and MRSA as well as other multidrug resistant pathogens [29, 30].

For the manufacture of extracts, several plant components have been utilized, including bulbs and leaves. These extracts were administered at lower quantities between 0.02-0.04 mg/ml, and they strongly inhibited *M. tuberculosis* between 2.5-17.3 mm. According to the L-J proportion approach, the A. indica plant outperformed the other three studied plants in terms of its ability to suppress *M. tuberculosis* H37Rv. A derivative of curcumin called curcumin monoglucoside demonstrated the greatest suppression of S. pneumoniae. Curcumin and its derivatives were found to have more potent anti-bacterial activity against several strains of S. pneumonia. By using the in-vitro agar well diffusion methodology, it was discovered that both the aqueous and organic leaves extracts possessed potent anti-bacterial activity against a variety of pathogenic bacteria. *Mentha apiperita* leaf extract in ethyl acetate shown more significant suppression than chloroform, petroleum ether, and water, with leaf extracts being more effective against S. aureus, P. aeruginosa, and S. marcescens [20-25].

Since ancient times, licorice has been employed in traditional Chinese medicine and some other natural therapies. Several of the active ingredients in licorice, such as glycyrrhizin, glabridin, and liquiritigenin have potent anti- viral activities. Licorice root extract has been shown in test tube tests to be efficient against a variety of virus infections, including those that cause significant pneumonia such as SARS-CoV, HIV, herpes and RSV. Oleanolic acid, one of the many plant chemicals in rosemary that has therapeutic uses, is commonly used in cooking. In experiments on animals and in test-tubes, oleanolic-acid showed anti-viral action against the HIV, hepatitis, influenza, and herpes viruses. Numerous cultivars of basil, such as the sweet and holy variants, may be used to treat specific viral diseases. For instance, a test tube research reveals that sweet basil extract, which contain ingredients like ursolic acid and apigenin, have powerful antiviral

properties against hepatitis B, herpes and enterovirus. Tulsi, commonly known as holy-basil, has been demonstrated to boost immunity, which may aid in the prevention of viral infections. Additionally, research on oregano oil and carvacrol has revealed that they have anti-viral properties against respiratory-syncytial-virus (RSV), that causes respiratory disease, rotavirus, a frequent condition of diarrhea in thing children, and herpes simplex virus type 1 (HSV-1) [26-29].

In recent years, it has been discovered that opportunistic Candida fungi illnesses are the cause of fungal diseases in both animals and humans. The diseases caused by these organisms not only present difficulties for treating the infections but also place an economic strain on the patients who are afflicted with them. There are currently more than 20 different Candida species, with Candida albicans being the most prevalent opportunistic fungus linked to candidal infections. These C. albicans species and similar species may override host immune system and become pathogenic, resulting in vaginal, systemic and oral candidiasis; under circumstances such impaired human immune response. It results in oral-thrush in people [28-30].

CONCLUSION

Treatment issues caused by *C. albicans* infections can range from the lack of readily available, efficient antifungal medications, to Candida's toxicity and resistance to over-the-counter anti-fungal, to recurrent Candida infections. In order to treat these fungal infections with fewer severe side effects and less cost load than chemical medications, physicians and investigators are now more interested in finding new pharmaceuticals, plant, and herbal items.

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