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Review Article

A Review On Various Herbs Used As Anti-Fungal And Anti-Microbial Agents

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ABSTRACT

Skin is a continuously renewing and largest organ in human body which is a main physical barrier to avoid any infections caused by toxic substances or foreign organisms. Epidermis is a formidable barrier in the skin which resists the penetration of any foreign components while retains the nutrients, moisture inside the body. In the post antibiotic era the issue of resistance not only refers to antibiotics but also antifungals and hence there is a urgent need to for new antifungals and antimicrobials. Natural prescriptions normally will generally have numerous wide synergistic or corresponding activity on physiological frameworks simultaneously which are for the most part in a similar general helpful bearing and frequently vague. The substances which acts against various fungal infections refers to as antifungal agents common examples for herbal antifungals include datura metel, senna leaf, olive leaf, henna, cissus quadrangularis, thyme, cumin etc. The substances which act against various microbial infections refers to as antimicrobial agents common examples for herbal antimicrobials include castor leaf, dwarf copper leaf, cinnamon, oregano etc. Phenols, triterpenoids, terpenoids, alkaloids, saponins, glycosides, steroids, essential oil, volatile oil, tannins are few important phytoconstituents which acts against various microbial and fungal infections.

INTRODUCTION

Since ancient times natural plant products are used for their medicinal values, these natural plant-based products comprise many components which are the major sources for novel biologically active components [1]. Medicinal plants are been used globally as an effective and powerful drugs because comparatively these medicinal plants are

inexpensive and remains stable for a long period of time at normal room temperature [2]. Plant kingdom is considered to be a rich source of organic compounds many of which are being used for medicinal purposes. In traditional system there are many crude drug substances which have many beneficial effects in treating diseases or disorders [3]. The World Health Association (WHO) has

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expressed that 80% of the creating scene actually profits by the utilization of customary medications got from medicinal plants. WHO has likewise recorded the names of more than 20,000 types of medicinal plants and depicted as one of the expected wellsprings of new medications. In excess of 100 nations have created guidelines for medicinal plant ^[4]. The people live in quiet concurrence with the encircling microorganisms yet a contamination might rise out of the encircling microorganisms when the guard framework is harmed or the grouping of microbes arrive at a particularly high thickness while irresistible illness is a condition wherein the infecting agents truly do produce a reaction in body, which prompts clinically manifest signs and symptoms. Microorganisms, infections, parasites, organisms, prions, worms, and helminths have all been engaged with causing irresistible sicknesses ^[5].

Fungal infections are considered to be more critical as it affects 3rd layer of the skin. Contagious contaminations are regularly perceived by symptoms, for example, hair loss, crusted patch, irritated red variety patches. A few normal circumstances prompting parasitic contamination are wearing tightly-fitting garments or co-working space, garments, or furniture with a tainted individual. Because of the quick arrival of the medication, these medications need to be administered for multiple periods of times due to poor penetration. Furthermore, these medications may not arrive at the objective area, which could prompt fragmented leeway of diseases. To defeat this issue, the utilization of regular plant concentrates and oils as antimycotic specialists could be a functional methodology. In any case, the blend of an antimycotic drug includes different cycles, including high-intensity and higher-temperature therapies, and because of these therapies, the construction of the phytochemicals in the home grown extricate is upset, which leads to the epimerization process. A few examinations

have found that joining high temperatures and a soluble state causes initial changes in polyphenolic parts. As medication transporters, different methodologies like nanohydrogels, liposomes, niosomes, nano emulsions, ethosomes, spanlistics, trans-ferosomes are utilized to beat this issue ^[6].

Types of fungal infections.

- **Topical (or) superficial infection:** - Infections caused by the fungal pathogens which effects the outermost layers of the skin, hair, nails and mucous membrane.
- **Subcutaneous infection:** - Its limited to dermis and subcutaneous tissues.
- **Systemic infection:** - Fundamental parasitic diseases can be separated into two particular gatherings: The endemic or dimorphic mycoses. These diseases are brought about by obvious pathogenic organisms as contrasted and the mould and yeast contaminations that are saprophytes, which just will attack an immune compromised host. Such diseases are perilous and are related with high paces of death. Strong organ relocate beneficiaries who take immunosuppressive meds to restrict the gamble of dismissal additionally have an expanded vulnerability to fundamental contagious contaminations ^[5].

Fungal infections include Pneumocystis pneumonia, Candidiasis, Blastomycosis, Cryptococcosis, Tinea corporis, Coccidioidomycosis, and Mucormycosis.

- **Pneumocystis pneumonia:** - Pneumocystis carinii, Pneumocystis jirovecii are the different species which belongs to Pneumocystis genus that infects humans as well as rats. It's a contagious infection which infects in the immunocompromised individuals and in few cases it becomes ominous. It becomes worse in patients with deep seated illness that modify the host immunity like in oncological diseases, HIV, those who undergone organ transplantation or



taking immunosuppressive therapies and medications. It desires to infect primarily lungs^[7].

- **Candidiasis:** - Candidiasis is a sharp contamination brought about by *Candida*. *Candida albicans* cause thrush when ordinary host resistance is upset. Youngsters impacted with thrush are generally colonized by *Candida albicans* during section through the impacted vagina; with a functioning vaginal yeast disease, the possibilities of advancement of thrush in the child increment^[8].
- **Blastomycosis:** - Blastomycosis is contagious infection caused by *Blastomyces dermatitidis*. *Blastomyces dermatitidis* converts to the yeast structure, the thick wall gives protection from phagocytosis and killing, which can bring about suggestive aspiratory contamination, with the skin being the most widely recognized site of extra pulmonary illness^[9].
- **Cryptococcosis:** - *Cryptococcus neoformans*, *Cryptococcus gatti*. Cryptococcal infections are primarily caused by inhalation of infectious propagules from environment and deposits in pulmonary alveoli. *Cryptococcus neoformans* and *Cryptococcus gatti* found to infect majorly in the lungs and CNS, others secondary sites like skin, prostate, eye, bones, joints. In any case, it ought to be accentuated that this yeast can broadly scatter and taint most organs in seriously immunosuppressed patients and hence can show up at any human body site^[10].
- **Tinea corporis:** - The infection gets going as a level flaky spot that spreads radially and clears midway to shape a trademark annular sore leading to the term ringworm. Ringworm infection occurs superficially on different parts of body (face, groin, beard, scalp, feet, nails, hands). The dermatophytes causing tinea corporis belongs to genera *Microsporum*, *Trichophyton*,

Epidermophyton. *Trichophyton rubrum* accounts about most common causative organism in the majority of the cases. This infection is restricting to the outer or superficial regions of the skin, because of host defense mechanism this fungus is unable to penetrate to deeper layers of skin. Spread of infection occurs on skin to skin contact with a infected person^[11].

- **Coccidioidomycosis:** - Dimorphic fungus *Coccidioides* causes Coccidioidomycosis. The irresistible particles of Coccidiosis species are saved in the lung when breathed in most of diseases are asymptomatic (60%), and when side effects do happen, the show can be mistaken for local area obtained bacterial pneumonia^[12].
- **Mucormycosis:** - Mucormycosis is an irresistible infection brought about by an organism of the class of *Zygomycetes* and the order of *Mucorales*. The primary route for infecting is through breathing of irresistible spore which resides in the Paranasal sinuses and the lungs, other secondary routes include ingestion or skin contact. The most normally experienced clinical structure is rhino cerebral Mucormycosis, and the resultant mortality, even with pharmacological as well as careful treatment is high except if the resistant framework status can be reestablished^[13].

As a part of normal growth and development many herbs produces antimicrobial secondary metabolites which is required to fight against the microbial attack. The antimicrobial activity of herbal extracts might stay in different phytochemicals constituents like polypeptides, lectins, alkaloids, terpenoids, essential oils, polyphenolic and phenolic substances (phenolic acids, quinones, flavonoids, flavones, flavonols, simple phenols, coumarins, tannins). The antimicrobial movement of these concentrates might be identifiable to the joined impacts of the



polyphenols adsorption on bacterial film, prompting its burst and resulting spillage of cell content, and the age of hydro peroxides^[1].

Misusing of antibiotics has resulted in antimicrobial resistance which ultimately lead to medication ineffective. This made an emerging trend and WHO considered as maybe the most critical issue confronting clinical science. Consequently, there is a rising interest to foster new antimicrobial agents that can diminish the utilization of anti-toxins and to confront obstruction improvement. This has guided analysts to seclude and recognize new bioactive synthetic substances from plants to act against microbial opposition, likewise taking into account that roughly half of current drugs and nutraceuticals are normal items and their subsidiaries. Regular antimicrobial specialists can act alone or in blend with antimicrobials to upgrade antimicrobial movement against a great many microorganisms. As the antimicrobial activity of numerous restorative plants is as yet neglected, scientists are progressively focusing on the quest for quickly developing new and viable medicines^[4]. Due to the excess use of antibiotics in the prescription that resulted in developing antimicrobial resistant bacterial strains and therefore treatment becomes fatal on subsequent treatment with the same drug thus researchers are working more on natural and safe antibiotics as substitutes. Medicines obtained from natural herbs are extensively economic and are stable at room temperature hence can be stored for a prolonged period of time. Herbal antimicrobials have complex nature which are used to kill bacteria, cleanse blood, enhances immune system and functions of particular organ systems^[2].

Bacterial infections include E. coli infections, Tetanus, Anthrax, Tuberculosis, Cholera, Leptospirosis, Botulism.

- **Anthrax:** - *Bacillus anthracis* is an irresistible sickness brought about by an epitomized,

spore-shaping, gram-variable microbes called *Bacillus anthracis*. The pathogenesis of *Bacillus anthracis* follows the course of contamination with three essential structures in people: cutaneous, GI, and inhalational^[14].

- **Tetanus:** - It is a infection occurs from bacteria *Clostridium tetani*, which secretes a toxins called tetanospasmin and tetanolysin which is responsible for characterizing titanic fit which is a summed up constriction of agonist and hostile muscles. Lockjaw is portrayed by muscle fit and jaw spasming, likewise called lockjaw. In particular, tetanospasmin influences the nerve and muscle engine endplate communication, causing the clinical condition of unbending nature, muscle fits, and autonomic precariousness^[15].
- **Leptospirosis:** - Leptospirosis is caused by spirochete bacterium *Leptospira*. It can spread to non-intact skin, abrasions, cuts or incisions and mucous membrane (genital, Conjunctival, oral surfaces)^[16].
- **Cholera:** - Cholera is an intense secretory diarrheal disease brought about by the microscopic organisms *Vibrio cholerae*. Ingested *Vibrio cholera* will be destroyed by stomach acid, survived pathogen can prompt colonization of the small intestine. Important complications in patients will be electrolyte abnormalities and dehydration^[17].
- **Botulism:** - Botulism is an uncommon yet possibly deadly disorder of diffuse, ptosis, limp loss of motion, ophthalmoplegia brought about by botulinum neurotoxin, an exo neurotoxin expounded by the gram positive, anaerobic bacterium *Clostridium botulinum*. Botulism is a neuromuscular condition that outcomes from the foundational impacts of an exo neurotoxin. In food borne botulism patient nauseating feel, vomiting are the common symptoms^[18].



- **Escherichia coli infection:** - It's considered to be a normal intestinal flora which is a anaerobic, gram negative bacteria. Bloody or non- bloody Diarrhea is the major symptom observed in most of the cases. Transmission of infection is mainly through ingestion of contaminated water and food^[19].

Investigating the antifungal and antimicrobial properties of different herbs.

1. Avocado

Avocado is obtained from the plant of *Persea americana* Mill. and belongs to the family *Luraceae*^[1]. Which contains essential components like sugars, proteins, lipids profile, fatty acid derivatives, minerals, vitamins^[20]. Based on activities which are scientifically proven that studies with the seeds, peel, stem, leaf of Ethanolic and Dichloromethane extracts demonstrated antimicrobial activity against *Pseudomonas* spp., *Escherichia coli*, *Bacillus cereus*, *Staphylococcus aureus*, *Yarrowia lipolytica*^[1]. It contains acetogenins (Persenone B, Persenone A, Persenone C, AcO-avocadenyne, AcO-avocadene and others) naturally occurring lipidic molecules of avocado seeds were evaluated to control growth and endospore germination of *Clostridium sporogenes*. They also alter its purpose by disorganizing the phospholipids chain which results in disintegration and disordering of cell membrane causes in outflow of intracellular content and programmed cell death^[20].

2. Bilwa

Bilwa is obtained from the leaves of *Aegle marmelos* belonging to the family *Rutaceae*. The leaves contain terpenoids acts as an antifungal agent also broadly used to treat diarrhea, eye and skin diseases. It yields essential oil, alkaloids like aegelenine and aegeline, also condensed tannins, anthocyanins, skimmianine, Rutin, marmesinin. These compounds used alone or in combination for antifungal activity. Ethanolic extracts of leaves were studied using dermatophytic fungi

(*Epidermophyton floccosum*, *Trichophyton mentagrophytes*, *Microsporum gypseum*, *Trichophyton rubrum*, *Microsporum canis*). They also show in-vitro antimicrobial activity against (*Candida albicans*, *Trichophyton mentagrophytes*, *Escherichia coli*, *Staphylococcus aureus*, *propionibacterium acnes*)^[21].

3. Cumin

Cumin is obtained from the dried seeds of *Cuminum cyminum* belonging to the family *Apiaceae*. It is a potent antibacterial, antifungal, insecticidal, antioxidative agents. Hydro distilled extracts acts against *Candida* fungal species (*Candida krusei*, *Candida albicans*, *Candida glabrata*) by disrupting fungal cell wall. This is due to the presence of α -Pinene, α -Terpinene, Carbicool, 1,8-cineole, β -Pinene, p-Cymene, Limonene, 2-Caren-10-al, γ -Terpinene, cuminaldehyde, O-cymene among these γ -Terpinene has a major role in destroying *Candida* population^[22].

4. Datura metel

Datura metel consists of dried leaves and flowering tops of *Datura metel* Lonn. and *Datura metel* var *fastuosa*. which belongs to the family *Solanaceae*. Components like 7, 27-dihydroxy-1-oxowitha-2, 5, 24-trienolide, daturametelins H-J and daturataturin A, (4E, 8Z)-1-O-(beta-D -glucopyranosyl) -N- (2'-hydroxyhexadecanoyl)-sphinga-4,8- dienine found to exhibit Antifungal properties. Petroleum ether, chloroform, Methanolic extracts of leaves and flowers shows Antimycotic activity against *Trichoderma* species (*Trichoderma harzianum* and *Trichoderma viride*) and *Fusarium oxysporum* (*F. oxysporum* f. sp. *tuberosi* (FOT), *F. oxysporum* f. sp. *lycopersici* (FOL), *F. oxysporum* f. sp. *melonis* (FOM). Lower concentration of leaf extracts exhibited maximum effect against *Trichoderma viride* and Higher concentration of flower extract revealed maximum antimycotic activity^[23].

5. Dwarf copper leaf



Dwarf copper leaf is obtained from the leaves of *Alternanthera sessilis* which belong to the family Amaranthaceae. Aqueous, methanol, acetone, chloroform, ethyl acetate, ethanol, petroleum ether extracts show the antifungal and antimicrobial property. It also used to treat the intestinal inflammation, tight chest, bronchitis, to stop bleeding, wound healing property, hair tonic. The aqueous extracts are evaluated for antimicrobial and antifungal activity, The extract shows more inhibition against *Bacillus pumilus*, *Salmonella typhi*, *Bacillus subtilis*^[24].

6. Gauva

Gauva is obtained from leaves of *Psidium guajava* belongs to the family Myrtaceae. It has a potent antimicrobial activity and also used to treat gastroenteritis, dysentery, ulcers, sore throat, hypertension, obesity, malaria, vomiting, diabetes, coughs. The antimicrobial activity is evaluated by using extract against gram-negative bacteria (*Escherichia coli* and *Salmonella enteritidis*) and gram-positive bacteria (*Staphylococcus aureus* and *Bacillus cereus*) which exhibited inhibitory effect upon the Methanolic and Ethanolic extracts of the guava leaves, whereas the gram-negative bacteria were resistant to all the solvent extracts^[25].

7. Henna

Henna is obtained from the leaves of *Lawsonia inermis* belonging to the family Lythraceae. Ethanolic, Di ethyl ether filtrates, Chloroform, Dimethyl sulfoxide (DMSO), Ethyl acetate extracts of *L. inermis* leaves show antifungal property against filamentous fungi (*Aspergillus flavus*, *Rhizopus stolonifer*, *Aspergillus niger*, *Fusarium oxysporum*, *Penicillium* species). The best antifungal activity was obtained by the yield of Ethanolic, Diethyl ether, Chloroform, Ethyl acetate. The Methanolic and Ethanolic extracts were identified with the active components which shows the Anti-microbial activity^[26].

8. Mentha

Mentha is obtained from the fresh leaves of *Mentha piperita* belongs to the family Lamiaceae. It is a promising antifungal agent and also serve as a natural support for treatment of fungal infection. The antifungal activity of *Mentha* Essential Oil is against a wide panel of yeast and dermatophytes. Anti-dermatophytic activity is due to the Essential Oils (menthol and menthone) which is a principle component. This Essential Oil exerted the most remarkable antifungal activity, displaying the lowest minimum inhibitory concentration (MIC) and minimum fungicidal concentration (MFC) values against *Cryptococcus neoformans*. Higher antimicrobial activity was also detected against dermatophytes (*Microsporum* species) and other non-*Candida* yeasts, such as *Saccharomyces cerevisiae*, and *Pichia carsonii*^[27].

9. Myrrh

Myrrh is obtained from the dried exudates sticking to the bark of *Commiphora myrrh* belonging to family Burseraceae. It is used for its antimicrobial activity also as stomachic, astringent, perfumery, tonic, embalming. Ethanolic and ether extracts exhibits broad spectrum activity against gram negative (*Pseudomonas aeruginosa*, *Escherichia coli*), gram positive (*Bacillus subtilis*, *staphylococcus albus*) organisms. Lowest growth inhibition finds on *Ulocladium consortiale* and highest on *Acremonium strictum*^[28].

10. Olive leaf

Olive leaf is obtained from *Olea europaea*(L) belongs to the family Oleaceae^[29]. Ethanolic extract of leaves exhibits antimicrobial, anti-inflammatory, anti-carcinogenic activity it is also known for use in arrhythmia, prevent intestinal muscle spasm, fever, malaria^{[29][30]}. This activity is due to polyphenols compounds (Oleuropein, Verbascoside, Rutin, Catechin, Ascorbic acid) which is present in leaves, which acts against *E. coli*, methicillin resistant *Staphylococcus aureus*, *Salmonella typhimurium*, *Klebsiella pneumonia*,



Bacillus cereus, *Campylobacter jejuni*, *Helicobacter pylori* by denaturation of proteins^{[29][30]}.

11. Oregano

Oregano essential oil is isolated from dried leaves of *Origanum vulgare* L, which belongs to the family *Lamiaceae*^[31]. It has antifungal, antimicrobial as well as potent antiviral, antioxidant, anti-inflammatory, antidiabetic, antiproliferative^{[31][32]}. Hydro distilled extract is active against *Fusarium proliferatum*, *Penicillium chrysogenum* (least sensitive), *Fusarium subglutinans*, *Penicillium aurantiogriseum* (higher sensitivity) *Fusarium verticillioides*, *Fusarium oxysporum*, *Penicillium glabrum*, *Penicillium brevicompactum*, *Aspergillus niger*, *Aspergillus flavus*, *Aspergillus ochraceus*^[31]. Carvacrol and thymol are the major components which is associated with antimicrobial activity compared to p-cymene and γ -Terpinene^{[31][32]}.

12. Senna leaf

Senna consists of dried leaflets of *Senna obtusifolia* (L) and *Senna alata* Linn belongs to the family *Fabaceae*. Leaf Extracts of dichloromethane, methanol, acetone, ethanol, petroleum ether, hexane is effective against various fungal and microbial infections like, *Aspergillus niger*, *Mucor*, *Candida albicans*, *Rhizopus*, *Saccharomyces*, *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Staphylococcus aureus*. Methanolic extracts reveals as broad spectrum antimicrobial due to presence of alkaloids and effective antifungal. Leaf decoction is been used to treat Urinary tract infections, scorpion stings, dysentery, gingivitis^{[33][34]}.

13. Thyme

Thyme essential oil is obtained from the leaves of *Thymus vulgaris* belonging to the family *Lamiaceae*^[35]. Potent Antifungal property is due to its alcoholic, terpenoids and phenolic constituents Hydro distillation of thyme leaves reveals active

components like thymol, p-cymene, γ -terpinene among which thymol constituents major proportion and it has lipophilic properties this facilitates passage into the fungal cell wall (*Candida albicans*) which competitively inhibits squalene epoxidase enzyme which is required for conversion of squalene to squalene-2,3 oxide sequentially inhibits conversion of lanosterol to ergosterol synthesis causing fungal cell destruction and death^[35]. Antibacterial activity is due to capability of thyme essential oil to penetrate bacterial cell membranes (*Colletotrichum gloeosporioides* penz. And *Botryodiplodia theobromae* pat.) and destroys it thereby inhibits cell functions and ultimately leads to leakage of cell contents and death^[36]. Thymol and thyme essential oil both have been used traditionally as anti-inflammatory, expectorant, antiviral, antiseptic and in treatment of upper respiratory tract infections^[35].

14. Veld grape

Veld grape is obtained from stems of the plant *Cissus quadrangularis* belongs to the family *Vitaceae*. This herb possesses antimicrobial, antifungal, effective fracture healing property, anticancer, antiulcer, Cytoprotective, irregular menstruation, asthma, anti-inflammatory activities. Methanolic extracts reveals the presence of a great number of phytochemicals like polyphenols, sterols, saponins, ascorbic acid, terpenoids, triterpenoids, tannins, alkaloids, phenols, flavonoids and it shows maximum inhibitory activity against *Candida albicans*, *Trichoderma viride*, *Serratia marcescens*, *Micrococcus luteus*, *Shigella flexneri* and least inhibition seen in *Penicillium chrysogenum*, *Pseudomonas aeruginosa*^[37].

15. Vinca

Vinca consists of dried leaves of *Catharanthus roseus* which belongs to the family *Apocynaceae*. It possesses antimicrobial, anticancer, antidiabetic, antidiuretic, antidysentric, antihemorrhagic and



wound healing properties. Methanolic extracts were considered to be effective against gram positive (*Bacillus subtilis*, *Bacillus licheniformes*), gram negative bacteria (*Azotobacter*), better response was exhibited by *Aspergillus niger* followed by *Alternaria solani* and *Rhizopus oryzae* [38].

CONCLUSION

Negligence of any diseases or infections will lead to serious illness on human health utilizing conventional drugs for treatment will reside some side effects that came be severe, whereas incorporating plant-based remedies can be more beneficial, low risk of side effects and margin of safety is also broad. In this review discussed about the scope of herbal medicines upon various fungal and microbial infection and the principle phytoconstituents which is responsible for showing the activity, method of extraction has a direct influence on effectiveness of the herbs and this will have major impact on chemical constituents and spectrum of activity though each herb has multiple therapeutic activities.

REFERENCE

- Cardoso PF, Scarpassa JA, Pretto-Giordano LG, Otaguiri ES, Yamada-Ogatta SF, Nakazato G, Perugini MR, Moreira IC, Vilas-Bôas GT. Antibacterial activity of avocado extracts (*Persea americana* Mill.) against *Streptococcus agalactiae*.
- Gupta R, Sharma S. Herbal antibiotics: A Review. *Bull. Env. Pharmacol. Life Sci.* 2020 Oct 11; 9:136-42.
- Jena J, Gupta AK. *Ricinus communis* Linn: a phytopharmacological review. *International Journal of Pharmacy and Pharmaceutical Sciences.* 2012;4(4):25-9
- Vaou N, Stavropoulou E, Voidarou C, Tsigalou C, Bezirtzoglou E. Towards advances in medicinal plant antimicrobial activity: A review study on challenges and future perspectives. *Microorganisms.* 2021 Sep 27;9(10):2041.
- Kaushik K, Agarwal SH. The role of herbal antifungal agents for the management of fungal diseases: a systematic review. *Asian J Pharm Clin Res.* 2019;12(7):34-40.
- Kaur N, Bains A, Kaushik R, Dhull SB, Melinda F, Chawla P. A review on antifungal efficiency of plant extracts entrenched polysaccharide-based nanohydrogels. *Nutrients.* 2021 Jun 15;13(6):2055
- Truong J, Ashurst JV. *Pneumocystis jirovecii* pneumonia. In: StatPearls [Internet] 2023 Jan 21. StatPearls Publishing.
- Rafiq NB. Candidiasis. In: StatPearls [Internet] 2023 May 29. StatPearls Publishing.
- Miceli A, Krishnamurthy K. Blastomycosis.
- Maziarz EK, Perfect JR. Cryptococcosis. *Infectious disease clinics.* 2016 Mar 1;30(1):179-206.
- Leung AK, Lam JM, Leong KF, Hon KL. Tinea corporis: an updated review. *Drugs in context.* 2020; 9.
- Akram SM, Koirala J. Coccidioidomycosis.
- Hernández JL, Buckley CJ. Mucormycosis.
- Doganay M, Dinc G, Kutmanova A, Baillie L. Human anthrax: Update of the diagnosis and treatment. *Diagnostics.* 2023 Mar 10;13(6):1056.
- Bae C, Bourget D. Tetanus. [Updated 2023 May 31]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK459217/>
- Haake DA, Levett PN. Leptospirosis in humans. *Leptospira and leptospirosis.* 2015:65-97.
- Harris JB, LaRocque RC, Qadri F, Ryan ET, Calderwood SB. Cholera. *Lancet.* 2012 Jun 30;379(9835):2466-2476. doi:



- 10.1016/S0140-6736(12)60436-X. PMID: 22748592; PMCID: PMC3761070.
18. Rao AK. Clinical guidelines for diagnosis and treatment of botulism, 2021. MMWR. Recommendations and Reports. 2021;70.
19. Lim JY, Yoon JW, Hovde CJ. A brief overview of Escherichia coli O157: H7 and its plasmid O157. Journal of microbiology and biotechnology. 2010 Jan;20(1):5.
20. Bangar SP, Dunno K, Dhull SB, Siroha AK, Changan S, Maqsood S, Rusu AV. Avocado seed discoveries: Chemical composition, biological properties, and industrial food applications. Food Chemistry: X. 2022 Dec 30; 16:100507.
21. Balakumar S, Rajan S, Thirunalasundari T, Jeeva S. Antifungal activity of Aegle marmelos (L.) Correa (Rutaceae) leaf extract on dermatophytes. Asian Pacific Journal of Tropical Biomedicine. 2011 Aug 1;1(4):309-12.
22. Patil SA, Maknikar PA, Wankhade SU, Ukesh CH, Rai MA. Antifungal effect of cumin essential oil alone and in combination with antifungal drugs. Nusantara Biosci. 2015 May;7(1):55-9.
23. Rinez A, Daami-Remadi M, Ladhari A, Omezzine F, Rinez I, Haouala R. Antifungal activity of Datura metel L. organic and aqueous extracts on some pathogenic and antagonistic fungi. Afr J Microbiol Res. 2013 Jun 5; 16:1605-2.
24. Kumari ME, Krishnan V. Antimicrobial Activity of Alternanthera Sessilis (L) R. BR. Ex. DC and Alternanthera Philoxeroides (Mart). Griseb. World Journal of Research and Review. 2016;3(3):262897.
25. Biswas B, Rogers K, McLaughlin F, Daniels D, Yadav A. Antimicrobial activities of leaf extracts of guava (Psidium guajava L.) on two gram-negative and gram-positive bacteria. International journal of microbiology. 2013 Oct 20;2013.
26. Rahmoun N, Boucherit-Otmani Z, Boucherit K, Benabdallah M, Choukchou-Braham N. Antifungal activity of the Algerian Lawsonia inermis (henna). Pharmaceutical biology. 2013 Jan 1;51(1):131-5.
27. Tullio V, Roana J, Scalas D, Mandras N. Evaluation of the antifungal activity of Mentha x piperita (Lamiaceae) of Pancalieri (Turin, Italy) essential oil and its synergistic interaction with azoles. Molecules. 2019 Aug 29;24(17):3148.
28. Al-Sabri AE, Moslem MA, Hadi S, Yassin MA, Ameen F. Antifungal activity of Commiphora myrrha L. against some air fungi. J. Pure App. Microbio. 2014 Oct 1; 8:3951-5.
29. Bensehaila S, Ilias F, Saadi F, Zaouadi N. Phenolic compounds and antimicrobial activity of olive (Olea europaea L.) leaves. Asian Journal of Dairy and Food Research. 2022;41(2):237-41.
30. Aliabadi MA, Darsanaki RK, Rokhi ML, Nourbakhsh M, Raeisi G. Antimicrobial activity of olive leaf aqueous extract. Annals of Biological Research. 2012 Sep 12;3(8):4189-91.
31. Kocić TS, Dimić GR, Tanackov IJ, Pejin DJ, Mojović LV, Pejin JD. Antifungal activity of oregano (Origanum vulgare L.) extract on the growth of Fusarium and Penicillium species isolated from food. Hemijska industrija. 2012;66(1):33-41.
32. Leyva-López N, Gutiérrez-Grijalva EP, Vazquez-Olivo G, Heredia JB. Essential oils of oregano: Biological activity beyond their antimicrobial properties. Molecules. 2017 Jun 14;22(6):989.
33. Doughari JH, El-Mahmood AM, Tyoyina I. Antimicrobial activity of leaf extracts of Senna obtusifolia (L). African Journal of

- Pharmacy and Pharmacology. 2008 Mar 1;2(1):7-13.
34. Owoyale JA, Olatunji GA, Oguntoye SO. Antifungal and antibacterial activities of an alcoholic extract of *Senna alata* leaves. *Journal of Applied Sciences and Environmental Management*. 2005;9(3):105-7.
35. A Ahlahmad, N Berakdar, A Radwan, E Alyousef, in vitro antifungal activity of thyme oil against *Candida albicans* isolated from nail fungus (Onychomycosis), *Innovare journal of life science*, 2022;10(1):1-4.
36. Cai C, Ma R, Duan M, Lu D. Preparation and antimicrobial activity of thyme essential oil microcapsules prepared with gum arabic. *RSC advances*. 2019;9(34):19740-7.
37. Payani S, Bhaskar M, Kumar GS, Pradeepkiran JA. A study on antimicrobial and anticancer properties of *Cissus quadrangulris* using lung cancer cell line. *Cancer Treatment and Research Communications*. 2023 Jan 1; 36:100732
38. Naz S, Haq R, Aslam F, Ilyas S. Evaluation of antimicrobial activity of extracts of in vivo and in vitro grown *Vinca rosea* L. (*Catharanthus roseus*) against pathogens. *Pak. J. Pharm. Sci.* 2015 May 1;28(3):849-53.

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