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CALENDULA OFFICINALIS AND ECHINACAE PURPURAE AS ANTIMICROBIAL AGENT

G. Jyotisree, R. Sruthi, C. R. Biju*, Amita S. Menon

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ABSTRACT
Microorganisms includes viruses, bacteria, protozoan, fungi and algae. The potential sources of microbes includes soil, water, atmosphere, plants, animals etc., of which, soil is the No. 1 concern for microbes. They mainly cause infections in respiratory tract, gastro intestinal tract, urogenital tract, skin etc. The repeated intake of antibiotics against these infections leads to many adverse effects like antimicrobial resistance, which creates an urge for the society to depend on medicinal plants. Homeopathic medicine is considered as a complementary systems of medicine, which uses lower doses of plants, animals and inorganic substances to cure ailments and many of these homeopathic tinctures possess antimicrobial activity. This article reviews on antimicrobial property of *Calendula officinalis* and *Echinacae purpurae* mother tinctures and concludes that these two tinctures can be regarded as promising antimicrobial agents as they contain some phytochemical constituents responsible for the prevention of microbial growth.

INTRODUCTION

Ailments such as Corona spread by viruses and bacteria is the main life threat faced by countries because human mobility is increased dramatically. Naturally existing remedies from ancestral legacy are the cost effective replacement for the existing solution since, they show improved action and lesser side effects. Moreover, it is also used to overcome antimicrobial resistance acquired by microorganisms. Homeopathic medicines are the naturally existing remedy for human aliments, of which the mother tincture containing the fresh plant in suitable menstruum is taken as the drug. *Calendula officinalis* and *Echinacae purpurae* are two commonly used mother tinctures in homeopathy because these two tinctures possess promising antimicrobial activity.

Antimicrobial activity of *Calendula officinalis* and *Echinacae purpurae* at a glance

Calendula officinalis, also known as pot marigold, ruddles, common marigold or Scotch marigold, which is probably found in southern Europe is an annual or biennial plant which can attain

* *Dept. of Pharmaceutical Analysis, Devaki Amma Memorial College of Pharmacy, Chelembra, Malappuram, 673634 Kerala*

***For Correspondence:** bijucrmpharm@gmail.com

a height of 30-60 cm. The length of the leaves are 10-20 cm and width 1-4 cm; stems are angular, hairy and solid; flowers are bright yellow to orange in colour. It flowers from June to November, and seed ripens from August to November. Mother tinctures of *Calendula officinalis* are usually obtained from flowers. The dominant phytochemical constituents present in *Calendula officinalis* are flavonoids (quercetin, isorhamnetin), essential oils, triterpenoids (calendulosides A-F), and polysaccharides (rhamnoarabinogalactan, arabinogalactans). Besides this, they contain carotenoids and sesquiterpenes. It has anti-inflammatory, anti-viral, anti-genotoxic properties. It is used internally for curing gastrointestinal tract disorders, fevers and chronic infections. Externally, it is used for treating minor wounds, varicose veins, sprains and for the bites and stings of insects. Antibacterial activity can be found in methanolic extract whereas, antifungal activity can be found in both methanolic and ethanolic extract [1-3].

Fig.1 *Calendula officinalis*

Fig.2 *Echinacae purpurae*

Echinacea purpurea, eastern purple coneflower, hedgehog coneflower is a herbaceous perennial North American variety of sunflower family. At maturity it attains a height of 120 cm and a width of 25 cm. It flowers from summer into autumn. Leaves are deciduous, alternate, oval, lanceolate and petiolate with tightened to toothed margin [4, 5]. Roots are mainly used to prepare *Echinacea purpurae* mother tincture. The main phytochemical components of the plant includes, alkamides, polysaccharides and caffeic acid derivatives. Echinacae is used as immunostumilant, aphrodisiac, antiseptic, detoxicant in circulatory, lymphatic and respiratory systems and also for respiratory tract and urinary tract infection, wounds and burns [6].

Antibacterials are products or derivatives of microorganisms, which can either kill or arrest microbial growth. Antibacterial agents use different antibacterial activities in which they may interferes with cell wall synthesis, inhibit protein synthesis, inhibit nucleic acid synthesis or block metabolic pathways to inhibit microbial growth or to eliminate them. Fungi are complex, eukaryotic organisms with well-defined nuclear membrane, chromosomes and a rigid cell wall composed of chitin [7].

Antimicrobial action of *Calendula officinalis* was found out along with the antioxidant and UV- Hydrogen peroxide induced DNA damage protection activity. Preliminary phytochemical analysis, DPPH and FRAP assays were performed and the results shows antimicrobial and antioxidant action of *Calendula officinalis* extract. The dried *Calendula officinalis* leaf powders also shows antibacterial activity with various strains of *Aspergillus niger, Bacillus subtilis, Staphylococcus aureus,, Klebsiella pneumonia, Candida albicans and Escherichia coli.* The antimicrobial assay displayed that chloroform, aqueous and ethanol extracts of *C.officinalis* leaves exhibited invitro antibacterial action against Gram positive and Gram negative bacteria, whereas petroleum extracts don't show any significant antibacterial activity, while these extracts didn't show any antifungal activity [8, 9].

Calendula officinalis exhibits good antibacterial action in its aqueous, methanolic and acetone extracts against Klebsiella species, *Staphylococcus aureus, Pseudomonas aeruginosa, Bacillus cereus and E. coli* as they shows clear inhibitory zones in inoculated plates. Double serial dilution method in aqueous-alcoholic and aqueous extracts of *C. officinalis* shows decreased zone of inhibition in the test cultures of *Bacillus cereus, Candida albicans, Staphylococcus aureus, Escherichia coli* and *Pseudomonas aeruginosa* and it also tells the fact that wide spectrum of antibacterial action is possessed by the water extract. It also concludes that, in case of *Pseudomonas aeruginosa*, tincture is the vastly active form of medicine. While *Bacillus cereus* shows its activity both in tincture and liquid extract. Whereas, antimicrobial activity of *E.coli* was only observed in its water extract. The in vivo antifungal study on various organic solvent extracts of *Calendula officinalis* shows good antifungal action against different strains of *Candidia albicans, Aspergillus niger* using cup plate method [10-12]. *C. officinalis* has the ability to inhibit the progress of skin relevant bacteria. The in vitro study confirms the beneficial outcomes of *Calendula officinalis* on skin. Antimicrobial action of three mouth washes containing *Calendula officinalis*, 0.12% chlorhexidine digluconate and Camellia sinensis was compared.

This was done based on the adherence of microorganisms to suture materials after extraction of unierupted third molars. All of them, reduced microorganisms on sutures compared to that of control, but chlorhexidine digluconate showed better antimicrobial activity against adherence of microorganisms to sutures [13-15].

Calendula officinalis in combination with *Psidium guajava* shows a reduced growth zones in *Aspergillus flavus*, followed by *Staphylococcus aureus* and Candida *glaberata*, while inhibitory zones in *E. coli* increases when compared with that of streptomycin and fluconazole. The methanolic extract of *Calendula officinalis* with cefotaxim exhibits an increased bacterial suspectibility on *Escherichia coli* isolated from skin and soft tissue infections [16, 17].

Evaluation of the antibacterial action of herbal tinctures of *Calendula* officinalis and *Anacardium occidentale* exhibited relatively same zone of inhibition as that of 0.12% chlorhexidine digluconate against *Streptococcus mutanans, Streptococcus salivarius, Enterococcus faecalis and Eikenella corrodens. Staphylcoccus aureus* and *E. coli* shows maximum inhibitory zone with *Hibiscus rosa-sinensis* and *Calendula offcinalis* flowers extract respectively, when compared with that of *Staphylcoccus aureus, Salmonella typhimurium, Escherichia coli, Proteus vulgaris, Pseudomonas aeruginosa* using ampicillin as standard. Comparison of the antibacterial activity of sodium hypochlorite and *Calendula officinalis* against *Streptococcus mutans* shows that both Sodium hypochlorite and *Calendula officinalis* has good antibacterial potential [18-20].
The growth inhibition capacity of rhizospheric soil, roots, and stem/leaves of the medicinal plant *Echinacea purpurea* on Burk holderiacepacia complex bacteria strains (Bcc) shows that the roots of *E. purpurea* are superiorly active in the inhibition of Bcc strains. Determination of antimicrobial activity of different extraction products of *Echinacea purpurea* with agar well diffusion method using different strains of bacteria like *Bacillus subtilis, Escherichia coli, Pseudomonas aeruginosa, Candida albicans, Staphylococcus aureus, Saccharomyces cerevisiae* and *Aspergillus niger* shows that *Candida albicans* and *Saccharomyces cerevisiae* strains showed growth inhibition independent of the extraction technique, but significant growth inhibition was not observed in case of *Aspergillus niger* [21,22]. The antimicrobial activity of Echinacae varities was evaluated with *Bacillus subtilis, Staphylococcus aureus, Candida albicans Escherichia coli* and *S. cerevisiae using* well diffusion method [23-25].

The effects of *Echinacea purpurae* and chlorhexidine mouth washes on the oral microbial flora of human volunteers was assessed and concluded *Echinacea purpurae* as the suitable mouthwash with minor complications. Assessment of the antimicrobial activity *of Pulicaria undulate* and *Echinacea purpurea* extracts with/without Ni:FeO(OH) nanowires and NiS nanoparticles using disc diffusion methods against, *Pseudomonas aeruginosa, Candida albicans, Escherichia coli, Staphylococcus aureus, Aspergillus oryzae* and *Bacillus subtilis* shows that, Ni:FeO (OH)-NW has more effects on gram positive bacteria and NiS-NP shows more antibacterial effects on gram negative bacteria.

Pseudomonas aeruginosa and *Staphylococcus aureus* shows significant antimicrobial activity with *Echinacea purpurea* and NiFeO(OH) combination.

The synergistic action of lactic acid bacteria on *E. purpurea* shows that the Echinacea suspension with Lb. plantarum shows good antimicrobial activity on gram-positive and gram negative bacteria, compared to the water extract of Echinacea suspension with various strains of *Escherichia coli, Enterobacteraerogenes, Enterococcus durans* and *Yersinia enterocolitica* [26-30].

CONCLUSION

On basis of this review, both *Calendula officinalis* and *Echinacae purpurae* can be regarded as effective antimicrobial agents. Such herbs can be used instead of antibiotics to avoid antimicrobial resistance and serious side effects and also let us to conclude that these two tinctures contain some phytochemical constituents responsible for microbial growth inhibition which makes them promising antimicrobial agents.

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Nil

CONFLICT OF INTEREST

The authors declare no conflict of interest

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