RESEARCH ARTICLE

ANTI-BACTERIAL ACTIVITY OF ALOE VERA GEL EXTRACT

M. Anitha, J. Hema priya, D. M. Monisha, G. B. Pavithra
Department Of Microbiology, Shri Sathya Sai Medical College & Research Institute, Thiruporur, Sri Balaji Vidyapeeth University, Tamil Nadu, India.

Abstract:
Aloe vera is a medicinal plant with anti inflammatory, antimicrobial, anti diabetic and immune-boosting properties. In the current study, an attempt has been made to evaluate the presence of antibacterial activity in the Dimethyl sulfoxide extract of Aloe vera gel using four different concentrations (25, 50 100 and 200µg/ml). Seven isolates of each of these bacteria were investigated for their sensitivity to Aloe vera gel using the Well diffusion method. The extract was more effective against Gram negative and Gram positive bacteria. (E. coli, Klebsiella pneumoniae, Citrobacter koseri, Proteus mirabilis, Pseudomonas aeruginosa, Staphylococcus aureus, Streptococcus pyogenes) than the conventional antibiotics used. Hence our recent findings will be recommended that Aloe vera gel at optimum concentration could be used as an antiseptic for prevention of bacterial infections.

Key Words: Aloe vera gel, Antimicrobial activity and DMSO extract.

Introduction
In recent years, multiple drug resistance in human pathogenic microorganisms have developed due to indiscriminate usage of commercial antimicrobial drugs for the treatment of infectious diseases. This scenario forced scientists for searching new antimicrobial products from distinct sources, like medicinal plants, which are the better sources of novel antimicrobial chemotherapeutic agents. Infectious diseases are concerned to be pursued in majority of health institutions, pharmaceutical companies and governments all over the world (accounting for over 50,000 deaths every day), especially with the current raising trends of multidrug resistance among emerging and re-emerging bacterial pathogens to the available modern drugs or antibiotics. The search for newer sources of antibiotics is a global challenge in pre occupying research institutions, pharmaceutical companies and academia, since many infectious agents are becoming resistant to synthetic drugs. It is therefore very necessary, that the process of searching newer antibiotic sources. Plants are the cheapest and safer alternative sources of antimicrobials.(1)

The utilisation of plant product for pharmaceutical purpose has been gradually increased. According to World Health Organisation, medicinal plants would be the surpass source for procuring variety of drugs (Santos et al., 1995). (2) Aloe vera is an ornamental and medicinal plant. The name of Aloe vera was derived from the Arabic ‘Alloeh’ meaning ‘Bitter’ because of bitter liquid found in the leaves. It is also known as ‘Lily Of Desert’. Aloe vera is a stem less or very short –stemmed succulent plant growing to 60-100 cm tall, spreading by offsets. The leaves are thick and fleshy, green to grey-greenish, with some varieties showing white flecks on the upper and lower stem surfaces. It is being used therapeutically, since Roman times and perhaps long before.(3,4)

Aloe vera belongs to the Liliaceae family, of which there are about 360 species. It is a cactus-like plant that grows readily in hot, dry climates and currently, because of fraining, is cultivated in large quantities. (5) The gel of A. vera was used to treat stomach ailments, gastrointestinal problems, skin disease, constipation, radiation injury, inflammatory effect, healing wounds and burns, ulcerations and diabetes. A. vera products are mainly used for cosmetic, pharmaceutical, nutraceuticals and food industries.(6) A. barbadensis Miller (A. vera) possessed a number of therapeutic uses viz., anti-inflammatory, immune stimulatory, antibacterial, antiviral, antifungal and cell growth stimulatory activity. The gel stimulates cell growth and enhances the replenishment of damaged skin. It moisturizes the skin because it has a water holding capacity. As a drink, it protects the mucosal membrane of the stomach especially when it is getting irritated or damaged. (7)

Aloe vera is a perennial, drought resisting, succulent plant. It has stiff green, lance-shaped leaves containing clear gel in a central mucilaginous pulp. Its thick leaves contain the water supply for the plant to survive long periods of...
drought. The gel contains 99.3% of water, the remaining 0.7% is made up of solids with carbohydrates which constitutes of large components Aloe gel is perhaps the most widely recognized herbal remedy in the United State today; it is used to relieve thermal burn, sunburn and promote wound healing. In addition, research suggests that Aloe gel can help to stimulate the body’s immune system. The aloe plant contains different nutrient contents including vitamins, minerals, enzyme, sugars, phenolic compounds, lignin, saponins, sterol and aminoacid. The aim of the present study was assessing the effects of an A. vera gel to inspect the resistance and susceptibility patterns of the clinically significant antibiotics against diverse bacterial isolations.

MATERIALS AND METHODS
Collection of Plant Material:
Leaves of Aloe vera were collected from the road sides of in and around thiruporur, Tamil Nadu, India.

Extraction: Mature, healthy and fresh leaves of A. vera were washed in the running tap water for 5 min and rinsed with sterile distilled water, then dissected longitudinally and the colourless parenchymatous tissue (aloe gel) was scraped out using a sterile knife by eliminating the fibres. The gel was ground with DMSO using the mortar and pestle. The extracts were filtered using Whatman No. 1 filter paper and the filtrate was centrifuged at 5000 rpm for 5 min.

Experimental Procedure: The supernatant was collected and stored in refrigerator at 4°C. Different concentration of A. vera gel extract was subjected to antimicrobial studies. Pure bacterial culture was obtained from the central lab of Shri sathya sai Medical college and Research institute, Thiruporur. Seven bacterial cultures such as E. coli, Klebsiella pneumoniae, Citrobacter koseri, Proteus mirabilis, Pseudomonas aeruginosa, Staphylococcus aureus and Streptococcus pyogenes were maintained in nutrient agar medium at room temperature and were sub-cultured into newly prepared nutrient agar slants, every two-week. Antimicrobial activity was carried out by well diffusion method against the selected pathogens. The crude DMSO extracts were used for bioassay against bacteria. Sterile discs with 6 mm diameter were loaded with different concentration of 25, 50, 100, 200 µg/ml of gel DMSO extracts was loaded into the well of sterile medium with the testing organisms. The plates were incubated at 37º C for 24 hours. Antimicrobial activity was evaluated by measuring the zone of inhibition. All the experiments were repeated thrice and results were recorded. DMSO was used as negative control.

RESULTS
All the four concentration (25, 50, 100, 200 µg/ml) of DMSO gel extracts of A. vera studied in the present investigation which exhibited varying degree of inhibitory effect against the selected bacterial pathogens. Aloe vera gel is widely used as a traditional folk medicine for the treatment of different infectious diseases. In our study, in vitro antimicrobial properties of Aloe vera gel were investigated against various common pathogenic bacteria. The well diffusion method showed significant zone of inhibition against all the pathogens tested and the results are comparable to the conventional antibiotics. The antimicrobial activity of the extracts and their potency was quantitatively assessed by the presence or absence of inhibition zone and zone diameter. These results support that the Aloe vera is a potent antimicrobial agent. DMSO gel extracts of A. vera were screened for the antibacterial activity against the human pathogens and the results are given in the Figure 1 & 2.

The antibacterial activity has been observed in the DMSO gel extracts of A. vera against all the tested bacteria with varied activity. By antibiotic disc diffusion method, the seven bacterial pathogens such as E. coli, Klebsiella pneumoniae, Citrobacter koseri, Proteus mirabilis, Pseudomonas aeruginosa, Staphylococcus aureus, Streptococcus pyogenes showed resistant patterns.(Figure 1). Similar to antibacterial activity of the A. vera gel extracts also varied according to the concentration (25, 50 and 200µg/ml), but after the application of DMSO aloe vera gel extract showed inhibitory effect on the seven pathogens with the maximum zone of inhibition in the highest concentration (200 µg/mL).(Figure 2)
DISCUSSION
In the present investigation, in vitro antibacterial activity of the four different concentration of DMSO gel extracts of *A. vera* was quantitatively evaluated on the basis of zone of inhibition. Highest concentration of DMSO gel extracts of *A. vera* showed better zone of inhibition against the selected pathogens. Similarly, D Lalitha Devi et al\(^7\) showed highest degree of activity against the selected pathogens using the DMSO gel extracts of *A. vera*.

The use of plant extracts, with known antimicrobial properties, can be of great significance in the treatment of various microbial infections. In the last decade, numerous studies have been conducted in different countries to prove such efficiency in number of medicinal plants. The mechanism of action of the gel extract on the lysis of bacterial cells may be due to the pore formation in the cell wall and the leakage of cytoplasmic constituents by the active components such as alkaloids present in the gel extract as revealed by Shelton (1991).\(^{11}\) Pawar et al\(^{12}\) prepared the crude *A. vera* gel extract by hot extraction with acetone, ethanol and methanol in the oven at 80°C for 48 h. In our study, we prepared the *A. vera* extracts by using Dimethyl sulfoxide as a solvent. Thiruppathi et al\(^{13}\) prepared the *A. vera* gel crude extracts according to the method described by Ahmad et al, with minor modifications. Ibrahim et al\(^{14}\) investigated the phyto constituents and antimicrobial activity of aqueous, ethanol and acetone extracts of the *A. vera* gel against some human and plant pathogens by disc diffusion method. Among the three extracts, ethanol and acetone extracts recorded significant antimicrobial activity against all test pathogens.

Agarry et al\(^{15}\) compared the antimicrobial activities of ethanolic extracts of *A. vera* gel and leaf against *S. aureus*, *P. aeruginosa*, Trichophyton mentagrophytes, *T. schoeleinii*, *M. canis* and *C. albicans*. Antimicrobial susceptibility test implies that both the gel and the leaf inhibited the growth of *S. aureus*. 

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**Figure 1**: Before the application of DMSO *aloe vera* gel extract – resistant patterns

**Figure 2**: After the application of DMSO *aloe vera* gel extract – high sensitivity
The antimicrobial activity of the Aloe vera juice against Gram-positive bacteria (Mycobacterium smegmatis, Enterococcus faecalis, Micrococcus luteus and Bacillus sphericus), Gram-negative bacteria (Pseudomonas aeruginosa, Klebsiella pneumoniae, E. coli and Salmonella typhimurium) and Candida albicans were also studied. The study depicting the antimicrobial activity of Aloe vera juice against M. smegmatis, K. pneumoniae, E. faecalis, M. luteus, C. albicans and B. sphericus, but no inhibitory effect against the other bacterial strains. The least inhibitory effect was found against M. luteus, while C. albicans was detected to be the most sensitive strain (Suleyman Alemdar et al., 2009). Thus in the present study the antibacterial susceptibility test showed the growth inhibition on E. coli, Klebsiella pneumonia, Citrobacter koseri, Proteus mirabilis, Pseudomonas aeruginosa, Staphylococcus aureus, Streptococcus pyogenes.

Cock et al (17) studied the antimicrobial activity of A. barbadensis leaf gel components. Methanolic extracts of A. barbadensis inner leaf gel were fractionated by RP-HPLC and the resultant fractions were tested for inhibitory activity against a panel of bacteria and fungi. Five fractions were identified as having antimicrobial activity. Of which fraction 1 had the broadest antibacterial activity.

Ferro et al. (18) also found that Streptococcus pyogenes was more sensitive than Shigella flexneri to Aloe vera gel. In the present study, we found that Aloe vera gel exerted strong bactericidal activity against both Gram positive and Gram negative bacteria, producing better growth inhibition zones on highest concentration. Although no adverse effects of Aloe vera have been reported in humans, but in rare cases of reversible hepatotoxicity (19), contact dermatitis, and mild itching have been documented. The results obtained in the present study revealed withstanding bactericidal activity of Aloe vera gel against some bacterial infections.

CONCLUSION
The present study has imparted, that the crude extracts of Aloe Vera gel has intended effect of antibacterial activity against both Gram positive and Gram negative bacteria. This investigation further assures that the plant extracts could be used for the treatment of microbial infections. Hence our present findings will be recommended that Aloe vera gel at optimum concentration could be used as an antiseptic for prevention of some microbial infections. It is believed that this study could be used to identify new and more potent antimicrobial drugs of natural origin.

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REFERENCES


