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Study on *Aloe Barbadensis* Miller As Medicinal Plants

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ABSTRACT:

Medicinal plants are rich source of antimicrobial agents plants are used medicinally in different countries and are the sources of potential and powerful drugs.The substances that can either inhabits the growth of pathogens or kill them and have no or least toxicity to host cells are considered candidates for developed new antibacterial drugs. In recent years antimicrobial properties of medicinal plants are being increasingly reports from different parts of world .Many efforts have been made to discover new antimicrobial compounds from various kinds of sources such as microorganism . one such resources is folk medicines. Systematic screening of them may result in the discovery of novel effective compounds. India processes a rich biodiversity of the medicinal plants that were still not explored completetly.

Key words: **MEDICINAL PLANT, *Pterocarpus santalinus* AND *Aloe barbadensis* MILLER PLANTS**

INTRODUCTION

Medicinal plants known to contain antimicrobial compounds (Frankic et al., 2009; Ghasemi et al., 2014; Mehdi et al., 2018; Toghyani et al., 2011; Windisch et al., 2008). A good number of plants possess therapeutic properties against bacterial infections (Kayode & Kayode, 2011). The neem (*Azadirachta indica*) is one of the popular medicinal plants in the South East Asia (Murthy & Sexena, 1998). It is also found in many countries of the world having tropical and subtropical climates (Alzohairy, 2016). It is very often used in Ayurveda, Unani and Homoeopathic medicines for its antimicrobial properties (Lakshmi et al., 2015). There are more than 140 bioactive compounds found in neem (Subapriya & Nagini, 2005). Azadirachtin, nimbin and nimbidine are the most abundance bioactive compounds found in the leaves of Neem (Mondali et al., 2009). The leaves, flowers, seeds, fruits, roots and bark of neem tree are used for the treatment of infections on skin, teeth and gums (Subapriya & Nagini, 2005). The leaves of neem are used to treat skin allergies, and healing of wound of small pox and chicken pox (Hla et al., 2011). The antimicrobial activity of neem leaves extract against *Staphylococcus* spp., *Streptococcus* spp., *Pseudomonas* spp., *E. coli*, and some fungal strains have been reported (Koona & Budida, 2011; Valarmathy et al., 2010). The use of neem leaf extract in immunosuppressed birds increased humoral and cell mediate immunity (Sadekar et al., 1998).

Pasteurella multocida, *Salmonella pullorum*, *Salmonella gallinarum* and *Escherichia coli* are known to cause fowl cholera, fowl typhoid, pullorum diseases, and colibacillosis in poultry. These bacterial diseases are prevalent in Bangladesh and causing significant economic losses in poultry industries due to high morbidity and mortality. Antibiotics are being used for treating these bacterial diseases which often leads to the developments of multidrug resistant (MDR) bacteria. Extract of neem leaf is known to have antibacterial activity (Akhter & Sarker, 2019) without drug resistant problem. Therefore neem leaf extract may be used as an alternative to antibiotics to treat MDR bacterial diseases. The objective of the present research was to determine antibacterial efficacy of neem leaf extract against MDR pathogenic bacteria of poultry: *P. multocida, S. pullorum, S. gallinarum* and *E. coli*.

Azadirachta indica A. Juss (syn. Melia azadirachta) is well known in India and its neighbouring countries for more than 2000 years as one of the most versatile medicinal plants having a wide spectrum of biological activity. A. indica A. Juss and M. azedarach are two closely related species of Meliaceae. The former is popularly known as Indian neem (margosa tree) or Indian lilac, and the latter as the Persian lilac. Neem is an evergreen tree, cultivated in various parts of the Indian subcontinent. Every part of the tree has been used as traditional medicine for household remedy against various human ailments, from antiquity1–6 . Neem has been

extensively used in ayurveda, unani and homoeopathic medicine and has become a cynosure of modern medicine. The sanskrit name of the neem tree is 'Arishtha' meaning 'reliever of sickness' and hence is considered as 'Sarbaroganibarini'. The tree is still regarded as 'village dispensary' in India. The importance of the neem tree has been recognized by the US National Academy of Sciences, which published a report in 1992 entitled 'Neem – a tree for solving global problems'. The advancement of neem research has earlier been documented7,8 .

Aloe vera

The number of people using traditional or alternative medicine is increasing rapidly all over the world. Traditional medicine often includes herbal medicines, which consist of biologically active compounds from plant materials, or whole plants (WHO, 2002). According to the World Health Organization, around 65% of the world's population have incorporated plant medicinal agents into their primary aspects of healthcare. The key reasons behind using plants as sources of therapeutic agents include a) isolation of bioactive compounds for direct use as drugs, b) producing bioactive compounds of new or known structures as references for the synthesis of entities with higher activity and/or lower toxicity, c) using agents as pharmacological tools and d) using the whole plant or a certain portion of it as herbal remedy (Fabricant & Farnsworth, 2001). Consumer interest in herbal and alternative medicines arise from the fact that they consider these products to be both safe and effective, and this has prompted scientists to investigate the numerous bioactive compounds available in plants (Wendakoon et al., 2012).

However, there is another important reason behind people turning to natural sources in search of compounds with potent antimicrobial activities these days - the alarming rate at which microbial resistance to synthetic antibiotics is growing. Owing to the side effects and resistance that pathogenic microorganisms develop against common, commercially available antibiotics, more attention is being paid to extracts and bioactive components that can be isolated from plants used in herbal medicine (Essawi & Srour, 2000). Antibiotic and multi-drug resistance is now a worldwide problem in hospitals, long-stay residential centres and also in the community (Livermore, 2000). Unselective and extensive use of antibiotics and selective pressure on bacterial strains is highly considered to be the reason behind such evolution (Goudrazi et al., 2015; Habeeb et al., 2007). Bacteria are not only able to acquire resistance through mutation, but also by plasmid spread through different strains (Robicsek et al., 2006). A deficiency in new drugs, vaccines and diagnostic aids is also recognized as a major problem in the management of drug resistant infections (Finch & Hunter, 2006). To address all these shortcomings, a significant number o new therapeutics is being derived from natural sources such as plants, as systemic and topical novel drugs and antiseptics to replace or to be used in collaboration with existing products (Woodford, 2005). Many plant materials used as traditional medicine have been proven to be more effective, and relatively cheaper than their modern counterparts (Mann et al., 2008). Antimicrobials of plant origin also alleviate many of the side effects that are often associated with synthetic ones (Iwu, et al., 1999; Mukherjee & Wahile, 2006).

Aloe barbadensis Miller (Aloe vera) is a member of the Liliaceae family which contains about four hundred species of flowering succulent plants (Newall et al., 1996; Mohammad, 2003). Aloe vera is a typical xerophyte. It is a cactus-like plant with thick, fleshy, cuticularized spiny leaves that grows readily in hot, dry climates (Choi et al., 2002; Tan & Vanitha, 2004). Aloe vera plants are stem less or sometimes very short-stemmed plants that grow up to 60-100 cm tall. The thick leaves are green, with some variants that show white flecks on the upper and lower stem surfaces. The serrated margin of the leaves have small, white teeth, and the flowers are produced in summer. Each pendulous flower has a yellow, tubular corolla 2-3 cm long. Aloe vera forms arbuscular mycorrhiza, a symbiotic mechanism that allows the plant better access to mineral nutrients present in soil (Gong et al., 2002).

The fresh leaves of this perennial, drought resistant plant is used to obtain two distinct products: a bitter, yellow latex (exudate) and a mucilaginous gel from the parenchymatous tissues in the leaf pulp. The gel is revealed after removal of the thick outer cuticle (Surjushe et al., 2008). Aloe

vera gel is 99.3% water and the remaining 0.7% consists of a range of active compounds including polysaccharides such as glucose and mannose, vitamins, amino acids, phenolic compounds and organic acids. These compounds give Aloe vera the special property as a skincare product (Crew et al., 1939; Borrelli & Izzo, 2000 and Agarry et al, 2005). The name of the plant was derived from the Arabic "alloeh" meaning "shining bitter substance" because of the bitter liquid found in the leaves. The word "vera" is Latin for "truth". It is also known as "lily of the desert", the "plant of immortality" and the medicinal plant that has the qualities to serve as alternate medicine (Arunkumar & Muthuselvam, 2009).

Products derived from Aloe vera are primarily used in cosmetics, pharmaceuticals, nutraceuticals and food industries (Klein & Penney, 1988). The gel has the ability to stimulate cell growth and enhance the restoration of damaged skin. Its moisturizing ability arises from its water holding capacity (Eshun & He, 2004). The first reference to Aloe vera in English was a translation by John Goodyew in A.D. 1655 of Dioscorides' Medical treatise De Materia Medica (Surjushe et al., 2008). The plant grows mainly in the dry regions of Africa, Asia, Europe, America and India. Because of its increasing demand these days, Aloe vera is now grown in large amounts in Bangladesh. People use Aloe vera as skin care products and also in the production of cosmetics and medicines.

Aloe vera is an ornamental and medicinal plant. It is being used therapeutically, since Roman times and perhaps long before, different properties being ascribed to the inner colorless leaf gel and to the exudates from the outer layers. Aloe has a history of traditional use by Native Americans for stomach disorders and intestinal disorders including constipation, hemorrhoids, colitis and colon problems. It is said to be a natural cleaner, powerful in penetrating tissues, relieving pain associated with joints and muscles, bactericidal, a strong antibiotic, virucidal when in direct contact with long periods, fungicidal, anti-inflammatory, instrumental in increasing circulation to the area, breaking and digesting dead tissue and moisturizing tissues. The skin absorbs *Aloe vera* up to four times faster than water, it appears to help pores of the skin open and receive moisture and nutrients of the plants. Additionally, numerous constituents within *Aloe vera* have demonstrated enhancement of immune system functioning within the body. Aloe also has the ability to stimulate macrophages.

To date more than 75 ingredients have been identified from the gel each of which may have a range of mechanism of actions, acting synergistically or individually to explain more than 200 different constituents notably mucopolysaccharides, enzymes, sterols, prostaglandins, fatty acids, amino acids and a wide variety of vitamins and minerals. It contains several potentially active bioactive compounds including salicylates, magnesium lactate, acemannan, lupeol, campestrol, β-sitosterol, aloin A and anthraquinone. In addition *Aloe vera* contains at least seven super-oxide dismutases with antioxidant activity.

The efficacy of Aloe liquid as an antibacterial agent is shown to have a wide range against Gram positive and Gram negative bacteria. The antimicrobial agents of *Aloe vera* gel was reported to effectively kill or greatly reduce or eliminate the growth of *Staphylococcus aureus, Klebsiella pneumoniae, Streptococcus pyogenes, Pseudomonas aeruginosa, Escherichia coli, Propionibacterium acne, Helicobacter pylori* and *Salmonella typhi* (16, 23, 24, 27). Whole leaf components are proposed to have direct antibacterial properties include anthraquinones and saponin (24, 27); While polysaccharides have been attributed within direct bacterial activity through the stimulation of phagocytic leucocytes to destroy bacteria (16, 23).Due to the increasing development of antibiotic resistance, the emphasis of the present study is being given on the use of *Aloe* vera as a natural remedy for the inhibition of various infections and to identify the different compounds.

Aloe vera (Aloe barbadensis miller) is a plant, which belongs to the family of Liliaceae and is mostly succulent with a whorl of elongated, pointed leaves (Strickland et al., 2004; Beckford and Badrie, 2000). The name is derived from the Arabic word 'alloeh' which means 'bitter', referring to the taste of the liquid contained in the leaves. The term ALOE refers to a solid residue

obtained by evaporating the latex derived from the outer layers of the plant leaf. Taxonomists now refer to Aloe barbadensis as Aloe vera. The central bulk of the leaf contains colourless mucilaginous pulp, made up of large, thin walled mesophyll cells containing the A. vera gel itself. Despite its wide use as a folk remedy over a long period of time, the biochemical details of its action on physiological/ pathophysiological functions have not been systematically investigated (Rajasekaran et al., 2006; Tanweer et al., 1996). The plant has a long history as a multipurpose folk remedy, and has been associated with myth, magic and medicine since pre-biblical times. Historical evidence indicates that A. vera originated in the warm, dry climate of Southern and Eastern Africa, and was subsequently introduced into Northern Africa, the Arabian Peninsula, China, Gibraltar, the Mediterranean countries, and the West Indies (Jassim and Naji, 2003; Pribitkin and Boger, 2001). A. vera is described as one of the most talked about, yet most misunderstood plants in history. Modern clinical use of A. vera began in the 1920s and claims now abound, in numerous research and commercial literature in journals and on the Internet, regarding its numerous therapeutic potentials when used both topically and parenterally. It is acclaimed to cure ailments ranging from mild fever, wounds and burns, gastrointestinal disorders, diabetes, sexual vitality and fertility problems to cancer, immune modulation and AIDS (Taiwo et al., 2005; Grindlay et al., 1986; Mackay and Miller, 2003).

Medicinal plants of the lily family (Liliaceae), genus Aloe, have been used for the treatment of skin diseases for more than 5000 years. Among more than 360 Aloe species, A. vera (A. barbadensis miller) has been the most popular in both folk and officinal medicine (Larry, 2003; Sun et al., 2002; Kodym and Bujak, 2002). A. vera extracts are widely used in a variety of over-the-counter and dermatological products. Many studies report the effective use of this plant when applied topically for the treatment of burns, sunburns, inflammatory skin disorders and wounds (Belo et al., 2006; Reider et al., 2005; Paulsen et al., 2005). A. vera is a plant that can produce latex and gel. The gel is extracted from the leaf, and it is this substance that is most used as a treatment. A. vera has been evaluated in a number of different clinical contexts and some promising results have been found for its use in controlling cardiovascular risk factors and diabetes, besides being beneficial in areas of dermatology. One explanatory factor for this is the antiinflammatory properties of the plant (Davis et al., 2006; Choi et al., 2001; Tian et al., 2003). It contains over 70 biologically active compounds and is claimed to have anti-inflammatory, anti-oxidant, immune boosting, anticancer, healing, anti-ageing and anti-diabetic properties. Aloes, by contrast, is an anthraquinone derivative of the sap of the Aloe leaf which has been used for centuries as a purgative (Langmead et al., 2004; Gallagher and Gray, 2003). A. vera gel has been widely promoted and used by patients for the treatment of a range of inflammatory digestive and skin diseases (Langmead et al., 2004; Lee et al., 2004). The antibacterial activities of A. vera were dependent on the dose of anthraquinone. It is reported that A. vera possesses antifungal, antiviral, antibacterial and acaricidal activity against skin infections such as acne, herpes and scabies (Mantle et al., 2001; Hart et al., 1990). It contains a compound that neutralizes and binds with FGF-2 receptor, or otherwise alters signaling pathways for FGF-2 by affecting both GJIC and proliferation of diabetic fibroblast (Abdullah et al., 2003). Several reports suggest that beneficial effects of Aloe gel are due to its high molecular weight components such as polysaccharide, lectin like proteins and prostaglandins (Kodym et al., 2003; Puke and Ayensu, 1985; Koo, 1994). The aim of the present study was to evaluate the effects of an A. vera gel and leaf extract on skin infection isolates. The results obtained with A. vera were compared with five different standard antibiotics. Skin infection isolates were obtained from septic wounds and burns patients undergoing injury dressing at different hospitals. Wound exudates were obtained from the infected sites of each patient with sterile cotton swabs and applied to freshly prepared slants of nutrient agar and Mannitol Salt agar (Oxoid). The cultures were then transferred to the laboratory where they were incubated at 37oC for 24 h (Kolawole and Shittu, 1997; Huys et al., 2002).

Therapeutic uses of Aloe vera

For thousands of years, Aloe vera has been used for medicinal purposes in several cultures: Greece, Egypt, India, Mexico, Japan and China (Marshall, 1990). It is a well-known dietary supplement and chemopreventive agent, and its gel is also used for topical treatment of skin irritations (Bergamante et al., 2007). It has been reported that Aloe vera gel has a protective effect against radiation damage to the skin (Roberts & Travis, 1995). The exact mechanism of action is yet to be discovered, but after administration of Aloe vera gel, metallothionein, which is an antioxidant protein, is generated in the skin. This scavenges hydroxyl radicals and prevents suppression of superoxide dismutase and glutathione peroxidase in the skin. This, in turn, reduces the production and release of skin keratinocyte-derived immunosuppressive cytokines such as interlukin-10, thereby preventing UV-induced suppression of delayed type hypersensitivity (Byeon et al., 1998). The effects of Aloe vera on the immune system includes Alprogen (Aloe single component) inhibiting calcium influx into mast cells, hence inhibiting the antigen-antibody-mediated release of histamine and leukotriene from mast cell (Ro et al., 2000). Anthraquinones present in the latex of Aloe vera are a potent laxative. It increases intestinal water uptake, stimulates mucus secretion and increases intestinal peristalsis (Ishii et al., 1994). Mucopolysaccharides in Aloe vera gel help in binding moisture into the skin. By stimulating fibroblasts which produce collagen and elastin fibres, it makes the skin more elastic and less wrinkled. The gel also plays a role of a cohesive agent on the superficial flaking epidermal cells by sticking them together, thereby softening the skin. The amino acids also soften hardened skin cells and zinc acts as an astringent to tighten pores (West & Zhu, 2003). Besides all these, Aloe vera is also known to have healing effects against ulcer, diabetes, inflammations and tumors (Surjushe et al., 2008)

Antimicrobial properties of Aloe vera

Despite the numerous number of literature present on antimicrobial properties of plant extracts, not many plant derived chemicals have been successfully exploited for clinical use as antibiotics. A considerable part of the chemical diversity produced by plants is thought to protect plants against microbial pathogens. Hence, they have been proven to have antimicrobial importance both in vivo and in vitro (Gibbons, 2004). A number of reports are available on antimicrobial activity of hexane, ethanol, acetone, petroleum ether and ethyl acetate extracts of Aloe vera gel and leaves (Agarry et al., 2005). Antibacterial activity of Aloe barbadensis was tested on certain clinically isolated bacterial pathogens such as Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, Klebsiella pneumoniae, etc. Antibacterial effects of ethanolic and aqueous extracts were tested by examining the appearance of any zone of inhibition on bacterial culture plates. Ethanol extracts were found to be quite effective on both gram positive and negative bacteria, but the aqueous extracts did not show any inhibitory effect (Pandey & Mishra, 2010). Another study was conducted to determine the antimicrobial activity of Aloe vera juice against gram positive and negative bacteria, and the fungus Candida albicans. Making use of disc diffusion method, the study revealed that the tested plant juice was mostly effective against gram positive bacteria and C. albicans (Alemdar & Agaoglu, 2009). A study aiming to investigate the antimicrobial activity of Dimethyl sulfoxide (DMSO) crude extracts of Aloe barbadensis Miller gel against selected bacterial and fungal pathogens showed that Aloe vera extracts are effective against most of the microbial strains used. The maximum zones of inhibitions appeared against E. coli, Proteus mirabilis, Pseudomonas aeruginosa, S. aureus, C. albicans and Penicillium spp (Devi, Srinivas, & Rao, 2012). It has also been reported that Aloe vera contains six antiseptic agents: Lupeol, salicylic acid, urea nitrogen, cinnamonic acid, phenols and sulfur, which causes Aloe vera to have inhibitory effects against fungi, bacteria and viruses (Surjushe et al., 2008). The anthraquinone aloin present in Aloe vera inactivates several enveloped viruses such as herpes simplex, varicella zoster and influenza (Sydiskis et al., 1991).

REFERENCES

Setua, G.C.; Banerjee, N.D.; Sengupta, T.; Das, N.K.; Ghosh, J.K. and Saratchandra, B.(2002). Comparative efficacy of different composts in 'S' mulberry (Morns *alba)* under rainfed condition. *Indian Journal of Agril Sciences,* 72(7):389-92.

Shalabi, M., Khilo, K., Zakaria, M.M., Elsebaei, M.G., Abdo, W., and Awadin, W. 2015. Anticancer activity of Aloe vera and Calligonum comosum extracts separetely on hepatocellular carcinoma cells. Asian Pacific J. Tropical Biomedicine, 5(5): 375-381.

Sharangouda, J.P, Satishagouda, S, Vishwanatha, T, Saraswati, B. (2010). Effect of *Terminalia bellirica* barks extracts on activities of accessory reproductive ducts in male rats. 1(2):015.

Sharma, B, Satapathi, S.K, Roy, P.(2007). Hypoglycemic and hypolipidemic effect of *Aegle marmelos* (L.) leaf extract on streptozotocin induced diabetic mice. *Int J Pharmacol.* 3:444-452.

Sharma, B.D.; Dhandar, D.C. and Bhargava, R (2003). Response of pomegranate (*Punica granatum* L.) to integration of nutrient sources in sandy soil of arid ecosystem. *In organic farming inHorticulture for sustainable production,* CISH, Lucknow: 33-34.

Sharma, H.G.(2004). Studies on blending impact of nutrient under different fertigation levels on growth, yield and quality of papaya *{Carica papaya* L.). Ph.D. Thesis, IGAU, Raipur (C.G.).

Sharma, S.K. and Ramamurthy, V. (2000). Micropropagation of 4 year-old elite *Eucalyptus tereticornis* trees. *Pl. Cell Rep.,* **19**: 511-518..

Sharma, S.U, Sharma,U.S, Singh, A, Sutar, N, Singh, P.J. (2010). Screening of Terminalia bellirica Fruits Extracts for its Analgesic and Antipyretic Activities. *Jordan J of Bio Sci*. 3(3):121-4.

Shrikanth, V.M., Janardhan, B., Dhananjaya, B.L., Muddapura, U.M., and More, S.S. 2015. Antimicrobial and antioxidant activity of methanolic root extract of Tabernaemontana alternifolia L. Int. J. Pharmacy and Pharmaceutical Sci., 7(13): 66-69.

Siddique, N.A, Mujeeb, M, Ansari, S.H, Ahmad, S, Ali, B, Aslam, J. (2010). Development of quality standards of *Aegle marmelos* L. leaves. *J Phyto*. 2:36-43.

Singh, Ajeet. (2007). Study on the effect of INM on yield and quality of aonla (E. *officinalis* Gaertn.) cv. NA-10. Thesis submitted to the Department of Horticulture, N.D.U.A. & Tech., Kumarganj Faizabad (U.P.).