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Aloevera- A Basic Review

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ABSTRACT: Aloe verais one of the plants exhibiting multiple benefits and has gained considerable importance in clinical research. Historically, it has been used for a variety of medicinal purposes. It has attracted the attention of many researchers because of its different properties. More than 200 different biologically active substances were found in this plant that contributed to the fact it has been used to treat various types of diseases. The healthy effect of Aloe verais primarily attributed to the polysaccharides contained in the gel of the leaves. It has been traditionally used to treat various conditions, including psoriasis, sunburn or radiation-related dermatitis, mucositis, oesophagitis or lichen planus. Aloe verahas also found application in wound healing, treatment of burns, protection against skin damage caused by X-ray, intestinal problems, reduction of plaque and gingivitis, regulating the levels of plasma lipoproteins, reduction of blood sugar levels and improving the immune system. Other biological activities of aloe, such as antifungal, antibacterial, antiviral, anti-inflammatory, anticancer and immunomodulatory have also been documented in numerous studies. This review examines the possible applications of Aloe verain clinical trials.

KEYWORDS : aloe barbadensis miller, biological activities, diabetes mellitus, emblica officinalis gaertn.

INTRODUCTION

The name Aloe comes from the Arabic word alloeh meaning a shining bitter substance. The botanical name of Aloe Vera is Aloe Barbadensis Miller. It belongs to the Liliaceae family, which has about 360 species. Aloe Vera is a cactus like plant that grows readily in hot and dry climate and currently, because of high demand, is cultivated in large quantities. It grows mainly in dry regions of Asia, Africa, America and Europe. In India, it is found in Maharashtra, Andhra Pradesh, Gujarat, Rajasthan and Tamil Nadu2. Cosmetics and some medicinal products are made from the mucilaginous tissue at the center of the Aloe vera leaf and are called Aloe Vera gel. This gel is a clear, tasteless, thin, jelly like material. The other part of the plant is a group of specialized cells known as the pericyclic tubules. They occur just beneath the outer green rind of the leaf. These cells produce exudates that consist of bitter yellow latex with powerful laxative- like action. This plant has yellow flowers. The leaves, arranged in a rosette configuration are triangular and spear like and have thorny ridges[1].

Fig 1: Aloe vera

Chemical constituents

Aloe contains two classes of Aloins: (1)nataloins, which yield picric and oxalic acids withnitric acid, and do not give a red coloration withnitric acid; and (2) barbaloins, which yield aloeticacid (C7H2N3O5), chrysammic acid (C7H2N2O6),picric and oxalic acids with nitric acid, being reddened by the acid. This second group may bedivided into a-barbaloins, obtained fromBarbados aloes, and reddened in the cold, and bbarbaloins,obtained from Socotrine and Zanzibar aloes, reddened by ordinary nitric acid only

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whenwarmed or by fuming acid in the cold. Nataloinforms bright yellow scales. Barbaloinformsyellow prismatic crystals. The plant produces at least 6 antiseptic agentssuch as lupeol, salicylic acid, urea nitrogen,cinnamonic acid, phenols and sulphur. All ofthese substances are recognized as antisepticsbecause they kill or control mold, bacteria,fungus and viruses, explaining why plant has theability to eliminate many internal and external infections. Lupeol and salicylic acid present inthe juice are two very effective pain-killer.It contains at least three anti-inflammatory fattyacids, cholesterol, campesterol and β-sitosterol.These are highly effective in treatment of burns,cuts, scrapes, abrasions, allergic reactions,rheumatoid arthritis, rheumatic fever, acidindigestion, ulcers, plus many inflammatoryconditions of the digestive system and otherinternal organs, including the stomach, smallintestine, colon, liver, kidney and pancreas. β-sitosterol is also a powerful anti-cholesterolwhich helps to lower harmful cholesterol levels,helping to explain its many benefits for heartpatients.About 23 polypeptides are present in Aloe juicewhich helps to control a broad spectrum ofimmune system diseases and disorders. Thepolypeptids plus the anti-tumor agents, Aloeemodin and Aloe lectins, are now also used intreatment of cancer[2].

Aloe vera(L.) Burm. f. (Family Liliaceae) is an evergreen perennial succulent plant widely used from antiquity. Aloe veracontains various carbohydrate polymers, notably glucomannans, along with a range of other organic and inorganic components. Phenolic compounds have been identified so far as chromone, anthraquinone or anthrone derivatives. Three distinct preparations of aloe plants are mostly used in medicinal practices that are quite different in their chemical composition and their therapeutic properties, aloe latex (aloe); aloe gel (Aloe vera); and, aloe whole leaf (aloe extract). Aloe latex is used for its laxative effect; aloe gel is used topically for skin ailments, such as wound healing, psoriasis, genital herpes and internally by oral administration in diabetic and hyperlipidaemic patients and to heal gastric ulcers; and, aloe extract is potentially useful for cancer and AIDS. Aloe verapossesses several pharmacological properties such as promoting and healing wound and burn, frost-bite healing, with addition to having antiinflammatory, antifungal, hypoglycemic and gastroprotective properties[3].

ANTI MICROBIAL

Aloe verais an herbal medicinal plant with biological activities, such as antimicrobial, anticancer, anti-inflammatory, andantidiabetic ones, and immunomodulatory properties. The purpose of this study was investigation of in vitro antimicrobial activityofA. veragel against multidrug-resistant (MDR) Pseudomonas aeruginosa isolated from patients with burn wound infections.In this method During a 6-month study, 140 clinical isolates of P. aeruginosa were collected from patients admitted to the burn wardsof a hospital in Tehran, Iran. Antimicrobial susceptibility test was carried out against the pathogens using the A. veragelandantibiotics (imipenem, gentamicin, and ciprofloxacin). Results.The antibiogram revealed that 47 (33.6%) of all isolates were MDRP. aeruginosa.The extract isolatedfromA. verahas antibacterial activity against all of isolates.Also, 42 (89.4%) isolates were in hibited byA. veragel extract at minimum inhibitory concentration (MIC) $\leq$ 200 μg/mL. MIC value of A. veragel for other isolates (10.6%)was 800 μg/mL. All of MDR P. aeruginosa strains were inhibited by A. veraat similar MIC50 and MIC90 200 μg/mL.Concluded based on our results, A. veragel at various concentrations can be used as an effective antibacterial agent in order to prevent woundinfection caused by P. aeruginosa. Their study supports the view that A. veragel could beactive against P. aeruginosa in wound infections at variousconcentrations and the use of it at optimum concentrationscan help better therapy of many microbial diseases. Furtherinvestigations are required to identify bioactive componentsofA. veragel and its effect on wide range of bacteria andfungus including the pathogenic strains. It is hoped that thisstudy would lead to the development of aloe gel usage as amain medicinal source to treat various infectious diseases[4].

One more study conducted, Aloe Vera compounds have inhibitory activity on fungi, bacteria, and viruses. This study examines theantibacterial activity of A. Vera purified extracts including gel, boiled skin, boiled gel, and distilled extract against pathogenicbacteria, Staphylococcus aureus, methicillin-resistant S. aureus (MRSA), Klebsiella pneumonia and Pseudomonas aeruginosa wereelucidated. In which the bacterial strains were collected from veterinary hospital. Freshly collected A. veraleaves were used forthe juice extraction of gel, skin and distilled extracts. Antibacterial effects of various A. Vera extracts were evaluated using broth micro dilution method. The crude polysaccharides of boiled skin extract were purified by phenol method; andfractionated by anion exchange chromatography. For each bacterium, minimum inhibitory concentration of

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various A. Veraextracts was determined. The protein expression changes of treated bacteria were detected by SDS-PAGE electrophoresis.The distillate extract exhibited more antibacterial effects than other extracts. Out of seven-carbohydrate fractions ofthe skin extract, the fractions 6 and 7 had antibacterial effects on S. aureus and MRSA at 0.089 and 0.134 mg/ml, respectively;also fraction 5 showed antibacterial effects on MRSA at 0.113 mg/ml concentration. The protein profiles of these strainsbefore and after treatment with A. Vera showed significant differences at 175, 60, 200 and 70 kDa protein bands of S. aureus,MRSA, P. aeruginosa and K. pneumonia, respectively. They concluded this finding showed that the distillate extract despite theminimal amount of carbohydrate and protein was more efficient against both Gram-positive and Gram negative bacteria[5].

By used Aloe Vera as a capping agent Zinc oxide (ZnO) nanostructures were synthesized on the surface ofcotton fabric via a simple wet chemical method for providing antimicrobial activity. Surface morphology and surfacechemistry were characterized by scanning electron microscopy (SEM) coupled with energy-dispersive X-rayspectroscopy. Antibacterial and (FTIR) Spectroscopy. Activity was evaluated against Gram-negative Ecoli and Grampositive Staphy lococcus aureus bacteria. Nanostructures were homogenously formed on the fibers' surface in case ofusedalovera capping agent, most of them are bundle like particles having different sizes. Antibacterial tests showedthat the ZnO-coated fabric possesses good bacteriostatic activity against to staphylococcus and Ecoli with alovera. Representative bacteria, demonstrated by the zone of inhibition. However, there was no reduction in the number ofbacteria, proving the lack of bactericidal activity. Demonstrate its excellent ability to block the UV radiation. Thewashing durability was also confirmed by performing repeated home laundering[6]

IMMUNITY BOOSTERS

this study evaluated the potential of Aloevera (Aloe barbadensisMiller) and vitamin E as immunostimulants on humoral and cellular immune responsesin broilers. Broilers were randomly assigned to three dietary treatments: a negative control (basal diet+ with no additive), basal diet + 1% Aloe vera gel in drinking water, and basal diet + 100 mg/Kg vitamin E inthe feed. Antibody titers against sheep red blood cells and Newcastle disease virus were used to examine thehumoral immune response, whereas cellular immune response was evaluated using the phytohemagglutinin-P tests. Result wasthe highest level of antibody titer against sheep red blood cells on examination days 28 and 38,and the highest response to injection of phytohemagglutinin-P on day 38 was observed in the Aloe veragelgroup ($p<0.05$). However, the response of broilers fed Aloe vera gel was not different from those receivingvitamin E ($p>0.05$). In addition, the greatest antibody level against Newcastle disease virus was obtained on days 25 and 35 in the vitamin E group, with no significant difference from the Aloe vera gel group ($p>0.05$). Concluded that in general, our findings demonstrated that both Aloe vera gel and vitamin E can enhance humoraland cellular immune responses of broilers, while Aloe vera gel can be used as an immunostimulant in chickens[7].

The purpose of this research work was to evaluate the Aloe vera (Aloe barbadensis) and Yeast (SaccharomycesCerevisiae) powder. A total of 72 (Arbor-Acres) day old chicks were used in this study. Four levels of an Aloevera and Yeast powder at the rate of 0.00%, 0.50% (Yeast), 0.50% (Aloe vera), and 0.50% Yeast + 0.50% Aloevera were incorporated into the basal diet for six weeks. Feeding period for all groups was lasted for 42 days.Results revealed a significant effect of Aloe vera and Yeast powder in feeds on mean body weights per broilersand mean feed conversion ratio per broilers in 5th week ($P<0.05$) were significantly on feed supplemented with 0.50% Yeast + 0.50% Aloe vera powder. It was concluded from this study that 0.50% Yeast + 0.50% Aloe verapowder feed supplemented has a beneficial impact on the growth performance of broilers chicks[8].

ANTI BACTERIAL AND ANTI FUNGUL

New materials hold the key to fundamental advances in antibacterial and antifungal activities, both of which are vital in order to meet the challenge of global warning of microorganism's advantagesand limitations and the finite nature of medicinal plants. The use of additive to augment the effect of asynthetic or natural drug candidate is well known. Here there report the use of nanoparticles of tin oxide(SnO2) to enhance the antibacterial and anti fungal potency of Aloveraextract when compared to bulktinoxide (SnO2). The possible advantage and limitations of this result will be discussed. It is hoped thatthis study would lead to the establishment of nanomaterial compounds that could be used to formulatenew and more potent antimicrobial drugs

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of natural origin. Antibacterial activity of Alovera extracts waschecked against these gram positive isolates of Staphylococcus aureus, Escherichia Coli E, Salmonella Typhi,Streptococcuspyogenesand gram negative isolates of Pseudomonas Aeruginosa. They observed thateffective anti-bacterial and anti-fungal activities for SnO2 nanoparticles, particularly for Streptococcuspy ogenes micro organisms and antifungal microorganisms of Aspergillusniger, Mucorindicus microorganism than bulk SnO2. Here there report the findings of the use ofnanoparticles of SnO2 with Aloe vera for anti-bacterialand anti-fungal properties. These studies highlight thesize modified inorganic salt that modulates thebiological property of a natural compound. Furtherstudies to optimize the ratio and concentration of SnO2nanoparticles for maximum potency will be conducted.It is hoped that this study would lead to theestablishment of some compounds that could be usedto formulate new and more potent antimicrobial drugsof natural origin. Studies are in progress to identify thebioactive compound and to evaluate the mechanismsof action of Aloveraextracts on some organismsassociated with human diseases[9].

INHIBITORY ACTIVITY

Various concentrations of 2ml. 4ml, 6ml, 8ml and 10mls were prepared from the extract. Samples of palm oil and palm kernel oil were obtained fresh from the source and their physicochemical properties determined. The results obtained were kept as references. The oil samples were then blended with the various concentrations of the plant extract and times varied from 24hours to 120hours.Results obtained from the physicochemical analysis of blended oil samples showed that the effects of the plant extract at various concentrations was distinctively noticed after a period of 72hours of treatment. Results obtained from acid value analysis of the blended oil increased from 7.6mg/KOH/g to a constant value of 8.5mg/KOH/g at 72hours.Peroxide value of 1.6mmol/kg increased steadily to a constant value of 2.1mmol/kg.Value of free fatty acids of 4.1 in the control was steady at the value of 4.7 after 72hours.Iodine value of 58.4mg/g in the control increased steadily to a constant value of 58.4mg/g in the bend after 72hours.Saponification value of 147 increased to a steady value of 151 in the blend even after 48hours.These results indicated that the concentrations of the extract used has some degree of significance and points to the plausibility of using natural sources as antioxidants. Foods, oils and other allied industries may be potential beneficiaries of this botanical resource[10].

ANTI-DIABETIC

Delayed wound healing is one of the complications of diabetes mellitus. The present study was performed to investigate theeffect of Aloe vera oral administration on open wounds in type 2 diabetic rats. Full thickness open wounds (1.5 X1.5 cm) were createdunder general anesthesia on the backs of the rats. These rats were divided into two group, a control group (Group C) and an Aloe veraoral administration group (Group A). Each wound area was measured on days 1, 2, 4 and 8 postwounding. The stages of wound granulationtissues were evaluated histopatho logically. The expression of transforming growth factor (TGF)-β1 and vascular endothelialgrowth factor (VEGF) were determined by immunohist ochemically. The wounds were significantly contracted in Group A on days 2,4 and 8 postwounding. Histological results revealed that the inflammatory cell infiltration, angiogenesis, extracellular matrix depositionand epithelialization were promoted in Group A, respectively. The immunohistochemical results revealed that both TGF-β1 and VEGFprotein-positive cells increased in Group A on day 4 postwounding. We concluded that Aloe vera oral administration accelerated woundhealing in type 2 diabetic rats[11].

One of the complications of diabetes mellitus is diabetic ulcer. Diabetic ulcer is commonly infected by infectious agents, especially methicillin-resistant Staphylococcus aureus (MRSA). This study aimed to evaluate the potential effects of alcoholic extracts of Aloe vera, Apiumgra veolens, and Sauropus and rogynuson promoting wound healing in a diabetic wound infected with MRSA. A total of 60 male Sprague-Dawley rats (6 months old, weighing 250-300 g) were injected with 65 mg/kg body weight of streptozotocin to induce diabetes. On day 7, the backs of the rats were shaved, and two circular wounds (4 mm in diameter) were created on their back, which were infected with MRSA. The rats were divided into six groups: Group I = control, Group II = treated with cream base without extract, Group III = treated with 2% A. veracream, Group IV = treated with 2% A. graveolenscream, Group V = treated with 2% S. androgynuscream, and Group VI = treated with 2% A. vera+ 2% A. graveolens+ 2% S. androgynuscream. The wounds were treated twice a day for 14 days. The data were collected on days 7 and 14. The results showed that all three herbal extracts and their combination decreased

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wound area and percentage of the wound, increased tensile strength of skin, collagen deposition, vascular endothelial growth factor expression, and skin thickness, and depressed the C-reactive protein profile and cyclooxygenase-2 expression. Concluded with A. vera, A. graveolens, and S. androgynuscreams can be used as herbal therapies against diabetic wounds infected with MRSA, both as a single and combination treatment[12].

BURNS EFFECTS

Burn injury is a major cause of death and disability worldwide. Healing of burn wounds still remainsa challenge to modern medicine. The aim of the present study was to evaluate the efficacy of Aloe vera (AV)gel in the treatment of deep second-degree burn wounds and compare its results with those of silversulfadiazine (SSD) in dogs. A standard deep second-degree burn wound was produced, five dogs, each doghas three groups, AV gel, SSD 1% cream and control (no topical therapy at all). The efficacy of treatment wasassessed based on the healing percentage of the wound, time to complete wound healing and the degree ofinflammation and exudation. Wound contraction was higher in the AV group than both SSD and the controlgroup. It was significantly higher in the AV group than the control group on days 18, 21 and 24, 27 whilesignificantly higher than the SSD group on days 21 and 24. The mean times for wound complete closure were22.9 ± 2.56 and 25.7 ± 2.31 days for AV and SSD, respectively, being significantly shorter for AV. Clinically, inflammatory reaction and exudation were less in AV group than the SSD group and control group. Concluded using topical AV will accelerate the burn wound healing process in comparison with both the control and SSDgroups and can be used as an adjunctive or alternative agent in the future[13].

The corneal alkali-burn injury model was established unilaterally in Wistar rats by filter paper saturated with 0.01 M NaOH contacting the eyes for 45 seconds. Rats were divided into four groups: normal control (NC), normal AV (NAV), diabetic control (DC), and diabetic AV (DAV). NAV and DAV groups were treated with AV gel eye drops four times daily, and NC and DC groups were treated with normal saline for 3 days. Corneal epithelial wound closure and degree of edema were recorded using slit lamp and optical coherence tomography at 0, 24, 48, and 72 hours postwounding. Histological examination was conducted to evaluate the degree of inflammation and the healing effect. Result concluded that corneal epithelial wound healing was better in the NAV group than in the NC group, and it was significantly higher in the DAV group than in the DC group (P,0.05). In comparison to the DC group, DAV treated with AV demonstrated a marked reduction in edema at 48 and 72 hours. Histologically, corneal re-epithelialization was complete and higher in DAV group than that in DC group; moreover, the inflammatory cells were increased in DC group than DAV group (P,0.05). This study demonstrated the efficacy of AV for enhanced corneal re-epithelialization, as well as reduced inflammatory response after alkali burn in rats; therefore, it could be useful as a therapy for diabetic keratopathy[14].

PROTECTIVE EFFECT

Bisphenol A (BPA), an endocrine-disrupting chemical, has been considered as a possible risk factorfor fertility because it induces testicular toxicity. Thus, there sought to analyze the effect of Aloe veraas plant withantioxidant properties on tissues and oxidative stress parameters in male rats.In this experimental study, 50 adult male Wistar rats (200 ± 20 g) have been used in this 56 day study. Animals were completely randomized and divided into five groups: A1 (control), A2 (vehicle control),A3 (Aloe veragel 300 mg/kg), B1 (BPA 20 µg/kg bw) and B2 (Aloe veragel+ BPA). At the end of the study, the ratswere anesthetized and 2 ml blood samples were obtained for evaluation of oxidative stress markers. Also, bothtestes were collected for histological examinations. In which BPA significantly decreased ($P<0.05$) body and testis weights. Seminiferous tubule diameter (STD) andheight of seminiferous epithelium (HSE), were significantly decreased ($P<0.05$) in the groups receiving BPA ascompared to the control. There was also a reduction in the quantity of spermatocyte and spermatids. Moreover,malondialdehyde (MDA) increased and thiol protein (G-SH) decreased. But, co-administration of Aloe verawith BPA accelerated the total antioxidant capacity and testicular tissue structure healing.According to our findings, Aloe veragel extract can overcome the damaging effects of BPA on thereproductive system of rats and protects rats' testes against BPA-induced toxicity[15]

ANTI FUNGAL

The present study was undertaken to screen potential antifungal activity of extracts of EmblicaofficinalisGaertn. fruits, Aloe veraL. leaves and VitexnegundoL. leaves. The plant extracts were prepared by sequential cold maceration

method using hexane, ethylacetate, methanol and distilled water as a solvent. Extracts were evaluated for theirantifungal activity against As pergillusniger,Aspergillusflavus,Aspergillusoryzae, Penicilliumchry sogenum and Trichodermaviridae by using agar well diffusion method. All the plants showed maximum antifungal activity against Trichodermaviridae. While Penicilliumchry sogenumwas most resistant fungal strain against plantextracts used in the study. Aqueous extracts of all the plants showed maximuminhibitory action as compared to other extracts. Presence of various phytochemicals in the extract will lead to contribution in the antifungal activity. The knowledge of extentand mode of action for antifungal activity of specific compounds, present in the plant extracts, may lead to the successful utilization of such natural compounds for treatment of infections caused by pathogenic fungi[16].

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