

ALOE VERA PLANT: REVIEW WITH SIGNIFICANT PHARMACOLOGICAL ACTIVITIES

PAULOMI CHATTERJEE^{*1}, BODHISATTWA CHAKRABORTY² AND SUBHANGKAR NANDY³

¹M.Pharm in Pharmacology, Quality Assurance Coordinator, Emami, (W.B.) India ; ²M.Pharm in Pharmacology, Technical Associate, Indian Pharmacopoeia commission, Ghaziabad, (W.B.) India ; ³M.Pharm in Pharmacology, Territory Manager, Medley, Osteokare Division, Siliguri, (W.B.) India.
Email : bchakraborty303@gmail.com

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ABSTRACT

Aloe vera is an herb distributed throughout the world. The herb is used internally to combat most digestive problems, including constipation, poor appetite, colitis, irritable bowel syndrome as well as, asthma, diabetes, immune system enhancement, peptic ulcers. A scrutiny of literature revealed some notable pharmacological activities of the plant such as anti-inflammatory, antiviral and antitumor, moisturizing, anti-aging effect, antiseptic, enhance immune system, hypoglycemic, cytotoxic, antiulcer and antidiabetic effects, antibacterial effect, antioxidant, cardiovascular effect. The present review is an attempt to highlight the various ethnobotanical and traditional uses as well as pharmacological reports on Aloe vera.

Keywords: Aloe vera, Ethnobotanical uses, Pharmacognosy, Pharmacological activities.

INTRODUCTION

Aloe vera has been used for medicinal purposes in several cultures for millennia: Greece, Egypt, India, Mexico, Japan, and China [1]. The therapeutic claims made for Aloe vera range over a broad list of conditions, as do the Pharmacological activities associated with it. Most of these claims are based on historical use rather than hard evidence. Different parts of the plant are employed in traditional management of diverse veterinary and human diseases [2]. The herb is used internally to combat most digestive problems, including constipation, poor appetite, colitis, irritable bowel syndrome as well as, asthma, diabetes, immune system enhancement, peptic ulcers [3]. Aloe is used externally for the treatment of skin irritation, burns, scalds, sunburn wounds, eczema, psoriasis, acne, dermatitis, ulcers, to stimulate cell regeneration. The plant is also used in the treatment of healing properties, effects on skin exposure to UV and gamma radiation, anti-inflammatory, antiviral and antitumor, moisturizing, anti-aging effect, antiseptic, enhance immune system, hypoglycemic, cytotoxic, antiulcer and antidiabetic effects, antibacterial effect, antioxidant, cardiovascular effect [4,5,6 and 7].

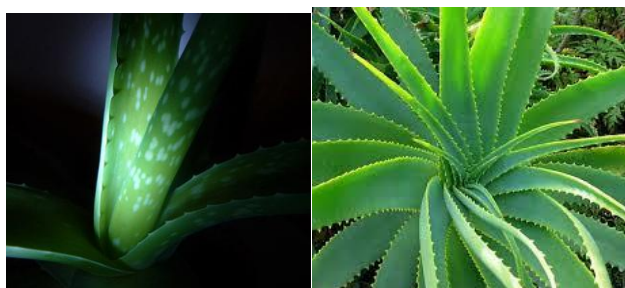


Figure 1: Represents *Aloe vera* plant

CHEMICAL CONSTITUENTS OF PLANT

There are over 100 active biologic constituents found within aloe. The plant is a rich source of many natural health-promoting substances including:

Anthraquinones/anthrones

Aloe-emodin, aloetic-acid, anthranol, aloin A and B (or collectively known as barbaloin), isobarbaloin, emodin, ester of cinnamic acid.

Vitamins/Minerals

Vit C, A, E, B vitamins, B-carotene, Zinc, Calcium, Copper, Magnesium, Manganese, and Phosphorous.

Enzymes

At least five different enzymes have been identified and likely more are contained within.

Amino Acids

Twenty-two amino acids are found within aloe.

Plant sterols

4 plant steroids (campesterol, cholesterol, β -sitosterol)

Polysaccharides

Including B1-3 and B1-4 Glucomannans known for their immune stimulating effects. Based on its constituent make up, aloe has a wide array of applications.

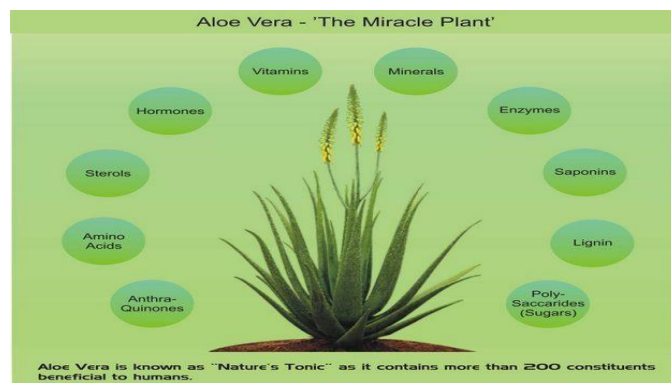


Figure 2: Represents active constituents of *Aloe vera* plant

TRADITIONAL AND ETHNOBOTANICAL USE

The *Aloe vera* exudate is a transparent, slippery mucilage or gel produced by the thin-walled tubular cells in the inner central zone (parenchyma) of the leaf. The raw "gel" resembles colorless gelatin with hair-like connective matrices and is also sometimes called "juice." In antiquity, this mucilage was applied to inflamed skin and during the 20th century it was used on radiation burns. The bio active compounds are used as astringent, haemostatic, antidiabetic, antiulcer, anti-septic, antibacterial, anti-inflammatory, antioxidant and anticancer agent and also, effective in treating

stomach ailments, gastrointestinal problems, skin diseases, constipation, radiation injury, wound healing, burns, dysentery, diarrhoea and in the treatment of skin diseases. Currently the plant is widely used in skin care, cosmetics and as nutraceuticals. In the present study we focus on some of the phytochemical, pharmacological and traditional properties of Aloe vera [8, 9 and 10].

PHARMACOLOGICAL ACTIVITIES

Following the folk and traditional uses of the plant, it has been investigated scientifically to validate the potential of plant in cure of variety of ailments. The pharmacological activities of *Aloe vera* are described below:

ANTITUMOR ACTIVITY

Antitumor activity of 50% ethanol extract (100 mg/kg) of *Aloe vera* was evaluated against Ehrlich ascites carcinoma (EAC) tumor in mice. The effect of *Aloe vera* on the growth of transplantable ascites tumor, body weight of EAC bearing hosts and simultaneous alterations in the hematological profile, serum (ALT, AST, LDH, ALP and glucose) and liver biochemical parameters (lipid peroxidation, GSH and antioxidant enzymes) were estimated. The *Aloe vera* showed decrease in abdominal circumference and body weight of EAC tumor bearing mice. Hematological profile reverted towards normal levels in extract treated mice. Treatment with *Aloe vera* restored the serum biochemical parameters towards normal levels and decreased the levels of lipid peroxidation and increased the levels of reduced glutathione and other antioxidant enzymes (SOD, CAT and GPx). The 50% ethanol extract of *Aloe vera* exhibited antitumor effect by modulating lipid peroxidation and augmenting antioxidant defense system in EAC bearing mice [11].

ANTI-ULCER ACTIVITY

This study was performed to determine the effects of Aloe vera on indomethacin induced ulcers in rats. Aloe vera showed statistically significant anti-ulcer activity comparable to standard drug omeprazole. The mean ulcer indexes of two drugs are formed to be statistically significant. Therefore, the results were suggestive of anti ulcerogenic activity of *A. vera*. However, the cellular mechanisms for these actions remain to be established. [12]

ANTIVIRAL ACTIVITY

In this study we tested the antiviral activity of a crude hot glycerine extract of Aloe vera gel which was grown in Bushehr (Southwest of Iran) against HSV-2 replication in Vero cell line. The extract showed antiviral activity against HSV-2 not only before attachment and entry of virus to the Vero cells but also on post attachment stages of virus replication. Therefore, compounds of Aloe vera from Bushehr could be a good candidate as a natural source. [13]

ANXIOLYTIC ACTIVITY

Aloe vera was evaluated for CNS activities in mice and different behavioral activities for anxiety and depression were tested on Exploratory activity, Open field test, Swimming – induced Depression test, Stationary Rod, Cage Crossing and Inclined Plane test. Aloe vera was administered orally in both sexes of mice and was found to cause significant depression in general as well as exploratory behavioral profiles. The results revealed that Aloe vera caused reduction of Exploratory and Locomotor activities along with the significant decrease in traction in an inclined plane test. The results suggest that Aloe vera may have anxiolytic potential with sedative action. [14]

HYPOLIPIDAEMIC EFFECT

The effect of diabetes mellitus on lipid metabolism is well established. The present study was designed to examine the potential antihyperlipidaemic efficacy of the ethanolic extract from Aloe vera leaf gel in streptozotocin (STZ)-induced diabetic rats. Oral administration of Aloe vera gel extract at a dose of 300 mg/kg bodyweight per day to STZ-induced diabetic rats for a period of 21 days resulted in a significant reduction in fasting blood glucose, hepatic transaminases (aspartate aminotransferase and alanine

aminotransferase), plasma and tissue (liver and kidney) cholesterol, triglycerides, free fatty acids and phospholipids and a significant improvement in plasma insulin. In addition, the decreased plasma levels of high-density lipoprotein-cholesterol and increased plasma levels of low-density lipoprotein—and very low-density lipoprotein-cholesterol in diabetic rats were restored to near normal levels following treatment with the extract. [15]

HYPOGLYCAEMIC EFFECT

The present study aimed to evaluate the antidiabetic activity of Aloe vera ethanolic extract in induced hyperglycemic and normal rats. In the induced hyperglycemic experiment twenty rats were divided into 4 groups. They were fasted for 18 hours and then injected intraperitoneally with 2 mg/kg Body weight (B wt) of 50% glucose solution. The first group served as a control, the second was administered orally with 10 ml/kg B wt glibenclamid (hypoglycemic drug) and the other two groups were given 100 and 500 mg/kg B wt of Aloe vera extract. The plasma glucose level was determined after 1, 2 and 4 hours following glucose loading. In the normoglycemic experiment, fifteen rats were divided into three groups; one as control and the other two were given 100, 500 mg/kg Bwt Aloe vera extract orally. The extract was given for 6 days. Clinical signs, body weight and plasma glucose level were recorded. The results in the hyperglycemic experiment revealed highly significant decrease ($P < 0.01$) in plasma glucose in the group received 500 mg/kg Bwt of Aloe vera ethanolic extract. However, the reduction in plasma glucose level at a dose of 100 mg/kg B wt Aloe vera extract and glibenclamide was similar. [16]

HYPOGLYCEMIC AND ANTI ATHEROGENIC EFFECT

Diabetes is a metabolic syndrome characterized by hyperglycemia, hypercholesterolemia and hypertriglyceridemia. Hence, there is a need to search the anti diabetic drugs which apart from lowering the blood glucose levels can also modify the atherogenic lipid profile without producing many side effects. Oral administration of Aloe vera leaf extract for 21 days in alloxan induced diabetic rabbits produced a significant reduction in fasting blood glucose levels and HbA1c in our study. Also there was significant decrease in serum levels of triglycerides (TG), total cholesterol (TC), low density lipoprotein cholesterol (LDL-C) and a concomitant increase in high density lipoprotein cholesterol (HDL-C) in Aloe vera treated diabetic rabbit indicates the potential of Aloe vera as anti diabetic drug. The significant decrease in 'Atherogenic index' in Aloe vera treated group shows its protection against cardiovascular diseases. [17]

EVALUATION OF THE ANTIFUNGAL AND ANTIOXIDANT

The antifungal activity was determined by the agar-well diffusion method against plant and human fungal pathogens. The methanol and ethanol portions of the extracts studied were more bioactive than ethyl acetate portion. It was also observed that the activity was more pronounced on plant pathogen than human pathogen except *Candida albicans*. This is an indication that the extract has the potential to treat plant fungal infections. The Aloe extract showed the significant antioxidant activity by the DPPH radical scavenging method. Therefore, the Aloe extract provided as natural antioxidant has been used in health foods for medical and preservative purposes. [18]

WOUND HEALING

Wounds are major cause of physical disabilities. Wound healing consists of orderly progression of series of events that establish the integrity of the damaged tissues. Aloe Vera leaves pulp of *Aloe arborescens* species is used for medicinal purposes, including treatment of constipation, colitis, asthma, irritable bowel syndrome, diabetes, peptic ulcer, inflammation, heart burn, stress etc. The present study was undertaken on experimental evaluation of Aloe Vera leaves pulp on wound healing activity through topical route on excision wound model. The activity was compared with standard drug Povidone Iodine ointment (5% w/w). Aloe Vera leaves pulp was found to have better and faster wound healing effect than standard drug Povidone Iodine ointment on excision wound model. [19]

IMMUNOHISTOCHEMICAL STUDY

Aloe vera is used worldwide for several medical purposes as alternative medicine. There are positive and negative reports on the hypoglycaemic effects of this plant. From previous acute studies, *Aloe* leaf gel and pulp extracts lead to significant decreases in blood glucose in neonatal streptozotocin treated type-II diabetic rats, whereas lowering of blood glucose during chronic treatment with the same extracts was statistically insignificant. Here we try to detect whether *Aloe* leaf gel and pulp extracts affect pancreatic β -cells. Using type-II diabetic rats, the immunoreactivity of β -cells of the islets of Langerhans did not differ among treatments of control, glibenclamide-, *Aloe vera* leaf pulp- and gel extract-treated rats. These results suggest that treatment of diabetic rats with *Aloe vera* gel or pulp or glibenclamide has no beneficial influence on the pancreatic β -cells in type II diabetes. [20]

ANTIBACTERIAL ACTIVITY

The objective of the present study was to evaluate the antibacterial activity of *Aloe barbadensis* Miller (*Aloe Vera*) by using agar diffusion assay and gel filtration chromatography. The bacterial strains used in this research work were *Escherichia coli*, *Bacillus subtilis*, *Salmonella typhi*, *Pseudomonas*, *Klebsiella pneumoniae*, *Staphylococcus epidermidis*. *Aloe Vera* plant leaves and gel were macerated in different organic solvents including ethanol, methanol and distilled water. Then, by using agar diffusion assay antibacterial activity was estimated. The *Aloe Vera* extract of Methanol showed the maximum antibacterial activity as compared to other solvent extracts. [21]

ANTIOXIDANT PROPERTY

The purpose of this study was to evaluate the ability of aqueous extract of *Aloe vera* on oxidative damage and Anion Exchanger 1 (AE1, also known as Band 3) expression in human erythrocytes exposed to the water soluble free radical initiator 2,2'-azobis-2-amidinopropano dihydrochloride (AAPH). In addition, total phenolic compounds in the extracts were determined as catechin equivalent and the various antioxidant activities were compared to natural and synthetic standard antioxidants such as BHA and ascorbic acid. Since *Aloe vera* extract did not cause a consumption of the cytosolic antioxidant, glutathione (GSH) when it was direct incubated with GSH in basic aerated aqueous solution, this indicates that *Aloe vera* extract does not proceed auto oxidation at this experimental condition. [22]

NEPHROPROTECTIVE ACTIVITY

In the present study, single oral 100–200 mg/kg/day of the leaf aqueous extract of *Aloe barbadensis* were studied for their protective effects in gentamicin and Cisplatin-induced nephrotoxic Wistar rats for 7 days and 5days respectively. In the gentamicin nephrotoxic rats, 100–200 mg/kg/day significantly attenuated elevations in the serum creatinine, total protein and blood urea nitrogen levels in dose related fashion and no treatment related effect on uric acid and ions, as well as, attenuation of gentamicin-induced tubulonephrosis. Similar effects were also recorded in the Cisplatin model of acute renal injury. Results suggest that the nephroprotective effect of *Aloe barbadensis* could be due to the inherent antioxidant and free-radical-scavenging principle(s) contained in the extract. [23]

THE GENOTOXIC AND ANTIGENOTOXIC EFFECTS

The genotoxic and antigenotoxic effects of *Aloe vera* leaf extract were investigated using the chromosome aberrations test for the bone marrow cells of rats, sister chromatid exchanges and micronucleus and CAs tests for human lymphocytes, and the Ames Salmonella/microsome test system. In the bone marrow cells of rats, AV extract significantly induced structural and total CAs at all concentrations and in all treatment periods. In human peripheral lymphocytes, AV did not increase the mean SCE; however, it significantly induced the MN frequency and structural CAs. In addition, *Aloe vera* showed a cytotoxic effect by decreasing the replication index (RI), mitotic index (MI), and nuclear division index in human lymphocytes and by decreasing

the MI in the bone marrow cells of rats. *Aloe vera* did not decrease the genotoxicity or cytotoxicity of urethane in the bone marrow cells of rats or in the mitomycin-C in human lymphocytes. [24]

CONCLUSION

In recent years, ethnobotanical and traditional uses of natural compounds, especially of plant origin received much attention as they are well tested for their efficacy and generally believed to be safe for human use. They obviously deserve scrutiny on modern scientific lines such as physicochemical characterization, biological evaluation, toxicity studies, investigation of molecular mechanism of action(s) of isolated phytoprinciple and their clinical trials. These are necessary classical approaches in search of new lead molecule for management of various diseases. Many Indian herbs are being used in traditional practices to cure various human ailments. *Aloe vera*, has an important place among such wound healing medicinal plants, it can also be used in treating inflammation, pain, ulcer and antihyperglycaemic agent. Furthermore, in future study, the isolated principles from *Aloe vera* needs to be evaluated in scientific manner using various innovative experimental models and clinical trials to understand its mechanism of action, in search of other active constituents, so that its other therapeutic uses can be widely explored.

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