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PHARMACOLOGICAL POTENTIAL OF ALOE VERA AND SAFETY STUDIES: AN OVER VIEW

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ABSTRACT

Aloe vera belongs to the family Liliaceae. There are approximately 360 species of *Aloe vera*. It is being widely use in the field of medicine now a day. It is extensively used in Ayurveda preparations for liver defense and overall weakness. *Aloe Vera* comprises numerous growth factors such as certain amino acids and sterols.Mannose-6-phosphate is the principal sugar in the gel of *Aloe* which causes wound restoration. However there are various pharmacological actions of *Aloe vera* such as anti-inflammatory, antitumor, antihyperlipidemic, anti-viral and antimicrobial etc. There are no any major withdrawal adverse reactions of *Aloe vera* reported in previous studies. *Aloe vera* is generally very well tolerated. These studies disclosed that *Aloe vera* is a good source of medicinal active components; hence it is encouraging to explore its new therapeutic use.

Keywords: Medicine, *Aloe vera*, growth factors, antitumor, antimicrobial

1- INTRODUCTION

Aloe vera, also known as Aloe barbadensis Miller belongs to the family Liliaceae. The name *Aloe vera* derives from two words i.e. Alloeh which means "shining bitter substance" and vera, means "true". There are about 360 species of *Aloe vera* [1, 2]. It is a cactus-like plant, grows readily in hot, dry climates and contains gel at the center which

cosmetically important part of this plant [3]. *Aloe vera* treats a number of conditions because of its anti-inflammatory, anti-arthritic, anti-viral, anti-tumor, anti-bacterial and hypoglycaemic effects [4, 5]. *Aloe vera* has been also used for medicinal purposes in several countries like Greece, Egypt, India, Mexico, Japan, and China [6]. *Aloe vera* contains 75 active constituents: vitamins, enzymes, minerals, sugars, lignin, saponins, salicylic acids, and amino acids as shown in Table 1 [7-9]. There is contradictory information in the literature about the shelf life of *Aloe* under changing storage conditions [10]. The aim of this review is to summarize the pharmacological activities of *Aloe vera* and to provide the evidence for its clinical effectiveness.

Table 1: Active components of *Aloe vera*

Compoenents	
Anthraquinones	Aloin, barbaloin, isobarbaloin, anthranol, aloetic acid, aloe-emodin, ester of cinnamic acid, resistannol, chrysophannic acid and emodin
Saccarides	Cellulose, glucose, aldopentose, L-rhamnose and mannose
Vitamins	Choline, folic acid, alpha-tocopherol, beta-carotene, B1, B2 and B6
Non-essential amino acids	Histidine, arginine, aspartic acid, glutamic acid, proline, glycine, tyrosine, alanine and hydroxyl proline
Inorganic compounds	Iron, magnesium, copper, potassium sorbate, chromium, zinc, manganese, chlorine, sodium and calcium
Enzymes	Carboxypeptidase, alkaline phosphatase, lipase, catalase, amylase, oxidase and cyclo-oxygenase
Essential amino acids	Methionine, phenylalanine, isoleucine, leucine, valine, threonine and lysine
Miscellanoeous	Arachidonic acid, salicylic acid, gibberellin, uric acid, lignins, beta-sitosterol, steroids, cholesterol and triglycerides

2- Applications of *Aloe vera* in traditional medicine system:

Aloe vera is commonly used for a variety of pharmacological and medicinal aspects in traditional medicine system. From thousands of years, it is well known in Greek, Egyptians, Roman, Indian, Arab and Ayurveda cultures for purgative, appetite-stimulant and cough, anthelmintic, colds, debility, piles, dyspnea, asthma and jaundice. It is extensively used in Ayurveda preparations for liver defense and general weakness. Egyptians uses the *Aloe vera* to rebuild wounds, release itching and inflammation [11].

3- Current pharmacological findings:

3.1-Anti-inflammatory activity:

The aqueous and chloroform extracts of the *Aloe vera* gel contain numerous growth factors such as certain amino acids and sterols, having potential to cause anti-inflammatory action by inhibiting the prostaglandin synthesis against carrageenan induced-edema [12], inflammatory bowel disease [13], irritants [14], UV-induced erythema [15], croton oil-induced ear

swelling [16], psoriasis [17], delayed type hypersensitivity [18] and ulcer [19].

3.2- Anti-tumor activity:

Aloe vera compounds i.e. three anthraquinones (aloesin, aloe emodin and barbaloin) produced their chemo-preventive action by modulating the antioxidant and detoxification enzyme activity levels, as they are one of the indicators of tumorigenesis [20, 21].

3.3- Anti-fungal activity:

Aqueous exract of *Aloe vera* significantly inhibited the growth of pathogenic fungi i.e. *Candida albicans, Candida tropicalis, Aspergillus flavus*, *Aspergillus glaucus*, *Trichophyton mentagrophytes, and Trichophyton rubrum* [22-24]. Two components of *Aloe vera* i.e. aloe, aloe-emodin showed their activity against *Cladosporium cucumerinum* and *Colletotrichum gloeosporioides* [25].

3.4-Anti-viral activity:

A variety of active phytochemicals and volatile essential oils had been identified to have antiviral activity. Different types of anthraquinones from extracts of *Aloe vera*, *Rhamnus purshianus*, *Rhamnus frangula*, *Rheum officinale* and *Cassia angusti folia* were considered to be active against HSV-1. Anthraquinones caused the inhibition of viral DNA and RNA replication to produce antiviral effect [26, 27].

3.5- Anti-bacterial activity:

Aloe liquid has an antimicrobial efficacy against Gram positive and Gram negative bacteria. The antibacterial agents of *Aloe vera* gel were considered to kill or reduce the growth of *Escherichia coli, Propioni bacterium acne, Staphylococcus aureus, Streptococcus pyogenes, Pseudomonas aeruginosa, Helicobacter pylori, Klebsiella pneumonia* and *Salmonella typhi*. *Aloe vera* leaf components like anthra quinones and saponins were observed to have direct antibacterial properties [28, 29].

3.6- Immune modulating activity:

The immunity of the body against infection can be increased by the use of herbal drugs. Many herbal preparations are widely used in the indigenous system of medicines that can enhance the body's immune system. *Aloe vera* is one of the most extensively used healing plants [30].Polysaccharides i.e. acetylated mannan, glucomannan and galactogalacturan isolated from the gel of *Aloe vera* had been identified to have immune-modulatory activity [31, 32].

3.7- Wound healing activity:

Mannose-6-phosphate is the principal sugar in the gel of *Aloe* which caused wound restoration. Wound healing is a complex and

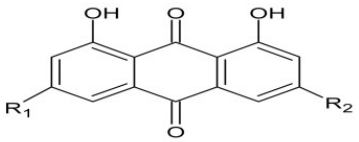
dynamic process. The initial stage of wound healing is the laying down of a provisional matrix. Then formation of granulation tissue and synthesis of collagen and elastin is carried out [33]. *Aloe vera* leaf constituent i-e saponin improved the process of wound healing by influencing the following stages such as inflammation, fibroplasia, collagen synthesis & maturation and wound contraction [34].

3.8- Hypoglycemic and anti-hyperlipidemic activity:

Aloe Vera constituent such as phenol exhibited a hypoglycemic effect by stimulating the loads of insulin discharge and reducing the levels of glycosylated hemoglobin &plasma glucose. Additionally, *Aloe vera* reduced the absorption of glucose from the intestinal mucosa [35, 36]. Saponin and phenolic components of *Aloe vera* extract also exerted the antihyperlipidemic effect by decreasing the levels of total cholesterol, triglyceride and low density lipoprotein [37].

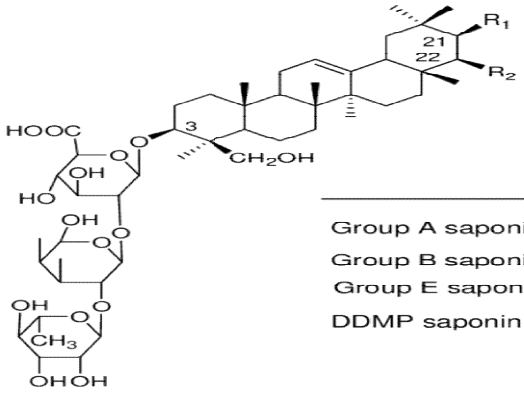
4- Molecular structures of metabolites isolated from *Aloe vera*:

4.1- Anthra-quinones [38]



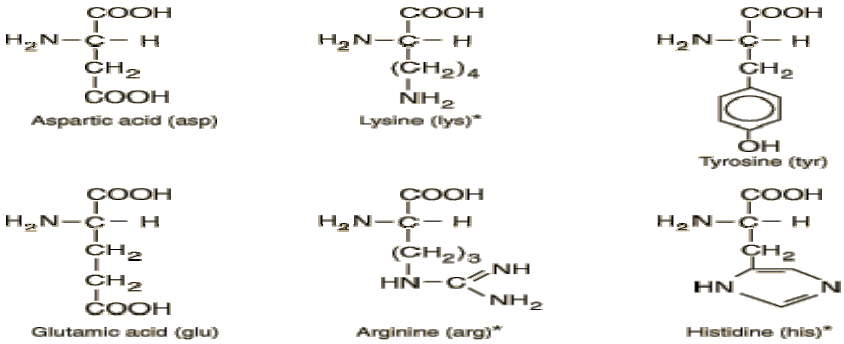
	R1	R2
Aloe emodin	H	CH_2OH
Chrysophanol	H	CH_3
Rhein	H	COOH
Emodin	OH	CH_3

4.2- Saponins [39]

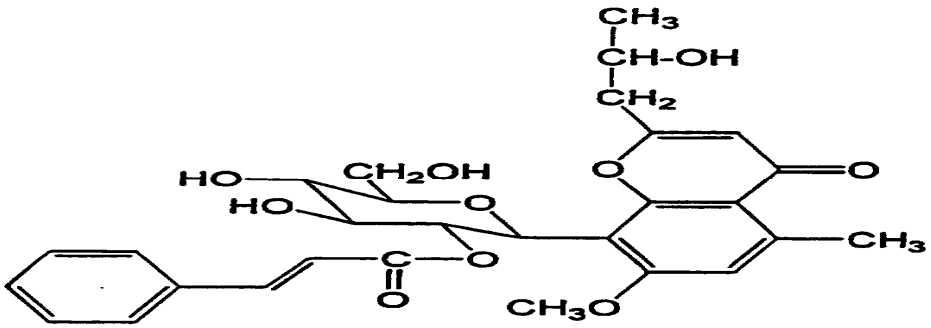


	R_1	R_2
Group A saponin	OH	Disaccharide
Group B saponin	H	OH
Group E saponin	H	=O
DDMP saponin	H	Maltol

4.3- Amino acids [40, 41]



4.4- C-glucosyl-chromone [42, 43]



5- Purposed mechanism of action:

Although, there are various standard oral drug therapies that act on different organs to treat a number of diseases. *Aloe vera* acts alone on all these organs and ameliorates the several diseases as shown in Figure 1:

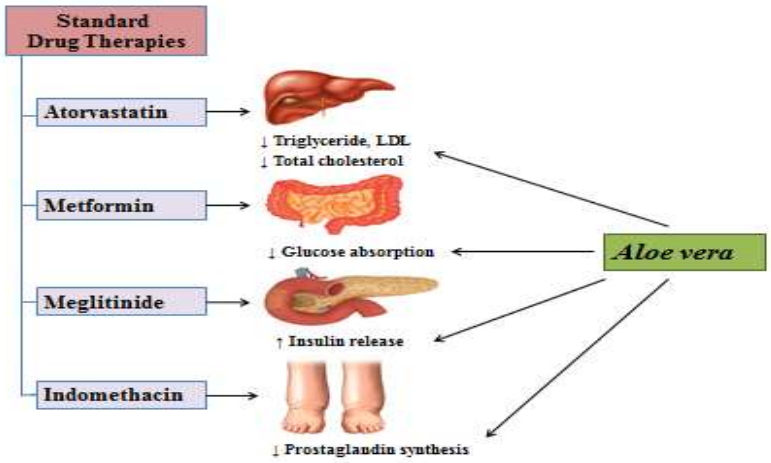


Figure 1: Purposed mechanism of *Aloe vera*

6- Safety studies:

It is manifested from the previous studies that there is no any major withdrawal adverse reaction of *Aloe vera*. Some patients experienced following adverse effects such as burning, mild itching and contact dermatitis but all these adverse effects were reversible. *Aloe vera* is generally safe and well tolerated [44].An acute toxicity study of *Aloe vera* extract was evaluated in mice and rats. *Aloe vera* extract was administered intravenously. LD50 values in mice and rats after the single dose were > 80mg/kg and > 15 mg/kg respectively [45] (Figure 2).

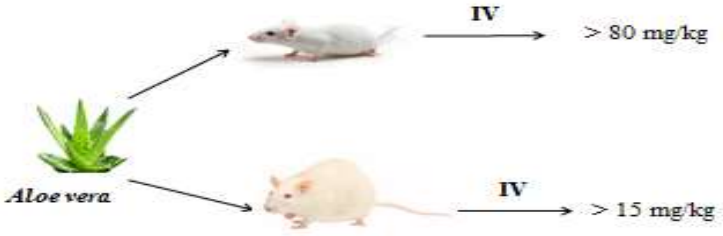


Figure 2: LD50 of *Aloe vera*in mice and rat through intravenous route

7- Products available in market [46-48]

- Aloe indica face scrub (Aloe indica. pvt. ltd) Vedico *aloe vera* hair conditioner (Vedico Bio Labs).
- *Aloe Vera* moisturizing cold cream (Combii Organochem Pvt. Ltd. Okhla, New Delhi, Delhi).
- *Aloe Vera* anti-wrinkle cream (Komal Health Care Pvt. Ltd, Thane, Maharashtra)
- *Aloe Vera* skin gel (Roy & Company, Mumbai, Maharashtra).

8- CONCLUSION

In view of all these points, it is concluded that *Aloe vera* has many pharmacological uses. There are no any major side effects of *Aloe vera*. It is safer and acceptable to use in many ways. There is a great necessity of more clinical research in order to acquire full benefits from this blessing herb.

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