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Review on Extracts and Therapeutic Use of *Aloe vera* in Veterinary Practice

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Abstract: The use of ethno-veterinary practices to treat and control livestock diseases is an old practice in a large part of the world, particularly developing countries where animal health services are still very poor or/and are found scarcely located at urban areas. Ethiopia is the origin and center of diversity for many of medicinal plant species. In the flora of Ethiopia and Eretria, fourty six species of aloe have been described out of which fourty one are endemic or near endemic indicating that they have high degree of endemism in the flora area. This review is prepared to highlight current articles about therapeutic uses of *Aloe vera* plant in veterinary practices. *Aloe vera* is a perennial, drought-resisting, succulent plant belonging to the Alliceae family. The leaf is long triangular sheaf with two external membranes which are green and leathery which contains seventy five conceivably dynamic constituents including vitamins, chemicals, minerals, sugars, lignin, saponins, salicylic acids and amino acids. Extraction of *Aloe vera* gel often involves some processing steps—e.g., crushing, grinding and pressing the entire leaf, or filleting to remove the outer leaf and grinding the gel to produce an aloe juice—followed by various steps of filtration and stabilization. The aloe vera plant has numarious therapeutic effect on animals including: wound therapy, antibiotic, antiviral, antifungal effect, anti-inflammatory. Along with its use *Aloe vera* has also associated side effects like redness, burning, stinging sensation and rarely generalized dermatitis were reported on its topical application.

Key words: Aloe vera · Animal · Antibiotic · Ethno-Veterinary · Therapeutic

INTRODUCTION

Traditional medicine is in practice for many centuries by a substantial proportion of the population of many countries. It is recognized that in some developing countries, plants are the main medicinal source to treat various infectious diseases. Plant extracts represent a continuous effort to find new compound against pathogens. Approximately 20% of the plants found in the world have been submitted to pharmacological test and a substantial number of new antibiotics introduced on the market are obtained from natural or semisynthetic resources [1].

In Ethiopia medicinal plants and knowledge of their use provided a vital contribution to human and livestock health care needs throughout the country [2]. Medicinal plants may control the disease and could be both sustainable and environmentally acceptable, if proper harvesting practices are applied [3]. For generations, the use of ethno-veterinary practices to treat and control livestock diseases is an old practice in a large part of the world, particularly developing countries where animal health services are still very poor or/and are found scarcely located at urban areas [4].

Aloe vera is a succulent plant species of the genus Aloe which is perennial plants that comprise herbs, shrubs and trees. They are recognized by fleshy, strongly cuticularized leaves usually with spiny margins [5]. They are native to main lands of south of Saharan Africa except few species occurring in Arabian Peninsula and on small islands of the insular Africa. Hence, Sub- Saharan Africa, including the island of Madagascar accounts for over 90% of the 450 taxa (species, subspecies or varieties) of the genus *Aloe* known today. It has been suggested that the center of origin for the genus is in the highlands of South East Africa [6].

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The leaf of aloe vera contains three structures which used for different medicinal purpose, the outer layer: is Rind and has a protective function. The middle layer: has a yellow sap which is bitter and contains anthraquinones and glycosides. An inner layer: is clear gel and contains 99% water. *Aloe vera* has been used for medicinal purposes in several cultures in Greece, Egypt, India, Mexico, Japan and China. The therapeutic claims made for *Aloe vera* range over a broad list of conditions, as do the Pharmacological activities associated with it Parthipan *et al.* [7].

Aloe is used externally for the treatment of skin irritation, burns, scalds, sunburn wounds, eczema, psoriasis, dermatitis, ulcers, by stimulating cell regeneration. The aloe vera plant is also used in the treatment of effects on skin exposure to UV and gamma radiation. Plus to that reports also indicted that *Aloe vera* has anti-inflammatory, antiviral and antitumor, moisturizing, antiseptic, enhance immune system, antiulcer and antidiabetic effects, antibacterial effect, antioxidant effects [8].

However, its therapeutic effect in Veterinary practices was not intensively explored and available information also not well reviewed and recorded. Therefore, the main objective of this paper is to highlight latest informations about therapeutic uses of *Aloe vera* plant in Veterinary practices and to review on the extracts and chemical composition of aloe vera plant.

Definition and Historical Background: *Aloe vera* is a perennial, drought-resisting, succulent plant belonging to the Alliceae family. The name, aloe, is derived from the Arabic "alloeh" or Hebrew "halal" meaning bitter shiny substance. It has a vast traditional role in indigenous system of medicine like ayurveda, siddha, Unani and homoeopathy [9]. The aloe plant is the source of two herbal preparations: aloe gel and aloe latex. Aloe gel is often called *Aloe vera* and refers to the clear gel or mucilaginous substance produced by parenchyma cells located in the central region of the leaf. Diluted aloe gel is commonly referred to as *Aloe vera* extract. The gel is composed mainly of water (99%) and mono- and polysaccharides, 25% of the dry weight of the gel [10].

The genus Aloe belonging to family Alliaceae is a succulent herb of 80 - 100 cm in height which matures in 4 - 6 years and survives for nearly 50 years under favorable conditions. *Aloe vera* Linne and *Aloe barbadensis* Miller, is most biologically active among 400 species. This succulent perennial herb has triangular, sessile stem, shallow root system, fleshy serrated leaves arranged in rosette having 30-50 cm length and 10 cm breadth at the base; colour pea-green. The bright yellow tubular flowers, length 25-35 cm, axillary spike and stamens are frequently projected beyond the perianth tube and fruits contain many seeds [11].

History states that Alexander and Christopher Columbus used *Aloe vera* for treating wounded soldiers. According to Hannibal states that war have been fought to obtain control over the growing area in North Africa around 1750 BC. It was described how the whole leaf of *Aloe vera* was used to treat radiation dermatitis in a modern medical paper that was published in 1934. In 20 century many papers were published and reports mainly focused on anti-diabetic, anti-microbial and anti-cancer properties of the whole leaf, gel or juice of the plant [12].

Botanical Classification of *Aloe vera*

***Aloe vera* Is Belonging to the Family:** Xanthorrhoeaceae; Genus: Aloe Species: *Aloe vera,* Common names: *Aloe vera; Aloe vera Linné*; True aloe; *Aloe barbadensis* [13]. In assessing the specifications and particular characteristics of the Aloe plant, they inserted it into a new botanical family, that of the *Aloaceae*. The *Aloaceae* family contains approximately three hundred and fifty varieties of the plant throughout the planet. In South Africa alone, in 1955, a total of 132 species were catalogued. The range spanned from the miniature type like *Aloe aristata* and *Aloe brevifolia*, to one which can be defined as the most beautiful in existence in the world, the *Aloe striata*. Among the larger-sized *Aloes* and those having a cosmetics and curative value, *Aloe arborescens* Miller, *Aloe ferox, Aloe barbadensis* Miller *vera, Aloe chinensis* are the main one [14].

Components of *Aloe vera*

Physical Classification: The leaf is long triangular sheaf with two external membranes which are green and leathery (Figure 1). Inside this tough resistant covering is the gel, which presents itself as a compact, gelatinous mass with a translucent pearly aspect. The outer layer: is called Rind and has a protective function, synthesizes carbohydrates and proteins. The middle layer: has a yellow sap which is bitter and contains anthraquinones and glycosides. An inner layer: is clear gel and contains 99% water, the rest is made of amino acids, lipids, sterols

Fig. 1: *Aloe vera* [17]

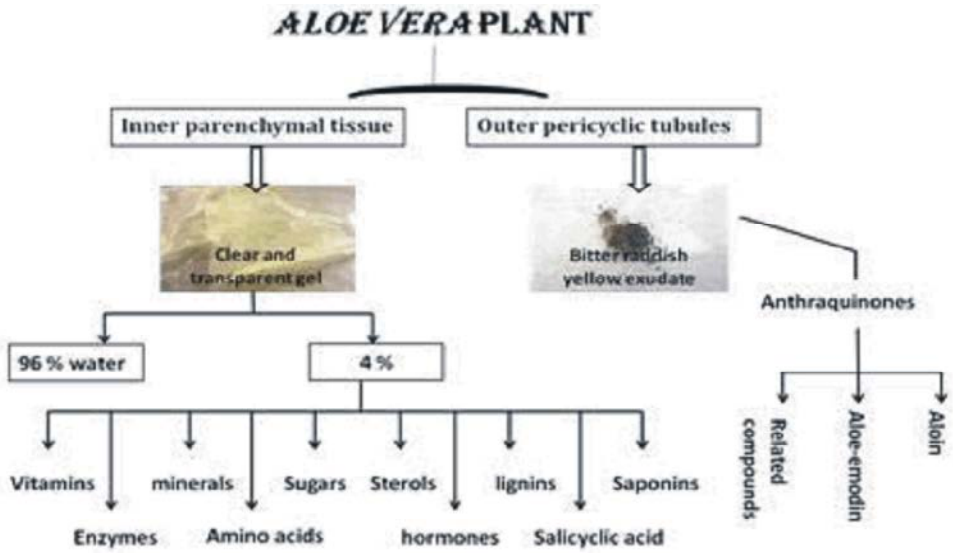

Fig. 2: Component of aloe vera leaf [20]

and vitamins [15]. The vascular bundles located within the leaf pulp, transport, water and minerals from the roots to the leaves; synthesized materials to the roots. The succulent property enables the species to survive in areas of low natural rainfall and other low-water use gardens. The species is hardy, although it is intolerant to very heavy frost or snow. The species is relatively resistant to most insect pests [16].

Chemical Component of Aloe Vera: *Aloe vera* contains 75 conceivably dynamic constituents: vitamins, chemicals, minerals, sugars, lignin, saponins, salicylic acids and amino acids. There are more than 200 mixes found in *Aloe barbadensis*, around 75 of which have natural movement. The noticeable parts are anthraquinones, Aloin, Aloe emodine polysaccharides, catalysts, lessening sugars, natural acids, metallic cations [18]. The ten main areas of chemical constituents of *Aloe vera* include: amino acids, anthraquinones, enzymes, minerals, vitamins, lignins, monosaccharide, polysaccharides, salicylic acid, saponins and sterols. On dry basis, aloe gel contains approximately 55% polysaccharides, 17% sugars, 16% minerals, 7% proteins, 4% lipids and 1% phenolic compounds (Figure 2) [19].

Anthraquinones: Twelve different types of anthraquinones are present in the sap of *Aloe vera*: Aloin, Isobarbaloin, Anthracene, Emodin, Ester of Cinnamonic acid, Chrysophanic acid, Barbaloin, Anthranol, Aloetic acid, Aloe Emodin, Ethereal oil and Resistannol. They act as natural laxatives, painkillers and analgesics and they contain powerful antibacterial, antifungal and virucidal properties [21].

Vitamins: Aloe vera contains numerous vitamins: Vitamins A, C and E (crucial antioxidants that combat dangerous free radicals in the body). Vitamin B & Choline (concerned with the production of energy, amino acid

metabolism and developing muscle mass). Vitamin B12 (responsible for the production of red blood cells) and Folic acid (helps develop new blood cells) [12].

Amino Acids: Amino acids are the building blocks of protein, which manufacture and repair muscle tissue. The human body requires 22 amino acids and needs 8 essential ones. *Aloe vera* provides 20 of 22 required amino acids and 7 of 8essential ones. Such amino acid are: tryptophan, methionine, histidine, cystine, tyrosine, isoleucine, phenylalanine, leucine, arginine, lysine, proline, threonine, valine, glutamine, alanine, glycine, serine, aspartic acid, asparagines, glutamic acid, hydroxyproline. Non-essential amino acids: histidine, arginine, alanine, glutamine, aspartic acid, proline, glycine, hydroxyproline and essential amino acids are: methionine, isoleucine, threonine, phenylalanine, valine, leucine and lysine [22].

Enzymes: Enzymes are natural protein molecules with highly specialized catalytic functions in biochemical reactions produced by all living organisms (microorganisms, plants, animals and human beings). Although like all other proteins, enzymes are composed of amino acids, they differ in function in that they have the unique ability to facilitate biochemical reactions without undergoing change themselves. Some of the most important enzymes in *Aloe vera* are: Peroxidase, Aliiase, Catalase, Lipase, Cellulose, Carboxypeptidase, Amylase and Alkaline Phosphates [23].

Minerals: Aloe vera contains the following minerals: calcium (essential for proper bone and teeth density); manganese (a component of enzymes necessary for the activation of other enzymes); sodium (ensures that the body fluids do not become too acidic or too alkaline); copper (enables iron to work as oxygen carriers in the red blood cells); magnesium (used by nerves and muscle membranes to help conduct electrical impulses); potassium (regulates the acidic or alkaline levels of body fluid); zinc (contributes to the metabolism of proteins, carbohydrates and fats); chromium (necessary for the proper function of insulin, which in turn controls the sugar levels in the blood) and Iron (controls the transportation of oxygen around the body via the red blood cells [23].

Saponins: These form soapy lathers when mixed and agitated with water. They have been used in detergents, foaming agents and contain antiseptic properties [24].

Sugars: The polysaccharides are responsible for the majority of the biological activities observed from the use of the *Aloe vera* plant. However, the biological activities of *Aloe vera* result from a synergistic action of a variety of compounds [25]. The polysaccharides consist of linear chains of glucose and mannose molecules. The major polysaccharides include cellulose, hemicellulose, glucomannans, mannose derivative and acetylated compounds. Acemannan and glucomannan are considered the two main functional components of *Aloe vera*. Acemannan is composed of a long chain of acetylated mannose, i.e.(1, 4)-linked acetylated mannose with molecular weights ranging from 30 to 40 kDa or greater. The anti-inflammatory effect of aloe is a result of mannose-6-phosphate and acemannan. Glucomannan and acemannan were proved to accelerate tissue regeneration, activate macrophages, stimulate the immune system and have antibacterial and antiviral effect [26].

Method of Preparation: The extraction and processing of gel and powder from *Aloe vera* plant have become a big industry worldwide due to applications in the food, medicine and cosmetic industries. Fresh gel can be harvested directly from the *Aloe vera* leaves and stored for future use. When this gel is processed, a watery clear fluid with a light amber color comes out. The quality of extraction is determined by species, growing circumstances (e.g., climate, amount of water, fertilization), time of harvest and method of extraction. Extraction of *Aloe vera* gel often involves some processing steps—e.g., crushing, grinding and pressing the entire leaf, or filleting to remove the outer leaf and grinding the gel to produce an aloe juice—followed by various steps of filtration and stabilization. The stabilization of *Aloe vera* gel is usually obtained by concentrating the gel to reduce water content, or drying the gel to make solid powder. The stabilization also can be achieved by adding preservatives and other additives, e.g., sodium benzoate and citric acid [19].

Therapeutic Use of *Aloe vera*

Antibacterial Effect: In spite of advances in controlling the infection of surgical wounds, bacterial wound contamination is still remains the most common post-operative complication. Presence of infection in wound, in addition to interference with healing process can be resulted in increasing the duration of wound repair, therapeutic period, costs and even morbidity and mortality rate [28]. Various bacterial species isolated from wounds, but *Staphylococcus aureus* is the most frequent

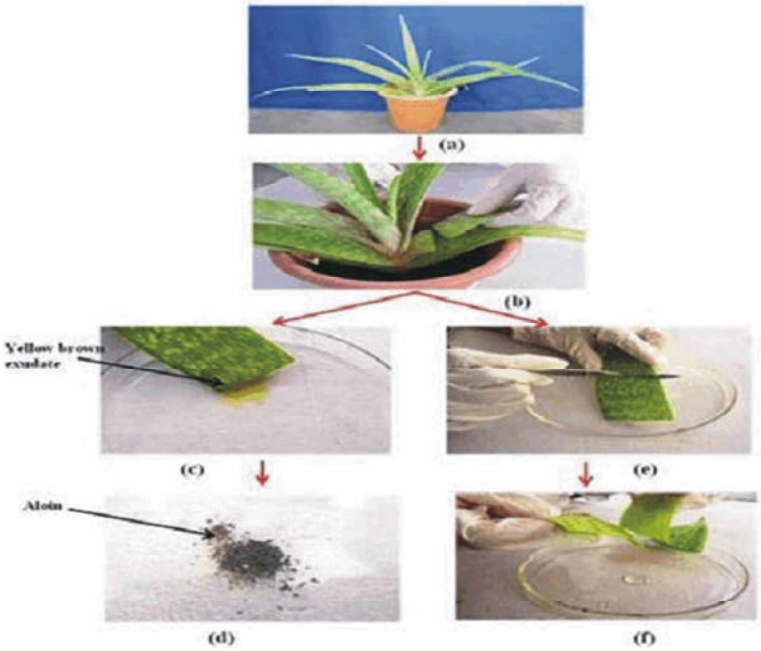

Fig. 3: The picture depicts the extraction of Aloe gel and the anthraquinone 'aloin' (a) Six month old *Aloe vera* plant (b) leaf detached with the help of scalpel. Aloe leaf contain two main constituents: (c) the yellow brown sap exudating from the cut portion and (d) upon freeze drying forms a dark brown powder, called aloin, one of the secondary metabolites of *Aloe vera*. Secondly, (e, f) the Aloe gel, an important constituent of most of the cosmetic products and therapeutics [27].

organism responsible for wound infection. Due to resistance against common antibiotics and its high prevalence, it seems that this bacterium is the best indicator for evaluation of the prevention and treatment infection in wounds [29].

Although mechanisms of *S. aureus* on delayed wound healing is not well identified but the extracellur adherent protein (EAP) is often responsible for inhibiting wound healing. Inflammation and neovascularization are two phases of healing process that would be affected [30].Nowadays, excessive and inappropriate use of antimicrobial drugs have developed the resistant bacteria and difficulty in management of infected wounds, so consideration to new antibacterial agents and least adverse effects seems necessary. Numerous plants are known for use related pharmaceutical activities. *Aloe vera* (*Aloe barbadensis*) is a well known medical plant with historical records that in recent decades is used for its unique properties such as anti inflammatory, Anti oxidant, wound healing promoting, immunomodulatory and anti-microbial activities [31].

The *Aloe* extract was potent against strains of *Mycobacterium* and a strong anti-mycobacterial activity against *M. tuberculosis* as well as antibacterial activity against *P. aeruginosa, E. coli, S. aureus* and *S. typhi*. Study revealed that *Aloe vera* gel exerted strong bactericidal activity against both Gram positive and Gram negative bacteria, producing better growth inhibition zones on highest concentration [32].

As different studiesexplained that component of aloevera: anthroquinones, dihydroxyanthroquinones and also, saponins have been proposed to have direct antimicrobial activity [33]. It has also been recommended as a teat-dip in lactating cows, by intramammary administration for treatment of mastitis or high somatic cell counts and by oral route in all food producing species as adjuvant treatment for a number of afflictions ranging from anaemia to infertility, mastitis and shock [34].

Study shows cow treated with bacterial caused clinical mastitis using the herbal formulation has got cured within 6 to 7 days of treatment. The pH, SCC and EC of milk became normal within 6 days of treatment. The antimicrobial activity of *Aloe vera* is attributed to the anthraquinones (aloin and emodin), flavonoids, tannins (active against MRSA), saponins, p-coumaric acid, ascorbic acid, pyrocatechol and cinnamic acid possess antimicrobial activity against bacteria. Traditional formulation of aloe vera is very effective in the cure of

mastitis. Ethnoveterinary medicine (EVM) a based natural product is an effective alternative to synthetic chemicals in treating mastitis in cattle. The molecular docking study revealed that the active ingredients from *Aloe vera* interact with the proteins that play crucial role in *Staphylococcus aureus* [35].

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, Helicobacter pylori* and *Salmonella typhi* [36]. In addition extracts of Aloe exhibited significant antimicrobial activities against *Salmonella typhi, Staphylococcus aureus* and *E. coli* in poultry [37].

Antiviral Effect: People have been using herbal medicines to cure infectious disease from ancient times. In many studies for finding novel antiviral agents, some plants and algae extracts were tested on different viruses including the herpes viruses. Herpes simplex virus type 2 (HSV-2) is an enveloped virus which causes genital herpes and some other important complications such as encephalitis, meningitis, eye infections and cold sore. This virus can produce latent infection in the host for life and is reactivated by stimulus to cause recurrent infections and lesions. *A. vera* One of the anthraquinones is emodin which has been reported to have antiviral activities to some kind of viruses, such as cytomegalovirus, herpes simplex virus type 1 [38].

A purified sample of Aloe emodin was prepared from aloin and its effects on the infectivity of *herpes simplex virus type 1* and *type 2,* feline rhinotracheitis, feline leukemia, *pseudorabies virus, influenza virus, adenovirus* and *rhinovirus* were seen. The results proved that Aloe emodin inactivated all of the viruses tested except adenovirus and rhinovirus. Electron microscopic examination of anthraquinone-treated herpes simplex virus showed that the envelopes were partially disrupted. These results conclude that anthraquinones are directly virucidal to enveloped viruses [39].Aloe species was the most commonly used herb in rural poultry management as it was used in management of a variety of diseases and Aloe acted as broad spectrum remedy in rural poultry health management. The incorporation of *Aloe vera* in laying hen diet resulted in a significant improvement in egg production. *Aloe vera* fed broilers showed significantly higher haemagglutination inhibition titre values against Newcastle disease [40].

Antifungal Effect: Skin, hair, nail and subcutaneous tissues in human and animal are subjected to infection by several organisms, mainly fungi named dermatophytes and cause dermatophytoses [41]. It is a major public and veterinary health problem reported from different parts of the world and causes great economic loss. It has been reported that animals housed in close proximity to each other for long periods and the presence of infected debris in buildings account for both the higher incidence and the greater infection rate in winter. Although Trichophyton and Microsporum species are the main causes of ringworm in horses, *T. equinum* is most commonly involved. Disease in horses can be quite variable, ranging from mild or subclinical disease to severe lesions mimicking pemphigus foliaceus [42].

There are some evidences that *Aloe vera* can be used as anti-dermatophytic agents, As Antickchi *et al.* [43] reported acceptable results in treating dermatophytosis with *Aloe vera* in calves. Various studies have been done to assess the antimicrobial activity of *Aloe vera* on *Candida albicans* [44]. *Aloe vera* leaf extracts can inhibit both the germ tube formation and hence the growth of *C. albicans*. The purified Aloe protein has been found to exhibit potent antifungal activity against *Candida paraprilosis, Candida krusei, Candida albicans, Aspergillus niger and Aspergillus fumigatus* [45]. *Aloe vera* was reported that the *Aloe* gel inhibited the growth of *Trichophyton mentagrophytes*, while the leaf possesses inhibitory effects on *Candida albicans.* The saponins perform strongly as anti-microbial against bacteria, viruses, fungi and yeasts [46].

Anti-Oxidant Effects: Aloe vera contains substantial amounts of antioxidants including a-tocopherol (vitamin E), carotenoids, ascorbic acid (vitamin C), flavonoids and tannins and it has been suggested that antioxidant action may be an important property of plant medicines used in treatment of various disease. *Aloe vera* possesses enormous antioxidant effect by scavenging both superoxide and peroxyl radicals from the body by generating antioxidant protein, metallothionein, from the skin, which scavenges hydroxyl radicals and prevents suppression of superoxide dismutase and glutathione peroxidase in the skin. Glutathione peroxidise, superoxide dismutase enzymes and a phenolic anti-oxidant were found to be present in *A. vera* gel, which may be responsible for these anti-oxidant effects. *A. vera* enhances the blood quality, probably by allowing the blood to more effectively transport oxygen and nutrients to the cells of body [47].

Therapeutic Application of Aloe Vera on Wound Management: Wounds are physical injuries, which lead to open or broken skin and thus appropriate method for wound healing is essential for the restoration of disrupted anatomical continuity and functional state of the skin. Due to poor hygienic conditions both in developed and developing countries, wound infection has become common disease in recent years [48].Wound healing is a complex mechanism which holds numerous steps involving coagulation, inflammation, granulation tissue formation, matrix formation, connective tissue remodeling, collagenization and wound strength acquisition. Traditional forms of medicine practiced for centuries in Africa and Asia have been scientifically studied for their potential in the treatment of disorders associated with wounds [49].

Among various plant herbs, *Aloe vera* is very popular in both Ayurvedic and traditional Chinese medicine for its vast medicinal properties. This may be due to the presence of active compounds present in *Aloe vera* and also substances like enzymes, glycoproteins, growth factors, vitamins and minerals [50]. *Aloe vera,* known as "the healing plant", has been demonstrated to be effective during healing process in various tissues. The plant plays its healing role through fibroblast proliferation, angiogenesis, production of different growth factors, synthesis of extra-cellular matrix components such as hyaluronic acid, dermatan sulfate and collagen, as well as increasing the amount of cross-links between the collagen molecules in skin, bone fractures and gastric lesion [51].

As reported by Aro *et al.* [52] among the two major constituents of Aloe glucose-6-phosphate and mannose-6-phospahte, mannose-6- phosphate is the important structural constituent that promotes wound healing and has anti-inflammatory activity. Soon after an injury a rapid protein synthesis occur in the wound area. Collagen is the principal extracellular protein in the granulation tissue of the healing wound. Collagen plays avital role in the haemeostasis in addition providing an integrity and strength of the tissue matrix. Several studies have shown aloe gel (derived from *A.vera*) to accelerate wound healing after systemic or topical administration. Several mechanisms have been proposed for the wound healing effects of *A. vera*; these include keeping the wound moist, increased epithelial cell migration, more rapid maturation of collagen and reduction in inflammation [53].

Aloe vera leaves pulp of *Aloe arborescens* species is also used for other medicinal purposes, including treatment of constipation, colitis, asthma, irritable bowel syndrome, diabetes, peptic ulcer, inflammation, heart burn, stress etc. As study was undertaken on experimental evaluation of *Aloe vera* leaves pulp on wound healing activity through topical route on excision wound model, activity was compared with standard drug Povidone Iodine ointment (5%). *Aloe vera* leaves pulp was found to have better and faster wound healing effect than standard drug Povidone Iodine ointment on excision wound model [54].

Mechanism of Action of *Aloe vera*: *Aloe vera* has anthraquinones as an active compound, which is structural analogue of tetracycline. The anthraquinones acts like tetracycline that inhibits bacterial protein synthesis by blocking the ribosomal A site where the amino acylatedt RNA enters [55]. In addition, *A. vera* contains pyrocatechol a hydroxylated phenol, known to have toxic effect on microorganisms [36]. Many reports have suggested that *A. vera* gel has antiviral activity that prevent virus adsorption, attachment, or entry to the host cell. An in vitro study has shown that crude extract of *A. vera* gel has antiviral activity against herpes simplex virus type 2 strain. Anthraquinone derivatives, such as Aloe-emodin, emodin and chrysophanol, reportedly exhibit antiviral activity where in their inhibitory mechanism and effect against influenza A virus with reducing virus-induced cytopathic effect and inhibiting replication of influenza A and the anthraquinonealoin inactivates various enveloped viruses such as herpes simplex and influenza [38].

Adverse Reactions of *Aloe vera*

Topical Use: As with all pharmacological agents, *Aloe vera* is associated with some side effects. In some cases contact dermatitis and hypersensitivity reactions after topical applications of *Aloe vera* gel have been noted. *Aloe vera* may cause redness, burning, stinging sensation and rarely generalised dermatitis in sensitive individuals. Allergic reactions are mostly due to anthraquinones, such as aloin and barbaloin. It is advised to apply first to a small area and check for the allergic reactions. If no allergic reactions are seen it can be applied [56].

Oral Use: Oral aloe is not recommended during pregnancy due to theoretical stimulation of uterine contractions, may cause vomiting, diarrheaea and abdominal discomfort. *Aloe vera* is also contraindicated in individuals with allergy to aloe vera plant [57].

Table 1: Traditional therapeutic use of aloevera in Ethiopia

Aloe species used as medicine	Disease treated	Part of aloe vera used	References
Aloe macrocarpa Tod.	Impotency in men	Root	[64].
	Malaria	Latex	[65].
	Ticks	Latex	[66].
	Bloat and fire burn	Fresh leaf	[67].
Aloe percrassa Tod.	Caught	Root	[68].
Aloe trichosantha Berger	Malaria, Stomach ache, Gonorrhea, Impotency in men	Latex	[69].
Aloe citrina Carter & Brandham		Latex	
Aloe barbadensis	Strain, Ascariasis	Latex	[70].
Aloe species used as medicine	Disease treated	Part of aloevera used	References
Aloe pubescens Reynoids	Anthrax, internal parasite	Root	[71]
Aloe debrana Christian	Wounds, to stop breast feeing	Sap	[72].
Aloe pulcherrima M.G. Gilbert & Sebsebe	Asthma	Sap	
	Psychiatric disease	Sap mixed with other medicinal plants	
Aloe vera (L) Burm.f.	Sprain	Root	[73]
	Diabetes	Fresh sap	[74].
Aloe pirottae A. Berger	Wounds	Leaf latex	[75].
Aloe monticola Reynolds	Liver disease	Root	[76].
Aloe gilbertii Reynolds	Malaria and wounds in humans	Leaves gel, roots and exudates	[77].
Aloe lateritia Engl.	Eye aliments	Exudates	[78].

Therapeutic Use of *Aloe vera* in Ethiopia: In the flora of Ethiopia and Eretria, 46 species of Aloe have been described, out of which 41(89%) are endemic or near endemic indicating that they have high degree of endemism in the flora area. Only five species: *Aloe laterita*, *Aloe macrocarpa, Aloe rivae, Aloe secundiflora* and *Aloe vituensis* have wider distribution extending to east or West Africa [58]. They are distributed in all floristic region of the country including: Afar, Arsi, Bale, Gamo Gofa, Gojam, Gonder, Harerge, Kefa, Shewa, Sidamo, Tigray, Wellega and Welo floristic regions [59]. *Aloe*s are available in variety of vegetation types at various altitudes in the country. Thus most *Aloe*s (about 48%) are found at elevation ranges of 1500-2500 m in middle altitude area. Some *Aloe*s (about 34%) are found at altitudes of 500-1500 m in semi-arid climate while other species of *Aloe* (about 14%) could be live between altitudes of 2500-3200 m in high altitude area [60].

In Ethiopia, *Aloe* spp. such as *Aloe trichosantha* Berger, *Aloe pubescens* Burger, *Aloe citrina* Carter and Brandham, *Aloe bertemariae* Sebsebe and Dioli, *Aloe eumassawana* Carter, Gilbert and Sebsebe and *Aloe schoelleri* Schweinfurth "have been used in a wide range of skin and hair care products; also they form the basis of health drinks and tonics. In rural parts of the country, its mucilaginous fluid applied to cuts and wounds in order to prevent infections and bring about healing [61].

As studies reported from southern parts of Ethiopia, Borana People Chew the stem and pith of Aloe shoots to apply on to a snake-bite, while the leaves are squeezed to obtain sap for treating ear pain, eye problems, skin wounds and burns [62]. Moreover, root extracts are used to treat stomach ache, epiphora, cold and flu. In addition, Leaves of the Aloe plant are used by the people to treat burns, after drying, burning and mixing with water and protect tick infestations for livestock [63].

CONCLUSION AND RECOMMENDATIONS

Aloe vera is a medicinal plant which distributed in wide area of the world. The chemical composition of *Aloe vera* is particularly interesting as several of its components which include: amino acids, anthraquinones, enzymes, minerals, vitamins, lignins, monosaccharide, polysaccharides, salicylic acid, saponins and sterols. The plant exhibits many pharmacological activities such antioxidant, antimicrobial, immune boosting, antitumor, promote wound healing and antidiabetic. In Ethiopia, *Aloe* spp. has been used in a wide range of skin and hair care products; also they form the basis of health drinks and tonics. Based on the above conclusion, The efforts of research and industry should be directed towards the improvement of processing and extraction methods in order to obtain aloe vera and its derivatives with high quality preserving and/or improving the particular biological properties and Efforts should be made by pharmaceutical companies towards carrying out more research work especially in the development of new drugs containing more of these biochemical and biologically active compounds which are of natural origin;

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