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 Eritrea, forty six species of aloe have been described out of which forty 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].
Miller, is most biologically active among Aloe vera often called herbal preparations: aloe gel and aloe latex. Aloe gel is composed mainly of water (99%) and mono- and polysaccharides, 25% of the dry weight of the gel [10]. Aloe vera is a succulent perennial herb 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. 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 Linne; 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 Aloeaceae. The Aloeaceae 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 Aloe 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.
Aloe vera [17]

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, 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 8 essential 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.
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 extracellular 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 antimicrobial 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 studies explained that component of aloevera: anthraquinones, 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 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 α-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-phosphohe, 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 haemostasis 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 acylated tRNA 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, diarrhoea and abdominal discomfort. Aloe vera is also contraindicated in individuals with allergy to aloe vera plant [57].
Table 1: Traditional therapeutic use of aloe vera in Ethiopia

<table>
<thead>
<tr>
<th>Aloe species used as medicine</th>
<th>Part of aloe vera used</th>
<th>Disease treated</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aloe macrocarpa Tod.</td>
<td>Root</td>
<td>Impotency in men</td>
<td>[64]</td>
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<tr>
<td></td>
<td></td>
<td>Malaria</td>
<td>[65]</td>
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<td></td>
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<td>Ticks</td>
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<td></td>
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<td>Bloat and fire burn</td>
<td>[67]</td>
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<tr>
<td>Aloe percrassa Tod.</td>
<td>Root</td>
<td>Caught</td>
<td>[68]</td>
</tr>
<tr>
<td>Aloe trichosantha Berger</td>
<td>Latex</td>
<td>Malaria, Stomach ache, Gonorrhea, Impotency in men</td>
<td>[69]</td>
</tr>
<tr>
<td>Aloe citrina Carter &amp; Brandham</td>
<td>Latex</td>
<td></td>
<td></td>
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<tr>
<td>Aloe barbadensis</td>
<td>Latex</td>
<td></td>
<td>[70]</td>
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<td>Aloe species used as medicine</td>
<td>Part of aloe vera used</td>
<td></td>
<td>References</td>
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<tr>
<td>Aloe pubescens Reynolds</td>
<td>Root</td>
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<td>[71]</td>
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<tr>
<td>Aloe debrana Christian</td>
<td>Sap</td>
<td>Wounds, to stop breast feeding</td>
<td>[72]</td>
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<tr>
<td>Aloe pulcherrima M.G. Gilbert &amp; Sebsebe</td>
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<td>Asthma</td>
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<td>Aloe vera (L) Burm.f.</td>
<td>Root</td>
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<td></td>
<td></td>
<td>Diabetes</td>
<td>[74]</td>
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<tr>
<td>Aloe pirottae A. Berger</td>
<td>Fresh sap</td>
<td>Wounds</td>
<td>[75]</td>
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<tr>
<td>Aloe monticola Reynolds</td>
<td>Root</td>
<td>Liver disease</td>
<td>[76]</td>
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<tr>
<td>Aloe gilbertii Reynolds</td>
<td>Leaves latex</td>
<td>Malaria and wounds in humans</td>
<td>[77]</td>
</tr>
<tr>
<td>Aloe lateritia Engl.</td>
<td>Exudates</td>
<td></td>
<td>[78]</td>
</tr>
</tbody>
</table>

**Therapeutic Use of Aloe vera in Ethiopia**: In the flora of Ethiopia and Eritrea, 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 lateritia, Aloe macrocarpa, Aloe riveae, 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, Harerger, Kefa, Shewa, Sidamo, Tigray, Wellega and Welo floristic regions [59]. Aloes are available in variety of vegetation types at various altitudes in the country. Thus most Aloes (about 48%) are found at elevation ranges of 1500-2500 m in middle altitude area. Some Aloes (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. 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;
REFERENCES


