

Review on Medicinal Value of Aloe Vera in Veterinary Practice



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Abstract

Aloe vera is a plant with height of almost 60-100cm containing very short stem or stem-less long leaves and belongs to the family Asphodelaceae. The aloe vera or succulent has a long history of being used for medicinal purposes, dating back to ancient Egypt. Aloe species are widely distributed in the African and the eastern European continents, and are spread almost throughout the world. The plant leaves contains numerous vitamins, minerals, enzymes, amino acids, natural sugars and other bioactive compounds with emollient, purgative, anti-microbial, anti-inflammatory, antioxidant, antifungal, antiseptic and cosmetic values for health care. The leaves of Aloe barbadensis are the source of two different products with medicinal properties: a yellow latex-like juice obtained from the cells just beneath the epidermis of the leaves with laxative properties and the parenchyma, the inner part of the leaves consisting of a mucilaginous gel. Aloe vera leaves are typically subjected to a series of processing techniques including: Reception of raw material, Filtration, Hot processing and flash cooling, Cold processing, Addition of preservatives and stabilizers and Storage. Many biological properties such as anti-diabetic, anti-inflammatory, peptic ulcers, antitumor, anticancer properties, activity effects on the Immune System, adverse reactions, Laxative effects, wound healing, antiseptic, anti-stress, are contributed by inner gel of the leaves. A. Vera has various health benefits in animals. The A. Vera as the Wonder plant" is multiple from being an antiseptic, anti-microbial, anti-ulcer, anti-inflammatory agent, helps in relieving tumor and diabetes. A. Vera has been used externally to treat various skin conditions such as cuts and burns. It is attributed to its minimal side effects, highly effective treatment. However, further study guided by research on therapeutic and medicinal uses of aloe vera are required in order to advance knowledge and to reduce adverse effects.

Keywords: Aloe Vera; Medicinal Properties; Health Benefits; Adverse Effects

Introduction

Herbal medicine has been widely used all over the world and formed an integral part of primary health care in many countries including Ethiopia Desta [1]. The use of medicinal plants to treat infections is an old practice in a large part of the world especially in developing countries where there is dependence on traditional medicine to maintain animal and human health Yisehak et al. [2]. Plants remain the most common source of antimicrobial agents. Many of the active ingredients in chemically manufactured drugs were originally derived from plant compounds (Mohan et al., 2002). Under re-discovering the treasure of the ancients, using medicinal plants to treat livestock is not new Hany et al. [3]. There is a renewed interest, especially in developed countries, in using plants to treat livestock, pets, and humans. Because many people believe that plants are less toxic, safer and more natural than manufactured drugs. Medicinal plants can be made at home and are less expensive than manufactured drugs Hany et al. [3]. Medicinal plants would be the best source for obtaining a variety of drugs According to World Health Organization. It is recognized that in some developing coun

tries, plants are the main medicinal source to treat various infectious diseases. Plant extracts represent a continuous effort to find new compound against pathogens Tsegaye et al. [4]. The methanolic extracts of Aloe vera, Zingiber officinale and Vinca major medicinal plants were evaluated for their antibacterial activity Yisehak et al. [2]. Aloe vera is a perennial, drought-resisting, succulent plant belonging to the Asphodelaceae family (Baby et al. 2010). A. Vera is the oldest and the most applied medicinal plant worldwide Karkala et al. [5]. It grows mainly in dry regions of Africa, Asia, Europe and America Sonia et al. [6]. There are more than 250 species of Aloe plants. However, only two species are grown today commercially, with Aloe barbadensis Miller and A. arborescens being the most popular. This plant has yellow flowers Karkala et al. [5].

The plant reaches maturity when it measures 1.5-4 feet long and has a base of 3 inches or greater in diameter Sonia et al. [6]. The plant is about 96% water Hany et al. [3]. The rest of its components are active ingredients including essential oil, essential amino ac

ids, minerals, trace elements, vitamins, enzymes and glycoproteins Hany et al. [3]. The Aloe plant is the source of two products used for different therapeutic purposes Aloe Latex or juice, usually in its deride form, is used as a potent laxative. Its products are available in the form of spray, cream, gel, lotion, capsule and liquid Vogler et al. [7]. Aloe gel is used both externally and internally for its wound healing properties and as a general tonic. It is effective, also, for sunburn, scratches, cuts and a cleansing purge for the body or skin. A. vera is used in treatment of ringworm, boils, inflamed joints, scalds, itchy allergic conditions, insect stings and bites Vogler et al. [7]. It creates a definite softening of external skin, relief from dry or sensitive skin and skin diseases Beaman et al. [8]. Aloe vera is known to contain several pharmacologically active ingredients, including a carboxypeptidase that inactivates bradykinin in vitro, salicylates and a substance (s) that inhibits thromboxane formation in vivo. Scientific studies exist that support an antibacterial and antifungal effect for substance (s) in A. vera Mantle et al. [9]. Therefore, the objective of this review is to highlight the medicinal value of Aloe vera plant in veterinary practices.

Historical Background of Aloe Vera

The Aloe plant and its' derivative products have played a role in medicine and health care dating as far back as the 4th century B.C. when ancient Greek doctors obtained aloe from the island of Socotra in the Indian Ocean. The medicinal use of aloe was already mentioned more than 4000 years ago in a collection of Sumerian clay tablets dated 2100 BC. Aloe was also mentioned as a laxative in the Egyptian Papyrus Ebers from 1552 B.C Karkala et al. [5]. Aloe has had a very long historical use as a strong laxative treatment for chronic constipation; it is still listed as a laxative in many pharmacopoeias Karkala et al. [5]. History states that Alexander and Christopher Columbus used Aloe Vera for treating wounded soldiers Vasani and Saple [10].

Botanical Nomenclature and Description of Aloe Vera

Botanical Nomenclature of Aloe Vera

Botanical name: Aloe barbadensis Millar; Aloe humilis Blanco; Aloe induce Royle. Kingdom: Plantae; Class: Angiosperms; Order: Asparagales; Family: Asphodelaceae; Subfamily: Asphodeloideae; Genus: Aloe; Species: Aloe vera; Common names: Aloe Vera Linné; True aloe; Aloe barbadensis Beland et al. [11].

Botanical Description of Aloe Vera

Aloe Vera is a perennial, xerophytic, succulent plant with turgid green leaves. It is a stemless or very short-stemmed plant growing up to 60 to 100 cm tall. It has thick fleshy elongated and pointed leaves that grow to about 30 to 50 cm in length and 10 cm in breadth at the base in the adult plant (Boudreaue and Bland, 2006). The Leaf Has Three Layers: 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 96% water. The rest is made of amino acids, lipids, sterols and vitamins (Wynn et al. 2006). The vascular bundles located within the leaf pulp, transport, water and minerals from the roots to the

leaves; synthesized materials to the roots Yates et al. [12]. The succulent property enables the species to survive in areas where there is no enough rainfall. The species is hardy, although it is intolerant to very heavy frost or snow Darokar et al. [13].

Chemical Constituents of Aloe Vera

The main constituents of Aloe vera gel are mucopolysaccharides (glucomannans, polymannoses, about 10% of total solids), enzymes, anthranoids, lignin, saponins, vitamins, amino acids (almost 50% of the total amount consisting of 8 of the 10 essential amino acids) and minerals (quantities not given). Total solids are in the range of 1.3 to 2%, the rest being water Lawless et al. [14].

I. Vitamins

Aloe Vera Contains Numerous Vitamins: Vitamin A, C, and D (are crucial antioxidants that combat free radicals in the body). Vitamin B and choline are concerned with the production of energy, amino acid metabolism developing muscle mass. Vitamin B12 (folic acid) is responsible for the production of red blood cells Jalal et al. [15].

II. Anthraquinones

Different Types of Anthraquinones are Present in A.Vera Like: Aloin, Isobarbaloin, Anthracene, Emodin, Barbaloin, Anthranol, Aloetic acid, Aloe Emodin and Resistannol. They act as natural laxatives, painkillers and analgesics and they contain powerful antibacterial, antifungal and virucidal properties Mahor and Sharique [16].

III. Minerals

A. 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)-Iron (controls the transportation of oxygen around the body via the red blood cells Jalal et al. [15].

IV. Sugars: Aloe Vera provides monosaccharides (Glucose and fructose) and polysaccharides (Glucomannans/polymannose). These are derived from the mucilage layer of the plant and are known as mucopolysaccharides. The most common polysaccharides are glucomannans (beta 1-4, acetylated mannan). Aglycoprotein with anti-allergic properties, called alprogen has been isolated from Aloe Vera gel Sonia et al. [6].

V. Fatty Acids

A.Vera Provides Four Plant Steroids: cholesterol, campesterol, beta-sisosterol and lupeol. All these have anti-inflammatory action and lupeol also possesses antiseptic and analgesic properties Sonia et al. [6].

VI. Enzymes

Some the Enzymes in the A.Vera Are: peroxidase, alliasse, catalase, lipase, cellulose, carboxypeptase, amylase and alkaline phosphatase. Enzymes help to breakdown food and assist in digestion. Some enzymes help to breakdown fats while others breakdown starches and sugars Jalal et al. [15].

VII. Hormones: Auxins and gibberellins are help in wound healing and have an anti-inflammatory action Sonia et al. [6].

VIII. Others: A. vera provides 20 of 22 required and 7 essential amino acids. It also contains salicylic acid that possesses anti-inflammatory and anti- bacterial properties Sonia et al. [6].

Handling and Processing

Aloe vera leaves are typically subjected to a series of processing techniques. For manufacture of A. vera leaf juices, processing should take place as soon as possible due to the highly perishable nature of the juice, ideally within 36 hours of harvesting the leaves. If immediate processing is not possible, leaves should be stored in a refrigerated facility. Prolonged storage of the leaves after harvest without refrigeration may result in enzymatic and bacterial degradation of the polysaccharides Karkala et al. [5].

Reception of Raw Material

The A. Vera leaves after harvesting must be transported in refrigerated vans from field to the processing plant. The leaves should be sound, undamaged, mold free and mature (3-4 years) in order to keep all the active ingredients in full concentration Lawless and Allen [14]. One important factor affecting the composition of final product is the handling of the leaves after its harvesting because the decomposition of the gel matrix starts just after its cutting due to natural enzymatic reactions and the activity of bacteria normally present on the leaves Amit and Shweta [17]. It can adversely affect the quality of the end product. Thus, the freshly removed leaves are refrigerated within 6 h or the leaves are directly fed to processing plant on the farm itself Grindlay et al. [18].

Filtration

Fibrous material is removed by this step. Poor filtration results in sedimentation of aloe juice on storage Amit and Shweta [17].

Hot Processing and Flash Cooling

In hot processing, sterilization is achieved by treating the aloe liquid with the activated carbon at high temperature Rodriguez et al. [19]. This step may affect the taste, appearance and the biological activity of aloe gel products. Biological activity of A.vera gel essentially remains intact when gel is heated at 65°C for a period of less than 15 min. Extended periods or higher temperatures greatly reduce activity levels. After heat treatment, the juice is flash cooled to 5°C or below within 15 s to preserve biological activity Amit and Shweta [17].

Cold Processing

In the cold processing technique, the entire processing steps are accomplished without the application of the heat. This tech-

nique uses enzymes like glucose oxidase and catalase to inhibit the growth of aerobic organisms within A. Vera gel Coats [20].

Addition of Preservatives and Stabilizers

In all the processing techniques, preservation can be achieved by the addition of chemical preservatives and other additives. For example; algal polysaccharides or xantham gum could stabilize the network structure of fresh Aloe vera polysaccharide Yaron et al. [21].

Storage

A. vera juice is packed in amber colored glass bottles to avoid the effect of light on the sensitive bioactive agents. Relative humidity and temperature are two most important environmental parameters that affect product quality. These two parameters can also affect the amount of the volatile substance of the juice absorbed by the packaging material (Hernandez et al., 1998) and consequently affect the shelf life of the product Sadler and Braddock [22].

Health Benefits of Aloe Vera

A. vera is a plant that can be used alone or in combination with other substances of natural or synthetic origin. There is a synergistic effect with also veterinary drugs (Grazyna et al. 2005).

Anti-Microbial Effect

Despite the existence of potent antibiotic and anti-fungal agents, resistant or multi-resistant strains are continuously appearing, imposing the need for a permanent search and development of new drugs. Plants are the cheapest safer and time-tested alternative sources of antimicrobial. In ancient times, people believed that plants had curative powers. Phytotherapy or phytomedicine has been a part of both Eastern and Western medical traditions since 2000 BC Shireen et al. [23]. A. vera has potent antibacterial, antifungal, and antiviral properties Ramasubramanian et al. [24]. The antimicrobial effects of A. vera have been attributed to the plant's natural anthraquinones which have demonstrated in vitro inhibition of Mycobacterium tuberculosis and Bacillus subtilis. Aloe juice has been found to be bacteriostatic against Staphylococcus aureus, Klebsiella pneumonia, Streptococcus pyogens, Pseudomonas aeruginosa, Salmonella paratyphi and E. choli Agarry et al. [25]. No sufficient information on mechanism of action of A.vera extract on microbes.

Anti-Bacterial Effect

Antibiotics are probably the most successful family of drugs so far developed for improving animal and human health. Because of increasing resistance to antibiotics of many bacteria, plant extracts are of new interest as antiseptics and antimicrobial agents in medicine Yisehak et al. [2]. The Aloe extract was potent against various species of bacteria including S. aureus, S. agalctia, E. choli, Streptococcus pyogens, M. bacterium tuberculosis, Pseudomonas aerogenosa, Klebsiella pneumonia, etc. Whole leaf components of A. vera are proposed to have direct antibacterial properties include anthraquinones and saponins Rubina et al. [26]. While polysaccharides have been attributed within direct bacterial activity through

the stimulation of phagocytic leucocytes to destroy bacteria Lawless, et al. [14].

Anti-Fungal Effect

The importance of skin affection in domestic animals draw the attention of many workers to suggest various methods of their control such as application of suitable and rapid method for their diagnosis and treatment. Bovine dermatophytosis causes economic loss due to hide damage and restrictions in showing and marketing infected cattle Hany et al. [3]. Ringworm infection is caused by invasion of cutaneous keratinized epithelial cells and hair follicle by a certain keratinophilic fungi causes dermatomphytosis Hany et al. [3]. *Trichophyton verrucosum*, *Trichophyton mentagrophytes* and *Trichophyton megnini* are the most commonly fungal species that involved in ringworm Quinn et al. [27]. Aloe gel is used topically for infections that are caused by these fungal agents. This therapeutically benefit of Aloe vera gel leaves might be due to its properties and chemical components. Also the potency of *A. vera* in curing ringworm might be due to increasing the ability of internal immunity that strength the natural resistance by boosting T- lymphocyte cells that aid the immune system Hany et al. [3].

Anti-Viral Effect

Antiviral activity of *A. vera* may be due to indirect or direct effects. Indirect effect is due to stimulation of the immune system and direct effect is due to anthraquinones. The anthraquinone aloin inactivates various enveloped viruses such as herpes simplex and influenza Sadeghi et al. [28]. Lectins, fractions of *A. Vera* gel, directly inhibited the cytomegalovirus proliferation in cell culture, perhaps by interfering with protein synthesis. Aloe emodin is effective against infectivity of herpes simplex virus and it is capable of inactivating all of the viruses, including influenza virus and pseudorabies virus Sadeghi et al. [28].

Anti-Inflammatory Effect

Inflammation is an innate response of the body against an injury, characterized by swelling, pain, redness, heat and loss of function, resulting in delay in the healing process. The gel of *A. vera* contains bradykinase and other antiprostaglandin compounds which relieve inflammation Hamman et al. [29]. The anti-inflammatory action of *A. vera* gel not only relieves from pain and discomfort, but also accelerates the healing process. The Aloe vera sterol is anti-inflammatory in nature, helps in reducing the inflammation pain and act as natural analgesic. Aloe vera gel sterols were able to reduce inflammation by up to 37%. Lupeol, the most active anti-inflammatory sterol, reduced inflammation in a dose dependent manner Jensen et al. [30].

Anti-Diabetic Effect

Aloe vera is a traditional remedy for diabetes mellitus in many parts of the world. Some evidences in animals and humans suggest that Aloe vera is able to alleviate the chronic hyperglycemia and perturbed lipid profiles that are characteristics of diabetes mellitus, which are major risk factors for cardiovascular mellitus Coronado et al. [31]. It also decreases blood sugar level in hyper-

glycemic patients. For this purpose, its juice is taken twice daily. The mechanism behind lowering of blood glucose levels could be enhancement of glucose metabolism. *A. vera* has also been proven effective for use with diabetes which pregnant women are often plagued with; taking Aloe vera daily can help to prevent gestational diabetes Rajasekaran et al. [32].

Wound Healing, and Anti-Ulcer Properties of Aloe Vera

Wound healing properties: The plant has been used to treat any number of small cuts, abrasions, skin irritations, and mild burns. It's been used as a topical ointment and in dressings (<https://www.advancedtissue.com/aloe-vera-effective-wound-care>, May, 2017). Glucomannan, a mannose-rich polysaccharide, and gibberellin, a growth hormone, interacts with growth factor receptors on the fibroblast, thereby stimulating its activity and proliferation, which in turn significantly increases collagen synthesis after topical and oral Aloe vera (Chithra, et al., 1998). Aloe gel not only increased collagen content of the wound but also changed collagen composition (more type III) and increased the degree of collagen cross linking. Due to this, it accelerated wound contraction and increased the breaking strength of resulting scar tissue Hegggers et al. [33]. Aloe Vera extract inhibits acid secretion which may be due to the presence of lectins in the plant Blanca et al. [34].

Anti-Tumor Effect

An induction of glutathione S-transferase and an inhibition of the tumor-promoting effects of phorbol myristic acetate has been reported which suggest a possible benefit of using aloe gel in cancer chemoprevention Kim et al. [35]. It has been shown that lectins inhibit aminopyrine uptake by parietal cells, thus the ability of the extract to inhibit gastric acid output may be as a result of direct action on the acid producing cells Radha et al. [36].

Effects on the Immune System

Alprogen inhibit calcium influx into mast cells, thereby inhibiting the antigen-antibody-mediated release of histamine and leukotriene from mast cells Ro et al. [37]. In a study on mice that had previously been implanted with murine sarcoma cells, acemannan stimulates the synthesis and release of interleukin-1 (IL-1) and tumor necrosis factor from macrophages in mice, which in turn initiated an immune attack that resulted in necrosis and regression of the cancerous cells, (Peng et al., 1991). Alprogen inhibit calcium influx into mast cells, thereby inhibiting the antigen-antibody-mediated release of histamine and leukotriene from mast cells, (Hansel et al. 1994).

Laxative Effect of Aloe Vera

Anthraquinones present in latex are a potent laxative. It increases intestinal water content, stimulates mucus secretion and increases intestinal peristalsis Ishii et al. [38].

Anti-Septic Effect

A. vera contains 6 antiseptic agents: Lupeol, salicylic acid, urea nitrogen, cinnamonic acid, phenols and sulfur. They all have inhibitory action on fungi, bacteria and viruses (Amar et al. 2008).

Side Effects of Aloe Vera

Topical

It may cause redness, burning, stinging sensation and rarely generalized dermatitis in sensitive individuals. Allergic reactions are mostly due to anthraquinones, such as aloin and barbaloin. It is best to apply it to a small area first to test for possible allergic reaction Syed et al. [39].

Oral

Abdominal cramps, diarrhea, red urine, hepatitis, dependency or worsening of constipation Bottenberg et al. [40].

Contraindication

Contraindicated in cases of known allergy to the plant. Oral aloe is not recommended during pregnancy due to theoretical stimulation of uterine contractions, and in breastfeeding mothers, it may sometime causes gastrointestinal distress in the nursing infant Ulbricht et al. [41].

Interactions

Application of aloe to skin may increase the absorption of steroid creams such as hydrocortisone. It reduces the effectiveness and may increase the adverse effects of digoxin and digitoxin, due to its potassium lowering effect Ulbricht et al. [42,43].

Conclusion and Recommendations

In recent years, 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 animal and human use. The nutrient make up of Aloe Vera is one of a kind and has amazing natural healing properties. Its uses are multiple and undoubtedly, the nature's gift to humanity and it remains for us to introduce it to ourselves and thank the nature for its never-ending gift. Thus, though Aloe vera has wide spectrum of the properties and uses, some of them could be myths and some of them could be real magic. In future, controlled studies are required to prove the effectiveness of Aloe vera under various conditions.

Based on above conclusion the following recommendations are forwarded:

- i. Further study guided by research on therapeutic and medicinal uses of aloe vera are required in order to advance knowledge and to reduce adverse effects.
- ii. It should be better to use herbal medicine in modern ways rather than using traditional methods.

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