



E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; SP2: 114-116

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Aloe vera and its medicinal components useful to human health

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Abstract

Aloe vera (*Aloe barbadensis*) is a perennial, drought-resisting, succulent plant belonging to Liliaceae family. Use of *Aloe vera* in nutritional, pharmaceutical and cosmetic preparations draws attention for generation of scientific information. Bioactive compounds from *Aloe vera* are very effective in various treatments, such as burns, allergic reactions, rheumatoid arthritis, rheumatic fever, acid indigestion, ulcers, diabetes, skin diseases, dysentery, diarrhoea, piles and inflammatory conditions of the digestive system and other internal organs, including the stomach, small intestine, liver, kidney and pancreas. The present review is therefore, an effort to give a detailed survey of the literature on its traditional, phytochemical, and pharmacological properties.

Keywords: *Aloe vera*, nutritional, cosmetic uses etc

Introduction

In India, only 4 species (*Aloe barbadensis*, *Aloe forbesii*, *Aloe inermis*, *Aloe ferox*) are reported to occur and of these *Aloe barbadensis* is the most widely distributed species (Nandal *et al.*, 2012) [21]. The species has a number of synonyms: *A. barbadensis mill.*, *Aloe Indica Royle*, *Aloe perfoliata L. var. Vera* and *A. Vulgaris Lam* (Rodriguez *et al.*, 1998; Coats, 1979) [7] And common names including *chines aloe*, *Indian aloe*, *True aloe*, *Barbados aloe*, *Burn also*, *first aid plant* (Heggars *et al.*, 1997 and Colman *et al.*, 2000) [16, 8]. The species name Vera means "true" of "genuine" (Colman *et al.*, 2000) [8]. Some Literature identifies the white spotted form of *Aloe vera* as *Aloe vera* var. *chinesis*, the species was introduced to china and various part of Southern Europe in the 17th century (Choo C vital vera, 2003) [6].

Aloe vera is a member of *Liliaceae* family; it is commonly called aloe, burn plant, lily of the desert, elephant's gall. *Aloe vera* in synonym *Aloe barbadensis* is a cactus (leaves) like plant with green, dagger shaped leaves that are fleshy, tapering, spiny, marginated and filled with a clear viscous gel (Cheesbrough M. Medical Laboratory Manual, 2000) [5]. The name of *Aloe vera* derives from the Arabic word "Alloeh" meaning, "shining better substance", while "Vera" in Latin mean "true". 2000 years ago, the Greek scientists regarded *Aloe vera* as the universal panacea. The Egyptians called *Aloe* "the plant of immortality" (Rai *et al.*, 2011; Himesh *et al.*, 2011) [23, 17].

The plant is rich in many natural health promoting substances. The raw pulp of *Aloe vera* contains approximately 98.5% water, while the mucilage or gel consists of about 99.5% water (Eshun and He, 2004) [9]. The remaining 0.5-1% solid material consists of a range of compounds including water -soluble and fat-soluble vitamins, minerals, enzymes, mono and polysaccharides, sugar, lignin, phenolic compounds and organic acids (Boudreau and Beland 2006; Lanjhiyana *et al.*, 2011 ; Foster and Tyler's, 1999) [3, 19, 10].

Aloe vera leaves content 1.83% fat, 10.50% protein, 19.50% ash, 56.27% carbohydrate, 1.90 mg/g phosphorous and 290.08 kcal energy. *Aloe vera* powder contents 6.75% moisture, 19.50% ash, 6.9 pH value (1% solution), and 68.50 % solid content. Dried *Aloe vera* powder can be used in formulations as a functional ingredient for health benefits. *Aloe vera* powder which contains antioxidants, dietary fiber, iron etc. may find its usage in number of Ayurvedic medicines. *Aloe vera* is the most commercialized aloe species and processing of the leaf pulp has become a large worldwide industry. In the food industry, it has been used as a source of functional foods and as an ingredient in other food products, for the production of gel containing health drinks and beverages. In the cosmetic and toiletry industry, it has been used as base material for the production of powder, capsule, creams, lotions, soaps, shampoos, facial cleansers, oil, and other products for both external and internal uses for a wide variety of indications (Hamman 2008; Haque *et al.*, 2012; Grindlay and Reynolds, 1986) [14, 15, 13].

According to World Health Organization, medicinal plants would be the best source for obtaining a variety of drugs.

Aloe vera contains over 75 nutrients and 200 active compounds, 20 minerals, 18 amino acid, 12 vitamins, 92 enzymes. It can be used as the source of vitamins like A, B1, B2, B6, B12, C, E, Folic acid, Niacin etc. (Bornare, 2015 and Modi *et al.*, 2012) [2, 21]. The *Aloe vera* gel has been extensively used in gastrointestinal disorders, including peptic ulcer, and its clinical efficacy has been documented. *Aloe vera* processing methods for gel expulsion by splitting of leaf, roller method, crushing of whole leaf, hand filleting method and stabilization are used. *Aloe vera* gel has got the potential to be used as food preservative, as a substitute of sulphur dioxide in preserving fruit and vegetable.

Chemical properties of *Aloe vera*:

Aloe vera has marvelous properties. 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.

1. Amino acids:

The amino acids in *Aloe vera* are the building blocks of proteins and influence our brain function. Human require 22 amino acids (Joseph *et al.*, 2010) [18]. Every one of the essential amino acids are available in *Aloe vera* and they include isoleucine, leucine, lysine, methionine, phenylalanine, threonine, valine and tryptophan, non-essential Amino acids found in *Aloe vera* include alanine, arginine, asparagine, cysteine, glutamic acid, glycine, histidine, proline.

Located in the sap of the leaves you will find twelve anthraquinones, a phenolic compound that has stimulating effects on the bowels and antibiotic properties. In small amounts the anthraquinones do not have a purgative effect. They help with absorption from the gastro intestinal tract and have anti-microbial and pain killing effects. Too many anthraquinones can produce abdominal pain and diarrhea. The most important anthraquinones are aloin and emodin. They are anti-bacterial, anti-viral, and analgesic. The anthraquinones in *Aloe vera* breakup residue, pus and lifeless cells, bring blood to the region and flush out material from the wounds and ulcers.

2. Enzymes

It contains 8 enzymes: amylase, alkaline phosphatase, amylase, bradykinase, carboxypeptidase, catalase, cellulase, lipase and peroxidase (Surjushe *et al.*, 2008) [28]. Enzymes act as biochemical catalysts that break down the proteins we eat into amino acids, Carboxypeptidase, inactivate bradykinins and produce an anti-inflammatory effect. During the inflammatory process, bradykinin produces pain associated with vasodilation and therefore, its hydrolysis reduces these two components and produces an analgesic effect (Obata *et al.*, and Shelton, 1991) [27].

3. Vitamins

It contains Vitamin A, C and E, which are antioxidants. It also contains vitamins B, niacin, vitamin B2 (riboflavin), vitamin B, choline, and folic acid (Coats, 1979) [7]. *Aloe vera* is an anti-oxidant rich plant. Anti-oxidants help boost the immune system and combat free radicals in the body.

4. Sugars

It provides monosaccharide (glucose and fructose) and

polysaccharides (glucomannans/ polymannose) (Surjushe *et al.*, 2008) [28]. Sugars are derived from the mucilage layer of the plant under the rind, surrounding the gel. They form 25% of the solid fraction. And comprise both mono and polysaccharides. The polysaccharides are absorbed complete and appear in the blood stream unchanged hence they act as immune-modulators (Green *et al.*, 1996; Kahlon *et al.*, 1991; Sheets *et al.*, 1991) [12, 26]. The sugars are also used in moistening preparations.

5. Minerals

Additional minerals found in *Aloe vera* include copper (important for red blood cells, skin and hair pigment), iron (involved in oxygen transportation and making of hemoglobin in red blood cells), potassium (helps with fluid balance), phosphorus (helps build bones and teeth, assists with metabolism and body pH), and sodium (regulates body liquids, helps with nerve and muscle performance, and helps deliver nutrients into body cells). *Aloe vera* also contains the trace minerals of rhodium and iridium used in cancer and tumor research experiments.

6. Salicylic acid

Aloe vera contains salicylic acid which is an aspirin-like compound with anti-inflammatory, analgesic, and anti-bacterial properties. It has anti-pyretic properties for reducing fevers. Other constituents of *Aloe vera* would include prostaglandins, tannins, magnesium lactate, resins, mannins, and proteins such as lectins, monosulfonic acid and gibberlin.

7. Saponins

Another constituent of *Aloe vera* includes saponins. These are soapy substances from the gel that is capable of cleansing and having antiseptic properties. The saponins perform strongly as anti-microbial against bacteria, viruses, fungi, and yeasts. The plant sterols or phyto-steroids in *Aloe vera* include Cholesterol, Campesterol, Lupeol, and B (Beta sign) Sitosterol. The plant steroids have fatty acids in them that have antiseptic, analgesic, and anti-inflammatory properties.

8. Anthraquinones

The bitter aloes consist of free anthraquinones and their derivatives, Barbaloin, aloin, aloin-9-anthrone, isobarbaloin, Anthrones-C-glycosides and chromones (Joseph *et al.*, 2010) [18].

Medicinal and Cosmetic use of *Aloe vera*

Aloe vera gel consists for 99.3% of water. The remaining 0.7% is the solid that consists for a large part of polysaccharides of the glucose and mannose type. Together with the enzymes and amino acids in the gel they give the gel the special properties as a skin care products (Leun *et al.*, 2007) [20]. Aloin and its gel are used as skin tonic against pimples. *Aloe vera* is also used for soothing the skin and keeping the skin moist to help avoid flaky scalp and skin in harsh and dry weather (Gomathi *et al.*, 2014) [11].

Generally *Aloe* juice is a good tonic for skin and digestive disorders (Cheesbrough, 1984) [4]. The enzymes in *Aloe vera* will improve digestion and nutrient absorption. It will help bring the body to a pH balance while being beneficial to the whole gastro-intestinal system (Zhang *et al.*, 1996) [29]. *Aloe vera* contains salicylic acid which is an aspirin like compound with anti-inflammatory, analgesic and anti-bacterial properties. It has anti-pyretic properties for reducing fevers

(Nandal *et al.*, 2012) [21].

It is used in Ayurvedic formulations for appetite stimulant, purgative, emmenagogue and antihelminthic, cough, colds, piles, debility, dyspnea, asthma and jaundice. It is widely used in Ayurvedic formulations for liver protection and general debility. The products (*Aloe vera* juice, *Aloe vera* jelly, *Aloe vera* pickle, *Aloe vera* sarbat, *Aloe vera* shampoo, *Aloe vera* fairness cream, *Aloe vera* hair gel, *Aloe vera* pimple gel etc.) prepared from aloe leaves have multiple properties such as emollient, purgative, anti-bacterial, anti-oxidant, anti-fungal, anti-septic and cosmetic. The Food and Drug Administration of the USA has approved the developmental study of *Aloe vera* for the treatment of cancer and AIDS (Nandal *et al.*, 2012) [21].

Cosmetics formulations derived from *Aloe vera* have a high potential due to their antioxidant activity. Antioxidants such as vitamins (vitamin C, vitamin E), flavonoids and phenolic acids play the main role in fighting against free radical species that are the main cause of numerous negative skin changes (Gomathi *et al.*, 2014) [11]. *Aloe vera* has unique, antiaging formulations to maintain healthy, fresh looking skin. The *Aloe* plant's healing powers are most widely touted to treat skin conditions. These conditions include psoriasis, shingles and other associated with itching, in addition, cuts, abrasions and burns are said to benefit from topically applying the leaf's gel to the affected areas (Gomathi *et al.*, 2014) [11]. Its cosmetic action is anti-inflammatory, soothing, toning, moisturizing and protective (Agarwal *et al.*, 2011 and Zhu *et al.*, 2003) [1].

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