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Review Article

Medical Welfare of Human Community with Aloe vera Products

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Abstract

Aloe vera has been used for medicinal purposes in several cultures for millennia: Greece, Egypt, India, Mexico, Japan, and China. There is broad list of the therapeutic claims of different parts of Aloe vera due to its Pharmacological activities which are employed in traditional management of diverse veterinary and human diseases. The herb is used internally to combat most digestive problems, including constipation, poor appetite, colitis, irritable bowel syndrome as well as, asthma, diabetes, immune system enhancement and peptic ulcers. A. vera is a succulent plant. Succulents are xerophytes, Storage tissue has higher water holding capacity ranging from 99–99.5% and 0.5–1.0% solid material has over 75 different potentially active compounds including water and fat-soluble vita-mins, minerals, enzymes, simple and complex polysaccharides, phenolic compounds, and organic acids. A. vera gel polysaccharides consist of linear chains of glucose and concentrated mannose molecules, there arrangement linear chains ranging in size from a few to several thou-sand molecules. Different Aloe species would have varying phytochemical contents due to interspecies variation and varying climate and soil conditions, the species of Aloe selected for commercial exploitation or selected by the traditional healer, would be based on its local availability and distribution. A. ferox contains various combinations of glucose and galactose as main monosaccharides, while A. vera yields only mannose. A. vera is rich in secondary metabolites. Anthraquinones (Aloe emodin), tricyclic aromatic quinines and chrysophanol are the major secondary metabolites. Aloe is used against skin irritation, skin exposure to UV and gamma radiation, scalds, sunburn wounds, eczema, psoriasis, acne, dermatitis, ulcers, to stimulate cell regeneration. Plants have hypoglycemic, cytotoxic, antiulcer, antidiabetic effects, antibacterial, antioxidant, cardiovascular effect on human. Healing properties, anti-inflammatory, antiviral and antitumor, moisturizing, anti-aging effect, antiseptic properties of plant stimulates the immune system, only a few species of Aloe have been considered for commercial importance, of which A. vera is considered the most potent and, thereby, the most popular plant in the research field. The leaf is long triangular sheaf with two external membranes which are green and leathery. Inside this tough resistant covering is the gel, which presents itself as a compact, gelatinous mass with a translucent pearly aspect. Leaf pulp having unpleasant sensations was used to extract the juice by a decortications process. It contains some active compounds which detoxified the body stimulating property worthy of highlighting. The nutritional components of Aloe are equally distributed between the pulp and the cortex of the leaf. Chemistry of the plant revealed the presence of more than 200 different biologically active substances including vitamins, minerals, enzymes, sugars, anthraquinones or phenolic com-pounds, lignin, saponins, sterols, amino acids and salicylic acid the wound healing property of Aloe vera gel has been attributed to Mannose-6-phosphate used for first to second degree burns. Wound healing is a dynamic process, occurring in 3 phases. The first phase is inflammation, hyperaemia and leukocyte infiltration. The second phase consists of removal of dead tissue. The third phase of proliferation consists of epithelial regeneration and formation of fibrous tissue. The Aloe gel has been used for the treatment of radiation burns and radiation ulcers, and complete healing has been observed in two radiation burns patients. The Aloe gel gives cooling effect and also acts as a moisturizing agent. It also has role in gerontology and rejuvenation of aging skin. This property of Aloe is because it's biogenic material. Aloe vera is used as skin tonic in cosmetic industry. It improves joint flexibility and helps in the regeneration of body cells. It strengthens joint muscles, which therefore reduces pain and inflammation in weakened or aged joints.

Keywords: cytotoxic; antiulcer; antidiabetic; anthraquinones; quinines and chrysophanol

Introduction

The compound formulation Halwa-i Gheekwar is frequently used by Unani physicians for prophylactic and therapeutic purposes. It contains various single Unani drugs, which have been report-ed to possess anticancerous, antioxidant and immunomodulatory activities. Therefore, the oral administration of Halwa-i Gheekwar may play an important role in prevention and treatment of

cancer. It may also help to reduce the side effects of chemotherapy or ra-diation therapy and improve the quality of life of cancer patients. Aloe barbadensis Miller, commonly referred to as Aloe vera, is one of more than 400 species of Aloe belonging to family Liliaceae that originated in South Africa, but have been indigenous to dry subtropical and tropical climates, including the southern USA. Aloe vera has been used for medicinal purposes in several cultures for millennia: Greece, Egypt, India, Mexico, Japan, and China, (Foster *et al*., 2011). There is broad list of the therapeutic claims of different parts of Aloe vera due to its Pharmacological activities which are employed in traditional management of diverse veterinary and human diseases. The herb is used internally to combat most digestive problems, including constipation, poor appetite, colitis, irritable bowel syndrome as well as, asthma, diabetes, immune system enhancement, peptic ulcers, (Mansour *et al*., 2013; Ezuruike *et al*., 2014; Kavyashree *et al*., 2015; Pandey *et al*., 2016). A. vera is a succulent plant. Succulents are xerophytes, Storage tissue has higher water holding capacity ranging from 99–99.5% (Hamman *et al*., 2008) and 0.5–1.0% solid material has over 75 different potentially active compounds including water and fat-soluble vita-mins, minerals, enzymes, simple and complex polysaccharides, phenolic compounds, and organic acids. Studies on the structural components of the A. vera plant leaf portions, the rind was found to be 20–30% and the pulp 70–80% of the whole leaf weight on a dry weight basis, the percentages of the rind and pulp represented as lipids (2.7% and 4.2%) and that as proteins (6.3% and 7.3%) only accounted for a minor fraction. However, the nonstarch polysaccharides and lignin were found to be 62.3% and 57.6% of the dry weight of the rind and pulp, respectively. A. vera gel polysaccharides consist of linear chains of glucose and concentrated mannose molecules, there arrangement linear chains ranging in size from a few to several thou-sand molecules, (is referred as polymannans, (Ni Y *et al*., 2004; Davis *et al*., 2006; Chang *et al*., 2011; Boonyagul *et al*., 2014; Aranda *et al*., 2016). The major polysaccharide, acemannan, repeating units of glucose and mannose in a 1:3 ratio, (Ni Y. *et al*., 2004; Chow *et al*., 2005). molecular weights ranging from 30 kDa to 40 kDa. Many investigators have endeavored to establish the active principles in A. vera gel, (Habeeb *et al*., 2007), polysaccharides found in the inner leaf parenchyma-tous tissue or pulp contains proteins, lipids, amino acids, vitamins, enzymes, inorganic compounds, with different carbohydrates, (Hamman *et al*., 2008). Over 75 active ingredients from the inner gel have been identified, to have therapeutic effects. Different Aloe species would have varying phytochemical contents due to interspecies variation and varying climate and soil conditions, the species of Aloe selected for commercial exploitation or selected by the traditional healer, would be based on its local availability and distribution. Biological activities of a plant are due to synergistic action of the different compounds together, (Avijgan *et al*., 2014; Esmaeilia *et al*., 2015; Taukoorah *et al*., 2016). In South Africa, the most widely distributed Aloe species are Aloe greatheadiivar. Davyana (Asphodelaceae) and Aloe ferox Mill. (Asphodelaceae). A. greatheadii grows wild in the northern parts of South Africa, whereas A. ferox grows wild primarily in the Eastern and Western Cape provinces. A. ferox contains various com-binations of glucose and galactose as main monosaccharides, while A. vera yields only mannose. A. vera is rich in secondary metabolites. Anthraquinones (Aloe emodin), tricyclic aromatic quinines and chrysophanol are the major secondary metabolites, (Tan *et al*., 2011; Xua *et al*., 2016).

The tricyclic aromatic quinines of Aloe were synthesized via the type III polyketide biosynthesis pathway. Recently, novel these novel plant enzymes plant-specific type III polyketide synthases (PKS), octaketide synthase, PKS4, and PKS5 were isolated from Aloe arbores-cens and their functions examined in E. coli, (Mizuuchi *et al*., 2009). their fuction is associated with biosynthesis of natural tricyclic aromatic quinines in Aloe, Aloesin, aloin and Aloe-emodin (oxidative product of aloin) are the most important secondary metabolites found in A. vera gel. Many secondary metabolites reported to have potent anti-inflammatory, lipid lowering, and anti-oxidant activities, (Rajasekaran *et al*., 2006). Aloe is used against skin irritation, skin exposure to UV and gamma radiation, scalds, sunburn wounds, eczema, psoriasis, acne, dermatitis, ulcers, to stimulate cell regeneration. Plants have hypoglycemic, cytotoxic, antiulcer, antidiabetic effects, antibacterial, antioxidant, cardiovascular effect on human. Healing properties, anti-inflammatory, antiviral and antitumor, moisturizing, anti-aging effect, antiseptic properties of plant stimulate the immune system, only a few species of Aloe have been considered for commercial importance, of which A. vera is considered the most potent and, thereby, the most popular plant in the research field, (Surjushe *et al*., 2008; Davis *et al*., 2012; Maharijan *et al*., 2015; Saito *et al*., 2016).

The leaf is long triangular sheaf with two external membranes which are green and leathery. Inside this tough resistant covering is the gel, which presents itself as a compact, gelatinous mass with a translucent pearly aspect, (Vogler *et al*., 2002; Ramachan-dran *et al*., 2012). Leaf pulp having unpleasant sensations was used to extract the juice by a decorti-cations process. It contains some active compounds which detoxified the body stimulating property worthy of highlighting. The nutritional components of Aloe are equally distributed between the pulp and the cortex of the leaf, (Hatano *et al*., and 2005). Among the larger-sized Aloes, and those having a cosmetic, curative value, we can mention Aloe arborescens Miller, Aloe ferox, Aloe Barbadensis MillerVera, Aloe chinensis, (Kokate *et al*., 2005). Aloe saponaria, and Aloe succotrine. A moregeneralized botanical distinction is achieved by observing the trunk and leaves. In this way, we can distinguish three large groups of Aloe: acauleas (without a trunk), subcauleas (visible trunk but with a reduced size), (Das *et al*., 2015; Sayed *et al*., 2016).

Chemistry of the plant revealed the presence of more than 200 different biologically active substances including vitamins, minerals, enzymes, sugars, anthraquinones or phenolic com-pounds, lignin, saponins, sterols, amino acids and salicylic acid (Chauhan *et al*., 2007). Studies have found that there are 75 ingredients contained in the Aloe leaf. These ingredients have a variety of medical benefits. They are divided into the following categories, (Rodriguez *et al*., 2005; Davis *et al*., 2006). The wound healing property of Aloe vera gel has been attributed to Mannose-6-phosphate used for first to sec-ond degree burns, (Maenthaisong *et al*., 2007). Wound healing is a dynamic process, occurring in 3 phases. The first phase is inflammation, hyperaemia and leukocyte infiltration. The second phase consists of removal of dead tissue. The third phase of proliferation consists of epithelial regeneration and formation of fibrous tissue, (Reddy *et al*., 2011). The Aloe gel has been used for the treatment of radiation burns and radiation ulcers, and complete healing has been observed in two radiation burns patients, (Yeh *et al*., 2003). The fresh gel was more effective than the cream, as Aloe gel treated lesions healed faster (11.8 days) compared to burns treated with petroleum jelly gauze (18.2 days). The 27 patients with partial thickness burns have been treated with Aloe gel in a placebo-controlled study. The Aloe administration influence collagen composition (more type III) and increased collagen cross linking for wound con-traction and improving breaking strength. It also increases synthesis of hyaluronic acid and dermatan sulfate in the granulation tissue of a healing wound, (Joshy *et al*., 2016). The aloe sterol includes campesterol, lupeol, and cholesterol which are antiinfl ammatory in nature, helps in reducing the inflammation pain and act as a natural analgesic. Other aspirin like compound pre-sent in Aloe is responsible for anti-inflammatory and antimicrobial properties (Ferro *et al*., 2003; Agarry *et al*., 2005). Three Aloe vera gel sterols were able to reduce inflammation by up to 37%. Lupeol, the most active antiinflamatory sterol, reduced inflammation in a dose dependent manner. The data suggest that specific plant sterols may also contribute to the anti-inflammatory activity of gel, (Jensen *et al*., 2015). Alprogen inhibit calcium influx into mast cells, thereby inhibiting the antigen-antibody-mediated release of histamine and leukotriene from mast cells. Several low-molecular-weight compounds are also capable of inhibiting the release of reactive oxygen free radicals from activated human neutrophils, (Lee *et al*., 2001; Zanuzzo *et al*., 2015). Muco-polysaccharides of Aloe vera has Agent which help in binding moisture into the skin. The amino acids also soften hardened skin cells and zinc acts as an astringent to tighten pores. Its moisturizing effects have also been studied in treatment of dry skin associated with occupational exposure where

Aloe vera gel gloves improved the skin integrity, decrease appearance of acne wrinkle and decrease erythema, (West *et al*., 2003). The Aloe gel gives cooling effect and also acts as a moisturizing agent. It also has role in gerontology and rejuvenation of aging skin. This property of Aloe is because it's biogenic material. Aloe vera is used as skin tonic in cosmetic industry, (Kaushik *et al*., 2016). Glycoproteins present in Aloe vera gel have been reported to have antitumor and antiulcer effects and to increase proliferation of normal human dermal cells, (Choi *et al*., 2001; Yagi *et al*., 2003). In recent studies, a polysaccharide fraction has shown to inhibit the binding of benzopyrene to primary rat hepatocytes, thereby pre- venting the formation of potentially cancer-initiating benzopyrene DNA adducts. An induction of glutathione S-transferase and an inhibition of the tumor-promoting effects of phorbol myristic acetate has also been reported which suggest a possible benefit of using aloegel in cancer chemoprevention, (Yonehara *et al*., 2015).

Anthraquinones present in latex are a potent laxative; its stimulating mucus secretion, increase intestinal water content and intestinal peristalsis. The laxative effect of Aloe is not generally observed before 6 hours after oral administration, and sometimes not until 24 or more hours after. The Aloe effects are primarily due to the 1, 8-dihydroxyanthracene glycosides, Aloin A and B (formerly designated barbaloin). After oral administration Aloin A and B, which are not absorbed in the upper intestine, are hydrolysed in the colon by intestinal bacteria and then reduced to the active metabolites (the main active metabolite is aloe-emodin-9-anthrone), which like senna acts as a stimulant and irritant to the gastrointestinal tract. Aloe latex is known for its laxative properties, (Haque *et al*., 2014). It is used in ayurvedic formulations as appetite-stimulant, purgative, emmenogogue and antihelminthic, for treating cough, colds, piles, debility, dyspnoea, asthma and jaundice, (Joseph *et al*., 2010). Traditionally, Aloe vera gel is used both, topically (treatment of wounds, minor burns, and skin irritations) and internally to treat constipation, coughs, ulcers, diabetes, headaches, arthritis, immune-system deficiencies, (Eshun *et al*., 2004). The bioactive compounds are used as astringent, haemostatic, anti-diabetic, antiulcer, antiseptic, antibacterial, anti-inflammatory, antioxidant and anticancer agent also, effective in treating stomach ailments, gastrointestinal problems, skin diseases, constipation, radiation injury, wound healing, burns, dysentery, diarrhoea and in the treatment of skin diseases, (Ali *et al*., 2012).

The juice of Aloe vera leaves is used as stomachic tonic and purgative. Scientific evidence for the cosmetic and therapeutic effectiveness of Aloe vera is limited and when present is frequently contradictory, (Marshall *et al*., 2000). Despite this, the cosmetic and alternative medicine industries regularly make claims regarding the soothing, moisturizing, and healing properties of Aloe vera, especially via internet advertising, (Boudreau *et al*., 2006, Sahu *et al*., 2013). The Aloe sugars are also used in moisturizing preparations, (Barcroft *et al*., 2003). Mixed with selected essential oils, it makes an excellent skin smoothening moisturizer, sun block lotion plus a whole range of beauty products. Aloe vera gel has an antioxidant protein, metallothionein, is generated in the skin, which scavenges hydroxyl radicals and prevents suppression of superoxide dismutase and glutathione peroxidase in the skin. Skin burns effect is reported and radiation dermatitis (Bosley *et al*., 2003; Vastrad *et al*., 2015). The antiseptic property of Aloe vera is due to presence of six antiseptic agents namely lupeol, salicylic acid, urea nitrogen, cinnamonic acid, phenols and sulphur. These compounds have inhibitory action on fungi, bacteria and viruses, (Qian *et al*., 2015; Anjum *et al*., 2016). Reviewed the beneficial effects of selective medicinal plant species such as Allium cepa, Allium sativum, Aloe vera,Azadirachta indica, Gymnema sylvestre, Syzygium cumini and Pterocarpus marsupium,and emphasizeon the role of active bio-molecules which possess anti-diabetic activity. The five phytosterols of A. vera, lophenol, 24-methyl- lophenol, 24-ethyl-lophenol, cycloartanol and 24-methy- lenecycloartanol showed anti-diabetic effects in type-2 diabetic mice, (Tanaka *et al*., 2006; Noor *et al*., 2008). Aloe vera contains poly-saccharides which increase the insulin level and show hypoglycemic properties, (Yagi *et al*., 2006; Epifanoa *et al*., 2015; Muammar *et al*., 2016). Aloe vera tincture and melatonin administration was studied as standard therapy against meta-static solid tumors, (Fenig *et al*., 2004; Shalabia *et al*., 2015; Chouhan *et al*., 2016). Aloe vera is an excellent example of a functional food that plays a signifi can't role in protection from oxidative stress, (Barcroft *et al*., 2003; Joseph *et al*., 2010). Aloe juice is helpful in smooth functioning of the body machinery, (Saroj *et al*., 2004). It reduces cell-damaging process during stress condition and minimizes biochemical and physiological changes in the body. Oxidative stress refers to chemical reactions in which compounds have their oxidative state changed. Some antioxidants are part of the body's natural regulating machinery while other dietary antioxidants are derived from diet sources, (Kaithwasa *et al*., 2014; Zhou *et al*., 2015; Cartera *et al*., 2016). It improves joint flexibility and helps in the regeneration of body cells. It strengthens joint muscles, which therefore reduces pain and inflammation in weakened or aged joints. (Sahgal *et al*., 2015; Susman *et al*., 2016). Our diets include many substances which can cause fatigue and exhaustion. Taken regularly, Aloe vera juice ensures a greater feeling of well-being, allowing energy levels to increase and also helps maintain a healthy body weight, (Lad *et al*., 2013; Kumbhar *et al*., 2015; Pani *et al*., 2016) It is especially great for those who have chronic immune disorders like polysaccharides or fibromyalgia since the polysaccharides in Aloe vera juice stimulate macrophages, the white blood cells that fight viruses, (Turner *et al*., 2004; Algieri *et al*., 2015; Shokri *et al*., 2016).

Drinking Aloe vera juice provides a fantastically rich cocktail of vitamins, minerals and trace elements to help our bodies deal with these stresses and strains every day, (Chaturved *et al*., 2007; Cellini *et al*., 2014; Lee *et al*., 2015; Mehta *et al*., 2016) Aloe vera protects aluminium induced changes in brain enzyme activity.Aluminium sulphate has significantly altered the normal levels of acetyl cholinesterase, sodium potassium ATPase and glutathione of rat brain. The levels of brain enzymes were found to be highly decreased in both the aluminium treated groups. But in contrast to this, elevated levels of acetyl cholinesterase, sodium potassium ATPase and glutathione were noticed in aloin and aluminium sulphate co treated groups, indicating the protective role of aloin against aluminium sulphate toxicity, (Jakkala and Ali 2015). Aloin has been recently found to ameliorate the toxic effects of aluminium sulphate, the histological structures of the seminiferous tubules and their cell cytoplasm, nuclei, nutritive cells, which were found to become near normal by treatment of aloin for more than 30 days, (Miraj *et al*., 2014; Jakkala and Ali 2016). The Aloe extract was potent against three strains of Mycobacterium (M. fortuitum, M. smeg matis and M. kansasii) and a strong anti-mycobacterial activity against M. tuberculosisss well as antibacterial activity against P. aeruginosa, E. coli, S. aureus and S. typhi. Streptoccocus pyogenes andStreptococcus faecalisare two microorganisms that have been inhibited by Aloe veragel. Glucomannan and acemannan have beenproved to accelerate wound healing, activating macrophages, stimulating immune system as well antibac-terial and antiviral effects, (Djeraba *et al*., 2000). Aloe vera gel was bactericidal against Pseudomonas aeruginosa and acemannan prevented it from adhering to human lung epithelial cells in a monolayer culture, a processed Aloe vera gel preparation inhibited the growth of fungus Candida albicans, (Stanley *et al*., 2014; Kumar *et al*., 2015; Rezazadeh *et al*., 2016).

Electron micrograph examination of anthro-quinone treated herpes simplex virus demonstrated that the envelopes were partially disrupted. Such results indicate that anthraquinones extract from variety of plants are directly virucidal to enveloped viruses. The anthraquinone aloin also inactivates various enveloped viruses such as herpes simplex, varicella zoster and influenza. Several ingredients in Aloe vera gel have been shown to be effective antiviral agent. acemannan reduced herpes simplex infection in two cultured target cell lines. Lectins, fractions of Aloe veragel, directly inhibited the cytomegalovirus proliferation in cell culture, per-haps by interfering with protein synthesis. A purified sample of aloe emodin was effective against infectivity of herpes simplex virus Type I and Type II and it was capable of inactivating all of the viruses, including varicella zoster virus, influenza virus, and pseudorabies virus, (Jia et al., 2008; Silvaa et al., 2014; Sadeghi *et al*., 2015; Rezazadeh *et*

al., 2016). Aloe vera was evaluated on the mycellium development of Rhizoctonia solani, Fusarium oxysporum, and Colle- totrichum coccodes, that showed an inhibitory effect of the pulp of A. vera on F. Oxysporum, R. solani reduced the rate of colony growth, (Rodríguez *et al*., 2005), (Agarry *et al*., 2005). reported that the Aloegel inhibited the growth of Trichophyton mentagrophytes, while the leaf possesses inhibitory effects on both Pseudomonas aeruginosa and Candida albicans. In contrast, Aloe vera extracts failed to show antibiotic proper ties against Xanthomonasspecies. The saponins perform strongly as anti-microbial against bacteria, viruses, fungi and yeasts, (Joerger *et al*., 2001; Peter *et al*., 2002; Moghadamtousi *et al*., 2014; Shireen *et al*., 2015; Ahmed *et al*., 2016). Steatorrhoea and protein-losing gastroenteropathy with hypoalbuminaemia have also been observed, as have excessive excretion of calcium in the stools and osteomalacia of the vertebral column, (Ernst *et al*., 2000; Hajheydari *et al*., 2014; Miroddi *et al*., 2015). 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, (Dhikav *et al*., 2002; Sharma *et al*., 2014; Ahluwaliaa *et al*., 2016). Abdominal cramps, diarrhoea, red urine, hepatitis, dependency or worsening of constipation. Prolonged use has been reported to increase the risk of colorectal cancer. Laxative effect may cause electrolyte imbalances (low potassium levels), (Chinnusamy *et al*., 2009; Salazar *et al*., 2010; Sundarkar *et al*., 2011; Kareman *et al*., 2013; Akev *et al*., 2015; Ahmada *et al*., 2016).

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