

## **Lesson no. 16 Aloe vera**



Aloe vera is very famous worldwide for its health benefits on skin, hair, nails, internal health of bones, joints; prevents from diseases etc. It is now days used by all people due to its easy availability. It is famous for its gel inside its leaves. The name Aloe vera derives from the Arabic word “Alloeh” meaning “shining bitter substance,” while “vera” in Latin means “true”. The botanical name of Aloe vera is Aloe barbadensis miller. It belongs to Asphodelaceae (Liliaceae) family, and is a shrub.

### **Basic encyclopedia of Aloe vera: -**

#### **• NAMES:**

1. In Hadees it is called as Sabir (صبر)
2. In Hindi & Urdu it is called as Ghikawar or Guarpatha.
3. In English & Latin it is called as Aloe Vera.
4. In Marathi it is called as Korphod.
5. Its family is Asphodelaceae (previously was Xanthorrhoeaceae).

It is mentioned in following books of Hadith (reference are also given as Hadith number) Abu Dawud, An-Nasai, Al-Haawi Al-Kabeer. In Hadith it is mentioned in amongst bitter which is remedy; in next Hadith it is mentioned that it brightens the face but it should be applied at night; in next Hadith it is advised to use in eyes during eyes infection. As mentioned in Hadith to apply in eyes aloe vera is scientifically proven as and best natural antibiotic & very helpful for eyes, actually its gel is to be applied in the eyes. Please read lesson no. 58 Aloe vera in part 2 page 185 of my English book Tibb E Nabawi or Please visit my website [www.tib-e-nabi-for-you.com](http://www.tib-e-nabi-for-you.com) for detail Islamic study on aloe vera, direct link is <http://www.tib-e-nabi-for-you.com/aloevera.html> you will be detail of Islamic study of aloe vera with scientific references.

#### **• USES OF IT: -**

1. It can be taken orally as its natural Juice.
2. Apply on skin, wounds, ulcers, burns & etc.
3. Taken mix with medicines.
4. Taken in medicinal preparations.

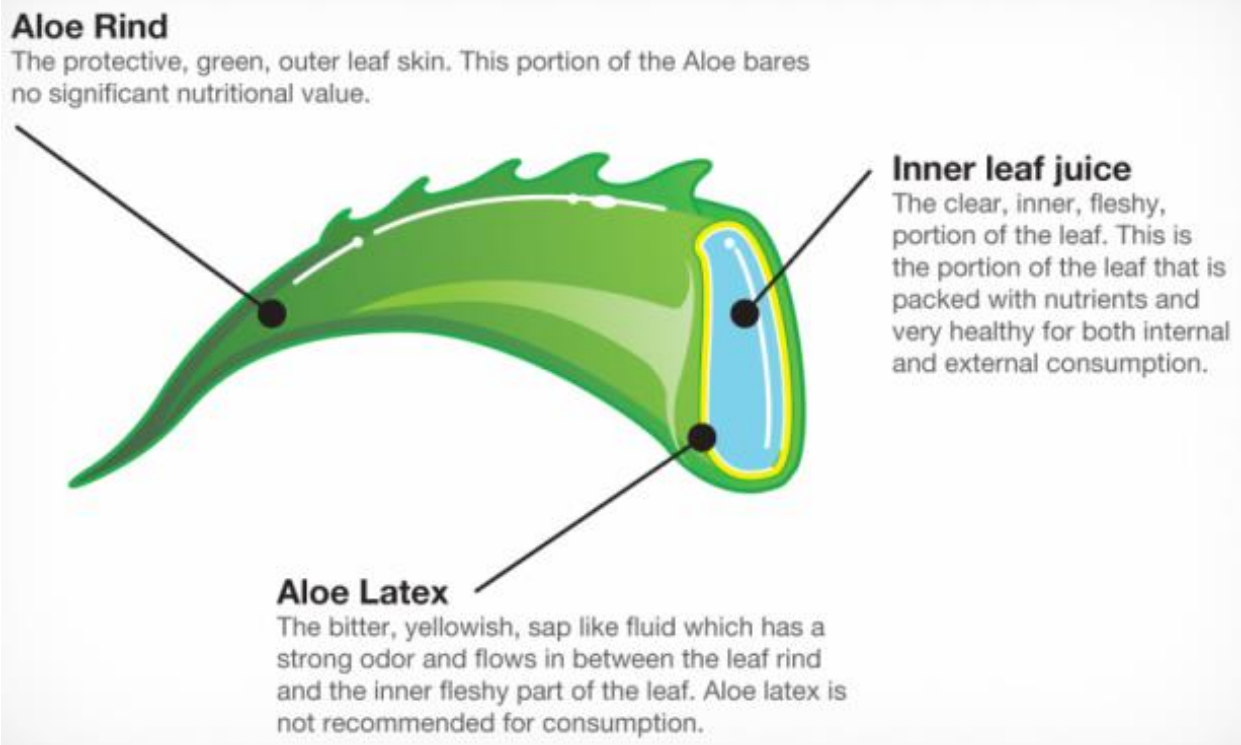
#### **• AVAILABLE IN MARKET AS: -**

1. Juice (in Natural form).
2. As shampoo, face wash, gel to apply on face or hairs.
3. Ointments creams, etc.
4. Pickle.
5. Tablets, capsules (in dried form or its extract).
6. Oils.
7. As a gel to apply on the body.

#### **• Aloe vera plant & leaves: -**

Aloe vera is member of the flowering plant genus Aloe, comprising about 400 species of succulent, evergreen perennial plants, most of which have a rosette of serrated leaves at the base with no or little stem; most aloes have a rosette of large, thick, fleshy leaves, leaves are often lance-shaped with a sharp apex and a spiny margin. It is cactus like succulent & belongs to genus of liliaceous plants; the stem may be absent or a short stem up to 25 cm long many be grown; the leaves in a straight dense rosette, more or less 20 leaves on the plant; the leaves grow to up to 40–50 cm long and 6–7 cm wide. The leaves are

rather thick, fleshy, water retaining; concave on the top side, grey-green often reddish-greenish and young plants are often speckled. The underside of the leaf is convex with a pale pink rim that is dressed with 2 mm long thorny pikes spaced at every 10–20 mm. One leaf can weight as much as 1.5 to 2 kg. The succulent leaf of the aloe is an adaptation to the very dry conditions of its habitat. The leaves have liquid & solid gel, also yellow or brownish latex which has many health benefitting properties. Leaves have white flecks on their upper and lower stem surfaces. It is cultivated for agricultural and medicinal uses; its gel is use in beverages, skin lotion, cosmetics, or ointments for minor burns and sunburns, infection etc. Aloe vera is considered to be native only to the south-west Arabian Peninsula. However, it has been widely cultivated around the world.



Each leaf is composed of three layers: 1) an inner clear gel that contains 99% water and rest is made of glucomannans, amino acids, lipids, sterols and vitamins. 2) The middle layer of latex which is the bitter yellow sap and contains anthraquinones and glycosides. 3) The outer thick layer of 15–20 cells called as rind which has protective function and synthesizes carbohydrates and proteins. Inside the rind are vascular bundles responsible for transportation of substances such as water (xylem) and starch (phloem).

- **Aloe vera flower:** -



The flowers are produced in summer on a long spike (stalk) up to 90 cm tall, each flower pendulous, with a yellow tubular corolla 2-3 cm long.

- **Aloe vera root: -**

The root system of the aloe vera tends to grow wide, but not deep into soil; it has shallow-rooted, an adaptation that allows them to absorb water efficiently when rainfall or watering is infrequent. Multiple tuberous roots store moisture while a fibrous system of small roots anchors the plant and absorbs moisture and nutrients.

- **Soil required growing aloe vera: -**

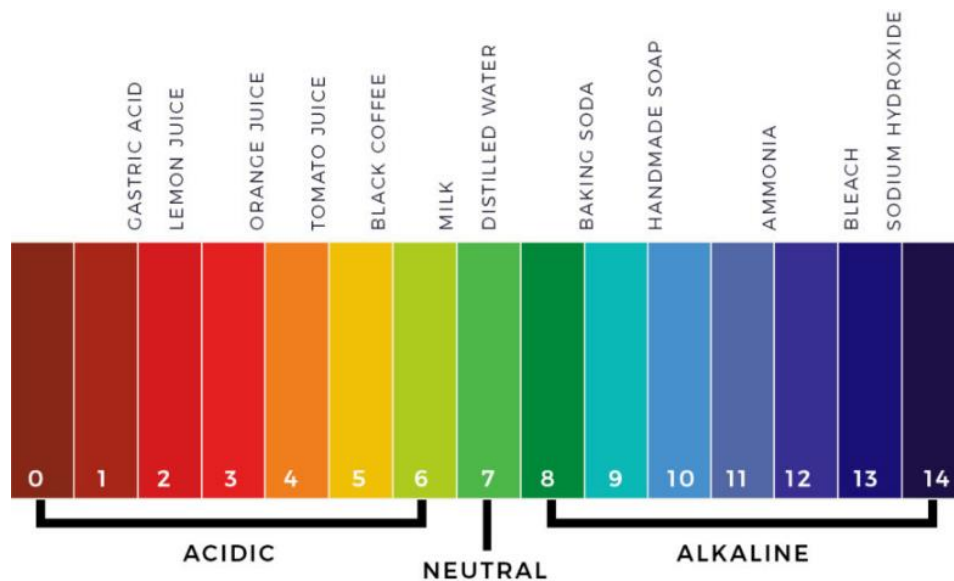
All members of the Aloe genus require sandy or gravelly soil with very good drainage to reduce the risk of root rot and nutritional deficiencies. When planted in containers, aloe vera plants do well in a mixture of commercial potting mix with extra sand, granite grit or perlite added.

- **pH of aloe vera is: -** pH is 4.5-5.5; it is mild acidic because its pH is below 7.

pH is a measure of hydrogen ion concentration, a measure of the acidity or alkalinity of a solution. The pH scale usually ranges from 0 to 14. Aqueous solutions at 25°C with a pH less than 7 are acidic, while those with a pH greater than 7 are basic or alkaline & 7 is neutral; only aqueous solutions have pH levels, vegetable oil has no pH value. Likewise, other oils such as animal and petrochemical oils also have no pH value. Fatty acids are organic molecules often found in foods, including vegetable oils.

The pH of pure water is 7. In general, water with a pH lower than 7 is considered acidic, and with a pH greater than 7 is considered alkaline. The normal range for pH in surface water systems is 6.5 to 8.5, and the pH range for groundwater systems is between 6 and 8.5. We can add normal water to reduce the acidity.

It is Sunnat of Prophet Muhammad (s.a.w) to mix acidic with Alkaline to make it neutral or less acidic that why He use eat dates with watermelon or cucumber or dry dates with little butter; so you can mix one acidic with alkaline; also it is Sunnat to drink honey mixed in water; also dates or raisins soaked in water over night & drink the syrup (sharbat). Remember do not soak dates & raisin together at one time; soak at separate time & drink.



- **Calories of Aloe vera juice:** - 100 ml of its juice give 15 calories only.
- **Glycemic index & Glycemic load:** - Aloe vera has a low glycemic index & load, diabetes patient can use it, remember we use it in medicinal dose & not in large quantity as food.

A food is considered to have a low Glycemic index (GI) if it is 55 or less; mid-range GI if 56 to 69 & high GI if 70 or more. *Glycemic index* is a number. It gives you an idea about how fast your body converts the carbs in a food into glucose.

A low Glycemic load (GL) is between 1 and 10; a moderate GL is 11 to 19; and a high GL is 20 or higher. For those with diabetes, you want your diet to have GL values as low as possible.

The *glycemic load* (GL) of food is a number that estimates how much the food will raise a person's blood glucose level after eating it. *Glycemic load* accounts for how much carbohydrate is in the food and how much each gram of carbohydrate in the food raises blood glucose levels.

### **Gross health benefits of Aloe vera: -**

It is anti bacterial, anti viral, anti fungal, good in all skin diseases, skin complexion, best of hairs, skin, nails, teeth, burns, best for eye infection, it can be you orally & application of skin, good in constipation, nourishes brain, heart; improves peristalsis movement of gastrointestinal tract, helpful in anemia, RBC formation, maintains pH of blood, reduces weight, fats, protects from cancer, it is antioxidant, anti inflammatory; increase urine output, strengthens the bone, teeth, eye sight, nerves; reduces thyroid activity so helpful in hyperthyroidism, help liver function, kills worm of GIT, improves bladder function, kidney function, reduces piles, blood pressure, best in summer season (it's juice), helpful in heavy menstrual bleeding, strengthens the whole body, best for recovery period, increases libido, skin disease like herpes zoster, varicella zoster, influenza; it is anti-aging, boost immune system, also it works on anti-tumour, aphthous ulcer, oral lichen planus, gingivitis, works on gram positive & negative bacteria;

- **Clinical pharmacology of aloe vera: -**

**Healing properties:** 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. 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. An increased synthesis of hyaluronic acid and dermatan sulfate in the granulation tissue of a healing wound following oral or topical treatment has been reported.

**Effects on skin exposure to UV and gamma radiation:** Aloe vera gel has been reported to have a protective effect against radiation damage to the skin. Exact role is not known, but following the administration of aloe vera gel, 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. It reduces the production and release of skin keratinocyte-derived immunosuppressive cytokines such as interleukin-10 (IL-10) and hence prevents UV-induced suppression of delayed type hypersensitivity.

**Anti-inflammatory action:** Aloe vera inhibits the cyclooxygenase pathway and reduces prostaglandin E2 production from arachidonic acid. Recently, the novel anti-inflammatory compound called C-glucosyl chromone was isolated from gel extracts.

**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. 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. Several low-molecular-weight compounds are also capable of inhibiting the release of reactive oxygen free radicals from activated human neutrophils.

**Laxative effects:** Anthraquinones present in latex are a potent laxative. It increases intestinal water content, stimulates mucus secretion and increases intestinal peristalsis.

**Antiviral and antitumor activity:** These actions 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, varicella zoster and influenza. In recent studies, a polysaccharide fraction has shown to inhibit the binding of benzopyrene to primary rat hepatocytes, thereby preventing 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 aloe gel in cancer chemoprevention.

**Moisturizing and anti-aging effect:** Mucopolysaccharides help in binding moisture into the skin. Aloe stimulates fibroblast which produces the collagen and elastin fibers making the skin more elastic and less wrinkled. It also has cohesive effects on the superficial flaking epidermal cells by sticking them together, which softens the skin. The amino acids also soften hardened skin cells and zinc acts as an astringent to tighten pores. Its moisturizing effects has also been studied in treatment of dry skin associated with occupational exposure where aloe vera gel gloves improved the skin integrity, decreases appearance of fine wrinkle and decreases erythema. It also has anti-acne effect.

**Antiseptic effect:** Aloe 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.

- **Modern uses of it: -**

**For acidity & GERD: -**

GERD is a digestive disorder that often results in heartburn. A 2010 review suggested that consuming half cup of aloe gel at mealtime could reduce the severity of GERD. It may also ease other digestion-related problems. The plant's low toxicity makes it a safe and gentle remedy for heartburn.

**For mouth ulcers, teeth problem, gum problem:-**

Aloe vera extract is safe and effective alternative to chemical-based mouthwashes. The plant's natural ingredients, which include a healthy dose of vitamin C, can block plaque, infection, heal mouth sores & ulcer; control teeth infection. It can also provide relief if you have bleeding or swollen gums. Applied pure aloe vera gel in mouth twice a day for 40 days followed by twice a week lifelong.

**For Diabetes: -**

Drink two tablespoons of aloe vera juice per day 3 times can cause blood sugar levels to fall in people with type 2 diabetes; continue your routine diabetic medicines.

**For complexion: -**

Apply pure aloe vera gel on face before sleep daily for 40 days followed by alternative day for 40 days followed by twice a week lifelong.

**For any skin diseases: -**

Apply pure gel of it on the affected part 3 times a day till complete relief followed by twice a week for 7 weeks. (for fungal infection, psoriasis, eczema, wounds, diabetic ulcers, venous ulcers etc.

**For constipation, piles etc: -**

Drink 20 to 30 ml of pure gel at night before sleep for 15 days followed by alternative days for 1 month followed once a week lifelong.

**For any cancer: -**

Drink 20 ml aloe vera gel 3 to 5 times a day lifelong & continue your other medicines.

**For IBD, bowel diseases: -**

Take 7ml of olive oil, 7 ml of aloe vera gel, 7 ml of pure honey, mix all in 1 cup water & drink it 3 times a day till complete relief.

**It should not be used during pregnancy.**

- **Types of Aloe vera:** -There are 250 types of it & mainly 20 types are as follows: -

1. Aloe Barbadensis Miller



This is one of the most common types and is very popular due to its healing properties. The gel produced when you cut the leaves help burns heal fast and resolve lots of skin and hair issues. This plant grows yellow flowers and has white spots that appear on the leaves but tend to disappear as the plant grows older.

2. Aloe Crosby's Prolific



This miniature or dwarf aloe has long leaves with translucent teeth. The plant grows orange-red flowers and the leaves turn red in the sun, contributing to the beauty of your landscape design. It's suitable for containers and beds.

3. Aloe Rubroviolacea



Arabian Aloe is tolerant of drought. It grows beautifully in beds, borders, containers, patios, and gardens.

The plant looks outstanding with its blue-green leaves and the reddish teeth that surround them. The leaves turn purple in full sun. It grows dense spires of red flowers in winter and is virtually disease-free.

#### 4. Aloe Ferox



Aloe Ferox is also known as Cape Aloe. Each leaf has brown teeth and spines, especially in the lower part. The plant produces large bright orange flowers. The transparent gel of the Cape Aloe is used in burn ointments and other skincare products, in addition to food supplements.

#### 5. Aloe Microstigma



The small clumps of this evergreen plant change to purple or red when it suffers from stress. The leaves have white spots and red teeth along the edges.

You can water it once a week in summer and not at all in winter so it's quite easy to maintain. The plant blooms in winter and grows reddish-orange flowers that reach a height of 3 feet.

#### 6. Aloe Broomii



It is also called as Snake Aloe; it is one of the most famous ornamental aloe plants thanks to the light green leaves. The candle-like lemon flowers attract birds. The plant grows beautifully in gravel and rock gardens.

#### 7. Aloe Aculeata



This one is known as Red Hot Poker Aloe and is native to South Africa. The word Aculeata means prickly and refers to the spines and teeth on the plant.

It has orange-yellow flowers that bloom between August and October. It can grow in beds and containers as long as it's protected from the winter rain.

#### 8. Aloe Marlothii



The fleshy leaves of this aloe can reach a height of 5 feet and have a broad base tapering to a sharp point. These leaves have reddish-brown spines along the edges and sometimes on the lower and upper surface of the leaves.

The plant grows flowers that are red, orange or yellow and attract nectar-feeding birds. It grows beautifully in rock gardens.

#### 9. Aloe Cameronii



The rich red copper leaves are the main reason why the Red Aloe is so popular. The color of the leaves depends on the exposure to sun and water. In late fall, it starts to grow red-orange flowers.

#### 10. Aloe Maculata



Soap Aloe is also known as Aloe Saponaria and has spotted leaves that can be green or red. The plant gets its name from soap because it makes a soapy lather in water, which is usually used by the locals.

It grows bright reddish-orange flowers but the seeds are poisonous. This plant is salt tolerant but gets really damaged if the temperature drops below 32 °F.

#### 11. Aloe Arborescens



Gardening enthusiasts value the Aloe Arborescens because of its evergreen leaves and bright reddish flowers. The name means “tree-like” because it can reach the size of a tree.

Some modern studies suggest that this plant can help with cells proliferation, which typically increases when there are tumors in the body. However, you should consult your doctor about the best way to incorporate this plant into your therapy plan.

#### 12. Aloe Petricola





This is widely known as Stone Aloe. It's very popular among gardening enthusiasts thanks to the bright colors of its inflorescences and blue-green leaves.

Stone Aloe grows from early to mid-winter but the flowers bloom in July. It's a low maintenance succulent plant that can grow in the stony ground with only some soil covering its roots.

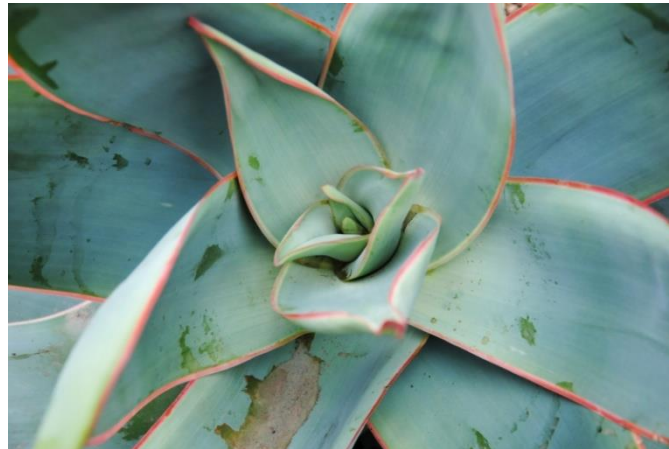
### 13. Aloe Ciliaris



This type of aloe has fine white hairs that grow on the margins of the curved leaves. Its name means climbing aloe because it grows very quickly, producing bright orange flowers that bloom between November and April.

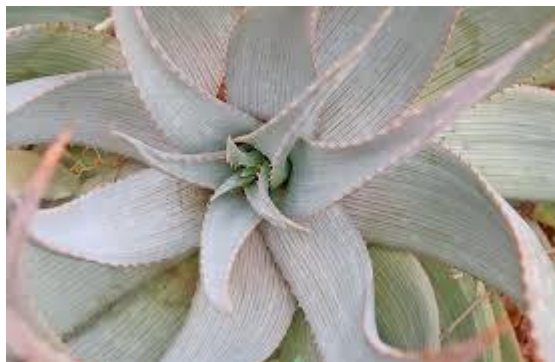
Aloe Ciliaris is a good houseplant and attracts bees and butterflies when kept outside. It's one of the easiest plants to grow from cuttings.

### 14. Aloe Striata



Coral Aloe has toothless flat broad leaves that are rather pale green but turn pink in the sun. The tubular clusters of coral-orange flowers grow from late spring until early winter.

### 15. Aloe Hereroensis



It is also called as Sand Aloe; it has pale blue-green leaves that turn rose-colored in the sun. The leaves are lined with red-brown spines and grow eye-catching scarlet red flowers. It's a good choice for borders and beds.

## 16. Aloe Polyphylla



This aloe has distinctively-arranged foliage in a spiral pattern. A single plant can have up to 150 leaves arranged in 5 ranks. It rarely blooms but when it does, it grows salmon-pink flowers that attract bees.

## 17. Aloe Brevifolia



Short-Leaf Aloe forms a carpet of colorful rosettes. The plant tolerates partial shade and grows pale green leaves that turn golden yellow and rosy-pink in full sun. It's an excellent choice for containers and groundcovers and grows tubular orange flowers in late spring.

## 18. Aloe Aristata



The leaves of the Torch Plant or Lace Aloe are pale green in the shade but become dark green in full sun. The incurved leaves have tufted tips and are lined with white teeth along the edges.

It forms clumps and grows red-orange flowers in winter. This plant prefers partial shade, especially in the strong afternoon sun.

## 19. Aloe Plicatilis



The Fan Aloe has a unique fan-like leaf arrangement. The light blue-green leaves usually have orange edges. This shrub-like arrangement grows bright pink flowers out of every leaf cluster. They're full of nectar and attract birds.

## 20. Aloe Capitata Var. Quartziticola



This aloe has milky-blue leaves when grown in partial shade but they become purple-tinged when exposed to the sun. This plant produces a branched flower stalk with a round flower head. Each bell-shaped flower is glossy orange and opens to reveal a golden-yellow interior. Unlike other types of aloe, this one can tolerate a little freeze.

- **Contents/constituents of Aloe vera: -**

Aloe vera contains 200 potentially active constituents: vitamins, enzymes, minerals, sugars, lignin, saponins, salicylic acids and amino acids, which are responsible for the multifunctional activity of Aloe.

All contents may not present in all types of it, because there are many varieties of it according to geographical regions & content may differ a lot as per cultivation, soil, seed, climate etc.

Aloe vera contains 75 potentially active constituents: vitamins, enzymes, minerals, sugars, lignin, saponins, salicylic acids and amino acids. It contains 98% of water.

**Vitamins:** It contains vitamins A (beta-carotene), C and E, which are antioxidants. It also contains vitamin B12, folic acid, and choline. Antioxidant neutralizes free radicals.

**Enzymes:** It contains 8 enzymes: aliiase, alkaline phosphatase, amylase, bradykinase, carboxypeptidase, catalase, cellulase, lipase, and peroxidase. Bradykinase helps to reduce excessive inflammation when applied to the skin topically, while others help in the breakdown of sugars and fats.

**Minerals:** It provides calcium, chromium, copper, selenium, magnesium, manganese, potassium, sodium and zinc. They are essential for the proper functioning of various enzyme systems in different metabolic pathways and few are antioxidants.

**Sugars:** It 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 prominent monosaccharide is mannose-6-phosphate, and the most common polysaccharides are called glucomannans [beta-(1,4)-acetylated mannan]. Acemannan, a prominent glucomannan has also been found. Recently, a glycoprotein with antiallergic properties, called alprogen and novel anti-inflammatory compound, C-glucosyl chromone, has been isolated from Aloe vera gel.

**Antraquinones:** It provides 12 anthraquinones, which are phenolic compounds traditionally known as laxatives. Aloin and emodin act as analgesics, antibacterials and antivirals.

**Fatty acids:** It provides 4 plant steroids; cholesterol, campesterol,  $\beta$ -sitosterol and lupeol. All these have anti-inflammatory action and lupeol also possesses antiseptic and analgesic properties.

**Hormones:** Auxins and gibberellins that help in wound healing and have anti-inflammatory action.

**Others:** It provides 20 of the 22 human required amino acids and 7 of the 8 essential amino acids. It also contains salicylic acid that possesses anti-inflammatory and antibacterial properties. Lignin, an inert substance, when included in topical preparations, enhances penetrative effect of the other ingredients into the skin. Saponins that are the soapy substances form about 3% of the gel and have cleansing and antiseptic properties.

**Active ingredient of Aloe vera: -**

Active components with its properties: Aloe vera contains 75 potentially active constituents: vitamins, enzymes, minerals, sugars, lignin, saponins, salicylic acids and amino acids.

A good quality of aloe vera juice contains little amount of amino acids mentioned in table below: -

The above ingredients are based on scientific study, means these has been identified, known & learnt by modern science, it does not mean that it contains only these ingredients; there may be many more ingredients which are yet to be discovered, learnt & known by modern science.

### **Natural Basic Pharmacology of Aloe vera based on human intake in natural food products: -**

The details given below are based on natural ingredients

- **Folate (vitamin B9): -**

Folate is an essential micro nutrient, it is a natural form of vitamin B9, it serves many important functions of the body, it plays an important role in cell growth & formation of DNA, RNA & other genetic material & helps in treating many diseases; its name is derived from Latin Word Folium, which means leaf, leafy vegetables have it in good amount; Folic acid is a synthetic form of vitamin B9.

#### **Main sources of folate: -**

It is present in watermelon, quince, dark green leafy vegetables, fruits, nuts, beans, dates, seafood, egg, dairy products, meat, chicken, legumes, beetroot, citrus fruits, broccoli, spinach, cereals etc.

#### **Basic pharmacokinetic of folate (based on human intake in natural food products): -**

Its absorption is complicated because folate present in food are of many different forms, some of which cannot be absorbed until broken down by intestinal enzymes; it is not absorbed more than 50%; dietary folate contains glutamate that need to separate it from glutamate before absorption starts; It is absorbed in duodenum & jejunum, after absorption it is converted into tetrahydrofolate (the active form of folate), then a methyl group is added to it to form methyltetrahydrofolate; now the body uses it for various functions & metabolism; the body can store folate 20-70mg in liver which is enough for 3 -6 months for the body; it gets excreted in urine & little in stools & bile.

#### **Basic clinical pharmacology of folate: -**

It is needed by the body to make DNA, RNA & other genetic material; it prevents many disease & conditions like anaemia, stroke, cardiac diseases, cancers, neurological diseases, macular degeneration (eye disease), palpitation, sores in mouth & tongue, hair fall, graying of hair. It is important in fertilization in male & female, essential during pregnancy to prevent neural tube defect in embryo (it is needed more), it protect us from free radicals & oxidation thus prevent cancers, it is essential in red blood cells formation, reduces high levels of homocysteine. Its deficiency may cause anaemia, tiredness, palpitation, breathlessness, hairfall, neural tube defect in baby during pregnancy etc.

- **Vitamin B12: -**

It is called as Cobalamin, it is water soluble, it is involved in metabolism of every cell of body, it is a cofactor in DNA synthesis, myelin, fatty acids & protein, it is important for nervous system, it acts on red blood cell maturation; it is very less present in vegetables. When we eat animal source for it, B12 is protein bounded. Our body cannot produce it we need to consume it in food sources.

#### **Main sources of vitamin B12: -**

It is present in fish, meat, egg, milk, dates, organ like liver, kidney, olive fruit etc.

#### **Basic pharmacokinetics of vitamin B12: - (based on human intake in natural food products):**

It is absorbed in ileum (small intestine), when humans eat animal food the B12 is protein-bound. When the protein-B12 complex reaches the stomach, the stomach secretes acids and enzymes that detach the B12 from the protein. Then in a process unique to B12, another protein, R-protein (aka cobalophilin, haptocorrin, and transcobalamin picks up the B12 and transports it through the stomach and into the small intestine. R-protein is found in many fluids in the human body including saliva and stomach secretions. The stomach cells also produce a protein called intrinsic factor (IF), which travels to the small intestine. When the corrinoid-R-protein complex gets to the small intestine, the corrinoid is liberated from the R-protein by enzymes made by the pancreas. Of the liberated corrinoids, only the cobalamins attach to intrinsic factor. Intrinsic factor then carries the cobalamins to the last section of the small intestine, the ileum. The cells lining the ileum contain receptors for the cobalamin-IF complex. The cobalamin-IF complex protects the cobalamin against bacterial and digestive enzyme degradation. The IF-receptor also ensures that cobalamins will be given priority for absorption over non-cobalamin corrinoids. In addition to the IF mechanism, passive diffusion normally accounts for 1-3% of B12 absorbed when obtained

through normal food sources. Some inactive B12 analogues are most likely absorbed through passive diffusion. It is metabolized in liver & excreted in urine. It is stored in liver for years mainly.

### **Basic clinical pharmacology of vitamin B12: -**

It helps in formation of Red blood cells, prevent anaemia, prevent birth defect, promotes bone health, prevent osteoporosis, reduces risk of macular degeneration in eyes, improves mood & prevents depression, help nerve function & promote nervous health, boost energy, improves heart health, nails, hairs, skin, memory, hormonal balance. It acts on wound healing, sooner recovery, ulcers, mouth ulcers etc.

Its deficiency causes anaemia, stress, weakness, stress, fatigue, delay wound healing, pain in nerves & tissues, joints, paleness, numbness in palms, feet etc. Diabetes & acidity medication reduces absorption of it in stomach & may lead to deficiency.

- **Vitamin A: -**

It is a fat soluble vitamin; it is group of unsaturated organic compound that includes retinol, retinal, retinoic acid & several provitamin A carotenoid. There are 2 types of vitamin A, 1) Vitamin A: - found in meat, poultry, fish & dairy products; 2) Provitamin A: - found in fruits, vegetables, plants; beta carotene is common type of provitamin A; it is an antioxidant, reduces wrinkles & repairs the skin damages; it is available in the market as tretinoin in tablets & creams to heal acne.

### **Main sources of vitamin A: -**

It is present in watermelon, fish oil, carrot, green leafy vegetables, citrus fruit, sweet potato, spinach, kale, quince etc.

### **Basic pharmacokinetic of vitamin A (based on human intake in natural food products): -**

It is absorbed in jejunum mainly, little through skin; metabolism is in liver & excreted in urine & stools, it is conjugated with glucuronic acid & then changed into retinal & retinoic acid; retinoic acid is excreted in stool, mainly. It is stored primarily as palmitate in Kupffer's cells of liver, normal adult liver stores sufficient amount of it which is enough for 2 years for the body, little is stored in kidneys, lungs, adrenal glands, fats, retina; it is excreted in urine & stools.

### **Clinical pharmacology of vitamin A: -**

it is needed by the body for vision and maintains eye health specially retina; it prevents night blindness; it helps in normal reproduction of cells thus prevents cancer; it is required for proper growth & development of embryo throughout the pregnancy period, it is good for skin, supports immune function; helps the heart, kidneys & lungs to work properly.

- **Vitamin E: -**

It is fat soluble vitamin; it is a group of eight fat soluble compounds that includes four tocopherols & four tocotrienols.

### **Main sources of vitamin E: -**

It is present in olive oil, almonds, cereals, wheat germ, sunflower oil, corn oil, soybean oil, peanuts, green leafy vegetables & etc.

### **Basic pharmacokinetics of vitamin E (based on human intake in natural food products): -**

It is absorbed in small intestines & metabolized in liver & distributed through lymphatic system & stored in fat droplets of adipose tissue cells; it is mainly excreted in stool, little in urine & through skin.

### **Basic clinical pharmacology of vitamin E: -**

It prevents coronary heart disease, supports immune system, prevent inflammation, promotes eye health, lowers the risk of cancer; It is a powerful anti-oxidant thus reduces UV damage of skin, nourishes & protects the skin when applied on face; also promotes hair growth.

- **Vitamin C: -**

It is also called as Ascorbic acid; it is an essential water soluble vitamin, very much needed by the body for many functions & absorption etc.

### **Main sources of vitamin C: -**

It is present in watermelon, citrus fruit, broccoli, cauliflower, sprouts, capsicums, papaya, strawberries, spinach, green & red chilies, cabbage, leafy vegetables, tomato, cereals, quince, cucumber etc.

### **Basic pharmacokinetic of vitamin C (based on human intake in natural food products): -**

It does not need to undergo digestion, 80 to 90% of it eaten is absorbed by intestine cell border by active transport & passive diffusion & through ion channels it enters the plasma via capillaries. It is very little stored in adrenal glands, pituitary gland, brain, eyes, ovaries, testes, liver, spleen, heart, kidneys, lungs, pancreas & muscles. All together body can store 5 grams of it & we need 200mg/day in order to maintain its normal level & uses, but old, disease person, smokers & alcoholic need more daily value. It is excreted in urine in the form of dehydroascorbic acid changed by liver & kidneys both, but unused vitamin C is excreted intact.

### **Basic clinical pharmacology of vitamin C: -**

It prevent cough & cold, repairs tissue, acts as an enzyme for curtain neurotransmitter, important for immune function, it is a powerful antioxidant (donates electron to various enzymatic & non-enzymatic reactions); body prepares collagen with the help of vitamin c; it is also helpful in Alzheimer's, dementia, acts on iron absorption, it protects the body from oxidative damages, reduces stiffness of arteries, reduces tendency of platelets to clump each other, improves nitric oxide activity (dilatation of blood vessels) thus prevents high blood pressure & heart disease, also prevent eye disease, reduces risk of cataract, prevents the lining of lungs & prevents lung disease, it is a natural antihistamine (anti allergy), eliminates toxins from the body. Deficiency of it causes Scurvy disease (brown spots on skin occurs, swelling of gums, bleeding from all mucous membrane, spots are more on thighs & legs, the person looks pale, feel depressed, cannot move, loss of teeth, suppurative wounds occur.

- **Choline: -**

It is water soluble vitamin & essential nutrient; it is a constituent of lecithin; it helps in many functions of the body.

### **Main sources of choline: -**

It is present in watermelon, egg, peanut, fish, dairy products, wheat, beetroot, spinach, beans, whole grains, grapes etc.

### **Basic pharmacokinetics of choline (based on human intake in natural food products): -**

Choline is mostly present in food in free form; it is absorbed in small intestine via transporter proteins & metabolized in liver; excessive choline is not stored but converted into phospholipids; it is changed into Trimethylamine in liver & is excreted in urine.

### **Basic clinical pharmacology of choline: -**

It helps the nerves to develop signals. Our body makes some amount of choline, but should be consumed to avoid deficiency; it helps liver function, brain development, muscles movement, cell messenger system, DNA synthesis, nervous system, gall bladder function; it can be taken in pregnancy because it prevents neural tube defect. It aids in fats & cholesterol metabolism & prevent excessive fat building in liver.

- **Phosphatase: -**

Phosphatase is an enzyme that uses water to cleave a phosphoric acid monoester into a phosphate ion and an alcohol. Because a phosphatase enzyme catalyzes the hydrolysis of its substrate, it is a subcategory of hydrolases.

### **What is the difference between a kinase and phosphatase?**

Protein Phosphatases & Kinases.

A kinase is an enzyme that attaches a phosphate group to a protein. A phosphatase is an enzyme that removes a phosphate group from a protein. Together, these two families of enzymes act to modulate the activities of the proteins in a cell, often in response to external stimuli.

- **Potassium: -**

It is a mineral with symbol K & atomic number 19, it is an essential mineral which body cannot prepare; it is necessary for heart, kidney & other organs to function, its low level in body is called as hypokalemia & high level is called as hyperkalemia; it is mostly present inside the cells (intracellular); normal blood range is 3.5 to 5.0 milli equivalents per/liter (mEq/L).

### **Main sources of potassium: -**

Potassium is naturally present in banana, orange, dates, raisin, broccoli, milk, chicken, sweet potato, pumpkin, spinach, watermelon, coconut water, white & black beans, potato, dried apricot, beetroot, pomegranate, almond, quince etc.

### **Basic pharmacokinetics of potassium (bases on human intake in natural food products): -**

It is absorbed in small intestines by passive diffusion; it is stored mostly inside the cell, little in liver, bones & red blood cells. 80 to 90% potassium is excreted in urine & 5 to 20% is excreted in stools, sweat.

### **Basic clinical pharmacology of potassium: -**

It is a mineral belongs to electrolytes of the body; it conducts electrical impulses throughout the body & assists blood pressure, normal water balance, muscle contraction, nerves impulse, digestion, heart rhythm, maintain pH balance. It is not produced in our body so we need to consume it through eating; Kidneys maintain normal level of it in the body by excreting excessive amount of it in urine or reabsorb it if the amount is less in the body so that the body may reuse it. Its deficiency may cause weakness, low blood pressure, constipation, nausea, vomiting etc. Its normal amount in body keeps blood pressure normal; water balance in body normal; prevents heart disease, stroke, osteoporosis, kidney stone etc.

- **Sodium: -**

Here we are learning natural sodium, its symbol is Na & atomic no. 11; it is not produced in the body we need to take it in food sources; it is an important & essential mineral on which our body functions; it regulates blood pressure, blood volume etc.

### **Main sources of sodium: -**

Excessive intake of sodium should be avoided; It has very less amount of sodium; vegetables & fruits have less sodium in them which is good for the body. It is present in beans, meat, fish, chicken, chili, bread, rolls, milk, celery, beetroot etc.

### **Basic pharmacokinetic of sodium (based on human intake in natural food products): -**

It is absorbed in ileum by active sodium transport because it is impermeable & in jejunum absorption takes place via mediated active transport & depends on levels of water, bicarbonate, glucose, amino acids etc; its absorption plays an important role in the absorption of chloride, amino acids, glucose & water; similar mechanism are involved in the reabsorption of it in kidneys when its level in the body falls. It is excreted mainly in urine, little in sweat & stools. It is stores in bones & dissolved in various body fluids.

### **Basic clinical pharmacology of sodium: -**

It is amongst the essential electrolyte within the body, it remains in extracellular fluid (outside the cell) mainly, it carries electrical charges within the body, kidney maintain its normal level in the body, normal level is 135-145 milli-equivalent per liter (mEq/L), it is not produce in the body, it acts on muscles contraction, nerve cells, regulates blood pressure, blood volume; it takes part in every function of the body mostly, its low level in body is called as hyponatremia, it is found more in older aged, kidney disease, heart disease, hospitalized patient, this condition may cause brain edema, low blood pressure, fatigue, tiredness etc; its high level in the body is called as hypernatremia may cause increase in blood pressure, thirst, confusion, muscle twitching or spasm, seizures, weakness, nausea, loss of appetite, swelling in body etc.

- **Calcium: -**

It is natural essential mineral for the body, it is among the electrolytes of the body; its symbol is Ca & atomic no. 20.

### **Main sources of calcium: -**

It is present in watermelon, quince, milk, banana, cheese, green leafy vegetables, soya beans, nuts, fish, meat, egg, bread, flour, yogurt, almonds, kale, soybean, spinach etc.

### **Basic pharmacokinetics of calcium (based on human intake in natural food products): -**

Calcium is absorbed in duodenum & upper jejunum (when calcium intake is low) by transcellular active transport process, this depends on action of calcitriol & intestinal vitamin D receptors & when calcium intake is high, absorbed by paracellular passive process throughout the length of small intestine by 3 major steps, entry across the brush border, intracellular diffusion via calcium-binding protein & extrusion; Vitamin D is necessary for absorption of calcium, also vitamin C, E, k, magnesium & exercise increases the absorption of calcium. Also the level of calcium is regulated by calcitonin released by thyroid gland it reduces calcium level in blood when it is excessive & increases the excretion of calcium via kidneys; Parathyroid hormones (PTH) released by parathyroid gland increases the blood level of calcium when body need it or calcium is less in blood & promotes reabsorption of it in kidneys (calcitonin & PTH both have opposite function). Intestines can absorb 500 to 600 mg of calcium at a time; it is mostly stored in bone tissues & teeth & excreted in stool & sweat & little in urine depended upon the

level of it in blood. Also estrogen act on transport of blood calcium in bones thus women mostly suffer from osteoporosis after menopause.

**Basic clinical pharmacology of calcium: -**

Calcium acts on bone health, communication between brain & other parts of the body, muscles contraction, blood clotting; it is a co-factor for many enzymes, it relaxes the smooth muscles & blood vessels; it maintains heart rhythm, muscles function; it is more needed in childhood & deficiency of it in childhood may cause convulsions (seizure); Excessive level of it in blood is called as hypercalcemia & may lead to kidney stone formation, heart attack, stroke, loss of appetite, excessive urination, memory loss etc; its low level in blood is called as hypocalcemia & may lead to cramps in the body, weak bones, weak teeth, numbness, tingling etc.

**Contraindication: -**

Sarcoidosis, excessive level of calcium in blood, very severe constipation, kidney stones, increased activity of parathyroid gland etc. Hypersensitivity of calcium, severe cardiac diseases, hypercalcemia, hypercalciuria, severe kidney stones etc.

- **Magnesium: -**

It is an important essential mineral; its symbol is Mg & atomic no. 12; it is a co-factor for more than 300 enzymes that regulates functions in the body. Its normal range in blood is 0.75 to 0.95 millimoles (mmol)/L.

**Main sources of magnesium: -**

It is present in watermelon, quince, spinach, meat, egg, nuts, dark leafy green vegetables, broccoli, pumpkin seeds, dates, chicken, fish, legumes, cucumber etc.

**Basic pharmacokinetics of magnesium (based on human intake in natural food products): -**

It is absorbed about 20 to 50% only; it is absorbed about 40% in distal intestine when the level of it is low via passive paracellular transport & about 5% in descending colon when the level of it is high via active transcellular transport. Vitamin D increases its absorption & also acts on its excretion in urine. It is excreted in urine & stool; it is stored in bones.

**Basic clinical pharmacology of magnesium: -**

It is a co-factor for more than 300 enzymes that regulates functions in the body. It acts on protein synthesis, muscles & nerve function, blood glucose, control blood pressure; it is required for energy production, bone development, synthesis of DNA & RNA. It also plays a role in active transport of calcium & potassium ions, muscles contraction, normal heart rhythm etc.

- **Manganese: -**

It is an essential mineral & micro nutrient, needed by the body for proper health. Its symbol is Mn & atomic no. 25.

**Main sources of manganese: -**

It is present in watermelon, nuts, beans, legumes, brown rice, leafy green vegetables, pineapple, beetroot etc.

**Basic pharmacokinetics of manganese (based on human intake in natural food products): -**

It is absorbed 40%, it is absorbed more in women than men; if intake of it is more, than absorption is less & if intake is less, absorption is more; its absorption takes place in small intestines, after absorption it is bounded to blood protein transferring & transmanganin & transport via blood stream to tissues; it is absorbed by inhalation & dermal (skin) also; it crosses brain blood barrier. It is stored in bones, liver, kidney, pancreas; it is excreted mainly in bile & stools, little in urine & sweating; unused manganese is transported to liver for excretion & excreted via bile mainly.

**Basic clinical pharmacology of manganese: -**

It is needed for proper health of skin, bones, cartilage etc; it helps in glucose tolerance, regulates blood sugar, reduces inflammation, reduces premenstrual cramps, it also aids in formation of connective tissues, bones, sex hormones, blood clotting, metabolism of carbohydrates & fats; it facilitates calcium absorption.

- **Selenium: -**

It is an essential trace mineral; it is micro nutrient helpful to our body; its symbol is Se & atomic no. 34.

**Main sources of selenium: -**

It is present in quince, watermelon, fish, nuts, beef, chicken, mushroom, egg, grains, garlic etc.

**Basic pharmacokinetics of selenium (based on human intake in natural food products): -**



It is mainly absorbed in duodenum & proximal jejunum by active transport process; Dietary selenium is in 2 forms organic (selenomethionine) it is 90% absorbed & inorganic (selenite) it is 50% absorbed; after absorption it is sent in liver via portal veins, liver turns it into selenite & then is bound with selenoproteins & send into blood stream, gets in RBC, muscles, tissues etc; it is not distributed evenly in the body, liver has more of it; Vitamin E & other vitamins increases its absorption & both work as an anti-oxidant. Natural selenium remains in the body for less than 24 hours; it is stored in amino acid in skeletal muscles, little in liver, kidneys & pancreas; it is primarily excreted in urine, stool & expired in air via lungs very little in sweat & semen.

#### **Basic clinical pharmacology of selenium: -**

It is important for many body functions, immune system, fertility (both male & female); it contributes in thyroid hormone metabolism, DNA synthesis; it protects the body from oxidative damages & infection, it is found in tissues, skeletal muscles; it helps testies & seminal vesicles in their function; it reduces the risk of miscarriages, liver disease, cancer, asthma, cardio vascular disease; deficiency of it causes pain in muscles & joints, weaken the hair, nails, white spots on nails are found etc.

- **Chromium: -**

Chromium picolinate is the form of chromium commonly found in dietary supplements, it is an essential trace mineral metallic element.

#### **Main sources of chromium: -**

Broccoli, potato, green beans, beef, chicken, apples, banana, grape, cucumber, milk, dairy products.

#### **Basic pharmacokinetics of chromium (based on human intake in natural food products): -**

It is poorly absorbed in human & rapidly excreted in urine, not much is known about its metabolism.

#### **Basic clinical pharmacology of chromium: -**

It is effective at improving insulin response & lowering blood glucose in diabetic patients. It also reduces hunger, it enhances protein, carbohydrate & lipid metabolism.

- **Iron: -**

It is an essential mineral for our body; its symbol is Fe & atomic no. 26; it is an important component of hemoglobin (hemoglobin binds oxygen in lungs & supply it to whole body, it is oxygen carrier).

#### **Main sources of iron: -**

It is present in watermelon, quince, meat, dates, spinach, egg, nuts, dark leafy green vegetables, broccoli, pumpkin seeds, chicken, legumes, fish, banana, cabbage, kidney, almonds etc.

Meat is the best source of iron; it provides Fe<sup>+2</sup> directly which can be transported from intestine to blood stream through Fe<sup>+2</sup> transporter ferroportin (this binds with transferrin & delivered into tissues).

#### **Basic pharmacokinetics of iron (based on human intake in natural food products): -**

The absorption of iron is not known fully; about only 10% of iron taken in food is absorbed; it is absorbed in duodenum & upper jejunum mainly & at the end part of ileum; low pH is needed for its absorption, after absorption it get bind to transferrin (each transferrin can carry 2 atoms of iron); ceruloplasmin (protein) also helps in binding of iron; Hcpidin a hormone produced by liver is released when iron stores are full & inhibits iron transport & binding, thus reduces the absorption of iron; vitamin C & copper enhances iron absorption.

#### **Storage of iron: -**

Iron is stored in liver (in hepatocytes & kupffer's cells) kupffer's cells play an important role in recycling body iron, they ingest aged RBC liberate iron for it & reuse by breaking down hemoglobin. Little iron is stored in liver, heart, & kidneys in form of ferritin also little in bone marrow, spleen.

#### **Excretion of iron: -**

The body does not possess a physiological mechanism for regularly eliminating iron from the body because most of it is recycled by liver cells; iron is lost within cells, from skin & interior surface of the body (intestines, urine, breathe).

#### **Basic clinical pharmacology of iron: -**

It is an important component of Hemoglobin (hemoglobin bind oxygen in lungs & supply it to whole body); iron is beneficial for nails, hair, skin etc; it acts on blood production, its deficiency causes Anaemia (low hemoglobin level in blood) (this causes reduced in oxygen carrying capacity & supply of it); most of the iron is present in

haemoglobin, it consists of one heme (iron), one protein chain (globin) this allows it to bind & load oxygen from the lungs & supply it to whole body.

Unbounded or free iron is highly destructive & dangerous it can trigger free radical activity which can cause cell death & destroy DNA.

- **Zinc: -**

It is a trace mineral; symbol is Zn & atomic no. 30; it is necessary for human body as it plays vital role in health.

**Main sources of zinc: -**

It is present in watermelon, quince, meat, fish, legumes, beans, egg, dairy products, seeds, nuts, whole grains etc.

**Basic pharmacokinetics of zinc (based on human intake in natural food products): -**

It is absorbed 20 to 40%, its absorption depends on its concentration & is absorbed in whole intestines (jejunum has high rate of its absorption) via carrier-mediated mechanism, it is released from food as free ions during digestion. Zinc from animal sources is easily absorbed comparing to plants sources. It is present in bile & pancreatic juices which is released in duodenum & is reused by the body this is called as endogenous zinc & zinc present in food sources is called as exogenous zinc. Its absorption depends on 2 proteins- Albumin & metallophionein. Albumin enables zinc to be transported from plasma into enterocytes. It is stored in muscles, bones mainly & little in prostate, liver, kidneys, skin, brain, lungs, heart & pancreas. It is excreted in stools 80% & rest in urine & sweat. Metallophionein binds to zinc to make it unavailable & excrete it in stools when zinc is excess in the body, & production of metallophionein is reduced when zinc is less in the body to make zinc available for the body.

**Basic clinical pharmacology of zinc: -**

It is necessary for immune system, prevents skin diseases, heal skin diseases, helps stimulate activity of at least 100 different enzymes in the body; it is required in little amount in the body, but children, pregnant & old aged need it more. It promotes growth in children, synthesizes DNA & acts on wound healing, it is best in treating initial diarrhea & cold cough. It improves learning, memory, fertility etc. It heals acne, attention deficit hyperactivity disorder (ADHD), osteoporosis, pneumonia etc.

- **Copper: -**

It is an essential micronutrient mineral; its symbol is Cu & atomic no. 29; there are lot of health benefits of it; it is needed in little amount in the body.

**Main sources of copper: -**

It is present in watermelon, quince, spirulina (water-plant), nuts, seeds, lobster, leafy green vegetables, guava, grapes, green olive, kiwi, mango, pineapple, pomegranate, egg etc.

**Basic pharmacokinetics of copper (based on human intake in natural food products): -**

It is absorbed 30 to 50%; it is absorbed easily than other minerals, its absorption depends on the copper present in the body, when the intake of it is less, absorption is increased & when intake is more absorption is less, it is mainly absorbed in small intestines & little in stomach via carrier-mediated process; its absorption is influenced by amino acids, vitamin C & other dietary factors. After absorption it is bound primarily to albumin, peptide & amino acids & transported to liver. Copper is secreted into plasma as a complex with ceruloplasmin. It is mainly stored in liver little in brain, heart & kidneys; it is excreted mainly in bile & little in urine.

**Basic clinical pharmacology of copper: -**

Together with iron it enables the body to form RBC; it helps to maintain health of bones, blood vessels, nerves & immune system; it also acts on iron absorption, protein metabolism, growth of body, it acts also on development of brain, heart & other organ; it is needed by the body for making ATP, collagen. Excessive of it may cause Wilson's disease.

**Deficiency of copper: -**

It is very rare; but may cause cardiovascular disease, genetic defects, inflammation of optic nerve etc.

- **Selenium: -**

It is an essential trace mineral; it is micro nutrient helpful to our body; its symbol is Se & atomic no. 34.

**Main sources of selenium: -**

It is present in quince, watermelon, fish, nuts, beef, chicken, mushroom, egg, grains, garlic etc.

**Basic pharmacokinetics of selenium (based on human intake in natural food products): -**

It is mainly absorbed in duodenum & proximal jejunum by active transport process; Dietary selenium is in 2 forms organic (selenomethionine) it is 90% absorbed & inorganic (selenite) it is 50% absorbed; after absorption it is sent in liver via portal veins, liver turns it into selenite & then is bound with selenoproteins & send into blood stream, gets in RBC, muscles, tissues etc; it is not distributed evenly in the body, liver has more of it; Vitamin E & other vitamins increases its absorption & both work as an anti-oxidant. Natural selenium remains in the body for less than 24 hours; it is stored in amino acid in skeletal muscles, little in liver, kidneys & pancreas; it is primarily excreted in urine, stool & expired in air via lungs very little in sweat & semen.

#### **Basic clinical pharmacology of selenium: -**

It is important for many body functions, immune system, fertility (both male & female); it contributes in thyroid hormone metabolism, DNA synthesis; it protects the body from oxidative damages & infection, it is found in tissues, skeletal muscles; it helps testies & seminal vesicles in their function; it reduces the risk of miscarriages, liver disease, cancer, asthma, cardio vascular disease; deficiency of it causes pain in muscles & joints, weaken the hair, nails, white spots on nails are found etc.

- **Campesterol: -**

It is a phytosterol whose chemical structure is similar to cholesterol, it is phyto-steroid in nature; it reduces cholesterol (reduces absorption of cholesterol in intestine), prevents cancer.

#### **Main sources of campesterol: -**

Soybean oil, vegetable oil, banana, cucumber, onion, potato, lemon grass etc.

- **Beta-sitosterol: -**

It is among phytosterols & a main dietary phytosterol found in plants. It is anti cancer, anti inflammatory, it improves urine flow, reduces symptoms of heart diseases, reduces cholesterol, boost immune system, reliefs bronchitis, migraine, asthma, fatigue, rheumatoid arthritis, improve hair quality, reliefs prostrate problems, improves erectile dysfunctioning, psoriasis, libido.

#### **Main sources of beta-sitosterol: -**

Canola oil, avocados, almond, soya bean oil, nuts, vegetable oil, dark chocolate, rice bran oil, wheat germ, corn oil, peanuts, grapes etc.

- **Lupeol: -**

Lupeol is a pentacyclic triterpenoid that is lupane in which the hydrogen at the 3beta position is substituted by a hydroxy group. It occurs in the skin of lupin seeds, as well as in the latex of fig trees and of rubber plants. It is also found in many edible fruits and vegetables. It has a role as an anti-inflammatory drug and a plant metabolite.

- **Auxin: -**

Auxin is a plant hormone produced in the stem tip that promotes cell elongation. Auxin moves to the darker side of the plant, causing the cells there to grow larger than corresponding cells on the lighter side of the plant. The main function of auxin is to help plants grow. Auxin stimulates plant cells to elongate, and the apical meristem of a plant is one of the main places that auxin is produced. It is a powerful growth hormone produced naturally by plants. They are found in shoot and root tips and promote cell division, stem and root growth. They can also drastically affect plant orientation by promoting cell division to one side of the plant in response to sunlight and gravity.

- **Cytokinins**

Cytokinins are just as important as auxins, especially since levels of both stay relatively even. To put it simply, when auxins are at 50%, so are cytokinins. If one rises to 60%, the other falls to 40% and so on. This balance is used precisely to produce different stages of growth. If the auxin and cytokinin are equal, then normal cells produce normally. If the concentration of auxin is higher, than roots will form and if the auxin is less, shoots will form. Cytokinins, including kinetin, are a plant's version of the fountain of youth. This hormone encourages plant cells (elongated by the auxins) to divide and create new plant organs. It can help plants repair themselves when wounded and slow the natural aging process in order to allow more time for root growth and volume and also will increase the time where roots are most functional. These hormones aren't able to develop a strong, healthy plant above the ground without a powerful root system to increase nutrient and water intake.

- **Gibberellins (GAs): -**

It is plant hormones that regulate various developmental processes, including stem elongation, germination, dormancy, flowering, flower development, and leaf and fruit senescence. GAs are one of the longest-known classes of plant hormone. Gibberellins are growth hormones that stimulate cell elongation and cause plants to grow taller; have a role in other plant processes, such as stem elongation, germination, flowering, and fruit ripening.

- **Lignin: -**

Lignin is a class of complex organic polymers that form key structural materials in the support tissues of vascular plants and some algae. Lignins are particularly important in the formation of cell walls, especially in wood and bark, because they lend rigidity and do not rot easily.

- **Saponin: -**

Saponins are glucosides with foaming characteristics. Saponins consist of a polycyclic aglycones attached to one or more sugar side chains. The aglycone part, which is also called sapogenin, is either steroid (C27) or a triterpene (C30). The foaming ability of saponins is caused by the combination of a hydrophobic (fat-soluble) sapogenin and a hydrophilic (water-soluble) sugar part. Saponins have a bitter taste. Some saponins are toxic and are known as saptotoxin.

**Basic clinical pharmacology of saponin: -**

It reduces cholesterol, LDL, increases testosterone, libido & muscle mass; it maintains balance between cellular proliferation & cell death the disturbances in the balance cause severe diseases like cancer etc; it is anti bacterial, anti oxidant, inhibit tumour growth.

- **Salicylic acid: -**

Salicylic acid is a phenolic phyto-hormone and is found in plants with roles in plant growth and development, photosynthesis, transpiration, ion uptake and transport. It is involved in the systemic acquired resistance in which a pathogenic attack on one part of the plant induces resistance in other parts. It is when applied on skin is keratolytic (peeling agent). Salicylic acid causes shedding of the outer layer of skin. Salicylic acid topical (for the skin) is used in the treatment of acne, dandruff, seborrhea, or psoriasis, and to remove corns, calluses, and warts.

- **Aloin: -**

Aloin, also known as barbaloin, is a bitter, yellow-brown colored compound noted in the exudate of at least 68 Aloe species at levels from 0.1 to 6.6% of leaf dry weight (making between 3% and 35% of the total exudate). It is the yellowish latex present in leaf of aloe vera. It is used as a stimulant-laxative, treating constipation by inducing bowel movements.

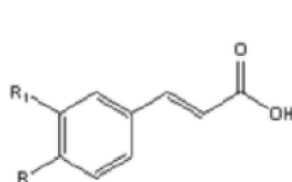
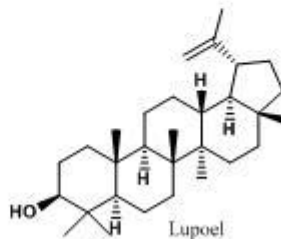
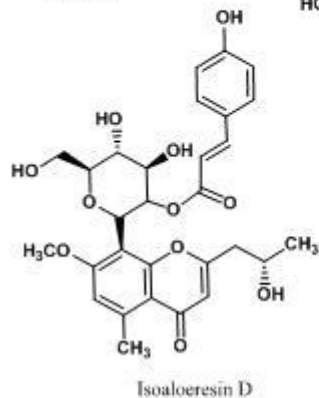
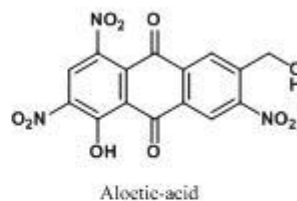
- **Emodin: -**

Aloe emodin (1,8-dihydroxy-3-(hydroxymethyl)anthraquinone) is an anthraquinone and a variety of emodin present in aloe latex, an exudate from the aloe plant. It has a strong stimulant-laxative action. Aloe emodin is an anthraquinone compound found in *Aloe vera* and other species of the Asphodelaceae and the Polygonaceae families, which has recently attracted much attention as a prospective antineoplastic agent (anti-cancer).

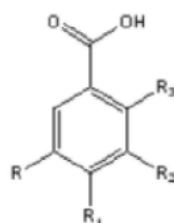
- **Glucomannan: -**

Aloe vera contains glucomannan, a polysaccharide, and gibberellin, a growth hormone. These works by interacting with growth factor receptors found on the fibroblast. As a result, the fibroblast's proliferation is triggered, increasing collagen synthesis. Hence, the process makes wound healing faster.

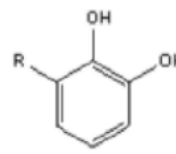
- **Main chemical structures of aloe vera:-**



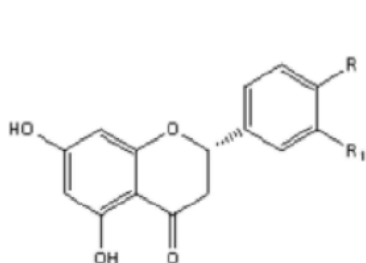
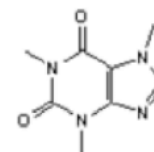
Cinnamic acid (R = H, R = H)  
 p-Coumaric (R = OH, R = H)  
 Caffek acid (R = OH, R = OH)  
 Ferulic acid (R = OH, R = OCH<sub>3</sub>)



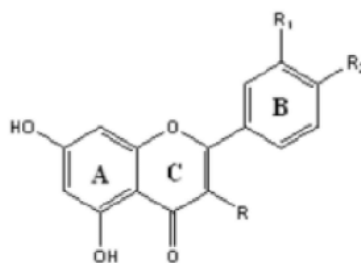
Benzoic acid (R = H, R = H, R = H, R = H)  
 Salicylic acid (R = H, R = H, R = OH, R = OH)  
 Protocatechuic acid (R = H, R = OH, R = OH, R = H)  
 Gallic acid (R = OH, R = OH, R = OH, R = H)  
 Vanillic acid (R = H, R = OH, R = OCH<sub>3</sub>, R = H)



Catechol (R = H)  
 Pyrogallol (R = OH)



Naringenin (R = OH, R = H)  
 Hesperetin (R = OCH<sub>3</sub>, R = OH)



Chrysin (R = H, R = H, R = H)  
 Apigenin (R = H, R = H, R = OH)  
 Kaempferol (R = OH, R = H, R = OH)  
 Quercetin (R = OH, R = OH, R = OH)

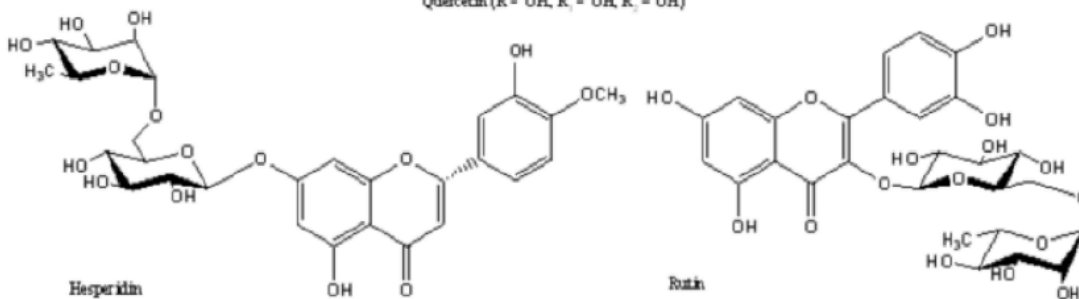
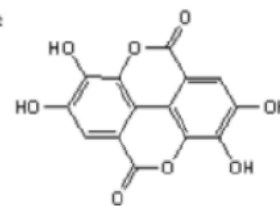




Fig. VI: Structures of the main anthraquinone compounds of *Aloe vera*

### Nutrition Facts of Aloe vera juice.

Serving Size

100 grams (100g)

**Calories 15**

% Daily Value \*

<b>Total Fat</b> 0g	0%		
Saturated Fat 0g	0%		
<i>Trans</i> Fat ~g			
<b>Cholesterol</b> 0mg	0%		
<b>Sodium</b> 8mg	0%	Vitamin D 0mcg	0%
<b>Total Carbohydrate</b> 3.8g	1%	Iron 0.2mg	1%
Dietary Fiber 0g	0%	Calcium 8mg	1%
Total Sugars 3.8g	8%	Potassium 0mg	0%
		Phosphorus 0mg	0%
<b>Protein</b> 0g	0%		
Vitamin C 3.8mg	4%		

\*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

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- **Research: -**

### **SCIENCE & HADEES REGARDING ALOE VERA: -**

#### **For eyes infection: -**

It is a best home remedy for eyes infection of all types, because it has anti bacterial activity & properties.

#### **Antibacterial: -**

The activity of Aloe vera inner gel against both Gram-positive and Gram-negative bacteria has been demonstrated by several different methods. *Streptococcus pyogenes* and *Streptococcus faecalis* are two microorganisms that have been inhibited by Aloe vera gel. Aloe vera gel reportedly was bactericidal against *Pseudomonas aeruginosa* while acemannan prevented it from adhering to human lung epithelial cells in a monolayer culture.

#### **Antifungal: -**

A processed Aloe vera gel preparation reportedly inhibited the growth of *Candida albicans*.

#### **Antiviral effects: -**

This action may be direct and indirect. Indirect due to stimulation of immune system and direct is due to anthraquinones. The anthraquinones aloin activates various enveloped virus; herpes simplex, varicella zoster (mainly eyes related) and influenza.

#### **Skin hydration actions: -**

Mucopolysaccharides help in binding moisture into the skin. It was proposed that the Aloe vera gel containing products improved skin hydration possibly by means of a humectant mechanism.

**Anti-aging effect: -**

Aloe stimulates fibroblast which produces the collagen and elastin fibers making the skin more elastic and less wrinkled.

**Wound-healing effects: -**

Different mechanisms have been proposed for the wound-healing effects of aloe gel, which include keeping the wound moist, increase epithelial cell migration, more rapid maturation of collagen and reduction in inflammation. Glucomannan, a mannose-rich polysaccharide and gibberellin, a growth hormone, interacts with growth factor receptor on the fibroblast, thereby stimulating its activity and proliferation, which in turn increases collagen synthesis after topical and oral application. An increase in synthesis of hyaluronic acid and dermatan sulfate in the granulation tissue of a healing wound is seen following oral and topical treatment.

Aloe vera gel contains a glycoprotein with cell proliferating promoting activity, while in one research it is found that Aloe vera gel improved wound healing by increasing blood supply, which increased oxygenation as a result. Topical application of the Aloe vera derived allantoin gel stimulated fibroblast activity and collagen proliferation.

**Anti-inflammatory effects: -**

It inhibits the cyclooxygenase pathway and reduces prostaglandin E2. Recently, the novel anti-inflammatory compound called C-glycosyl chromone was isolated from gel extracts. Recently, the peptidase bradykinase was isolated from aloe and shown to break down the bradykinin, an inflammatory substance that induces pain.

**Effect on immune system: -**

Immuno-modulating effects occur via activation of macrophage cells to generate nitric oxide, secrete cytokines (e.g., tumor necrosis factor- $\alpha$ , interleukin-1, interleukin-6 and interferon- $\gamma$ ) and present cell surface markers.

**Antioxidant property:-**

Glutathione peroxidases activity, superoxide dismutase enzymes and a phenolic antioxidant were found to be present in Aloe vera gel, which may be responsible for these antioxidant effects.

**Antitumor effect: -**

The two fractions from aloes that are claimed to have anticancer effects include glycoproteins (lectins) and polysaccharides. Different studies indicated antitumor activity for Aloe vera gel in terms of reduced tumor burden, tumor shrinkage, tumor necrosis and prolonged survival rates. An induction of glutathione S-transferase and an inhibition of the tumor-promoting effect of phorbol myristic acetate has also been reported which suggest aloe gel in cancer chemoprevention. Indirect action on antitumor activity is stimulation of the immune response.

**Laxative effect (Purgative effect): -**

Anthraquinones increase intestine water content, stimulate water secretion and increase intestinal peristalsis.

**Antiseptic Properties: -**

Aloe vera contain six antiseptic agents; lupeol, salicylic acid, urea nitrogen, cinnamonic acid, phenol and sulfur.

**USE OF ALOE VERA IN DENTISTRY: -****Apthous ulcer: -**

It has been reported that acemannan hydrogel accelerates the healing of Aphthous ulcers and reduces the pain associated with them. Researchers evaluated a gel that combined allantoin, Aloe vera, and silicon dioxide and its effects on Aphthous ulcers of the oral cavity. Each patient used a daily diary to document the number and duration of aphthous ulcers, the interval between ulcers, ulcer size, and ulcer pain over a period of 3-4 months. The reduced duration of the lesions in one arm of the study and the increased interval between lesions in the other arm of the study both were significant statistically. The gel did not demonstrate any consistent effectiveness on ulcers in the oral cavity.

**Oral lichen planus: -**

Lichen planus is a fairly common skin rash that is thought to be triggered by the immune system. Exactly why the immune response occurs is not known. There may be several contributing factors, and each case is different. Potential causes include viral infections, an allergen, or even stress or genetics. Sometimes lichen planus occurs along with autoimmune disorders. It can occur at any part of the body even oral cavity (mouth).





A patient of lichen planus with systemic involvement placed on Aloe vera therapy. The patient's treatment involved drinking 2.0 ounces of stabilized Aloe vera juice daily for 3 months, topical application using Aloe vera lip balm and aloe cream for itching hands. The oral lesions cleared up within 4 weeks, although the systemic lesions took longer, due in part to the fact that the patient temporarily interrupted the course of aloe therapy and sought an alternate source of treatment. The 46 patients with OLP were randomly divided into 2 groups. Each group was treated with Aloe vera mouthwash and triamcinolone acetonide 0.1% (TA). The treatment period for both groups was 4 weeks. Patients were evaluated on days 8, 16 and after completing the course of treatment (visit 1-3). The last follow-up was 2 months after the start of treatment (visit 4). Aloe vera mouthwash is an effective substitute for TA in the treatment of OLP.

A double-blind trial on 54 patients was randomized into two groups to receive Aloe vera gel or placebo for 8 weeks. The most common site of OLP was the lower lip. 81% patients treated with Aloe vera had a good response after 8 weeks of treatment, while 4% placebo-treated patients had a similar response ( $P < 0.001$ ). Furthermore, 7% patients treated with Aloe vera had a complete clinical remission. Burning pain completely disappeared in 33% patients treated with Aloe vera and in 4% treated with placebo ( $P = 0.005$ ). Therefore, Aloe vera gel can be considered a safe alternative treatment for patients with OLP. Another double-blind study of 64 patients with OLP were randomized to either Aloe vera (32 patients) or placebo (32 patients), at a dose of 0.4 ml (70% concentration) three times a day. The patients were evaluated after 6 and 12 weeks. In the Aloe vera group, complete pain remission was achieved in 31.2% of the cases after 6 weeks, and in 61% after 12 weeks. In the placebo group, these percentages were 17.2% and 41.6%, respectively. Concluded that Aloe vera improves the total quality of life score in patients with OLP.

**Gingival:-**

Aloe vera gel reportedly has been used to treat gingivitis and has been effective against herpes simplex viruses. Acemannan, a prominent glucomannan-stimulate gingival fibroblast proliferation.

**Pulp: -**

Acemannan promotes dentin formation by stimulating primary human dental pulp cell proliferation, differentiation, extracellular matrix formation, and mineralization. Acemannan also has pulpal biocompatibility and promotes soft tissue organization.

**Bacteria: -**

Results showed that Aloe vera tooth gel and the toothpastes were equally effective against *C. albicans*, *Streptococcus mutans*, *Lactobacillus acidophilus*, *Enterococcus faecalis*, *Prevotella intermedia*, and *Peptostreptococcus anaerobius*. Aloe vera tooth gel demonstrated enhanced antibacterial effect against *S. mitis*.

**Extracted socket: -**

Saliccept Patch (a freeze-dried pledget that contains Acemannan Hydrogel) significantly ( $P = 0.0001$ ) reduces the incidence of Alveolar Ostitis compared with clindamycin-soaked Gelfoam.

**Denture adhesive: -**

Because of the sticky and viscous nature of acemannan, a prototype acemannan was formulated into a denture adhesive and evaluated for adhesive strength in both wet and dry conditions; the adhesive was also used to evaluate cytotoxicity to human gingival fibroblasts.

**For eye disease:-**

It is a natural anti biotic, anti fungal, anti bacterial, anti viral with no side effects as dryness of eyes as causes by modern antibiotic eye drops. It is effective in all eye elements.

**CONCLUSION OF RESEARCH:-**

It is many important curative, healing, preventive, anticancer, antioxidant, anti-inflammatory etc constituents; it is very good for all disease diseases & condition & may be the leading herb in future for skin, wound healing, burns etc.