

## Lesson no. 29 Costus (Qust)



Costus herb has a lot of specie around the world; it is quite famous since olden time & was used as a medicinal herb for various diseases & conditions specially throat infections; amongst its specie *Saussurea lappais* most famous & potent as an herb & used widely in Ayurvedic, Homeopathic, Unani & Islamic systems of medicines; it is mentioned in Hadith of Prophet Muhammad (s.a.w) also; its type varieties are mentioned in Hadith (Qustul-bahri & Qustul-hind); for detail Islamic study on Qust (costus) please read my English book *Tibb e Nabawi* part 2 page 132 onwards or visit my website [www.tib-e-nabi-for-you.com](http://www.tib-e-nabi-for-you.com) or direct link to lesson Qust costus on my website <http://www.tib-e-nabi-for-you.com/kustha.html>

The genus *Saussurea* belongs to Asteraceae which comprises about 300 species in the world (Bremer, 1994) of which 61 species are found in India. *Aucklandia*, also known as costus or MuXiang, is the root of the plant *Saussurea costus*. The root of the plant is the key part used for medicinal purpose.

In Hadith it is mentioned by Prophet Muhammad (s.a.w) that Qustul-bahri is best for treatment; qust is advised to use with olive oil & memecyclon (warss) for pleurisy; qust is also advised to be used for throat infection for children & advised not to press the inner part of the neck of the child as people use to do at that time; also Prophet Muhammad (s.a.w) allowed widow women to use qust & azfar for purifying themselves after menses.

### • **NAMES:**

1. In Hadees it is called as Al Qust Al Bahri (القسط البحرى) & Al Qust Al Hindi (قسطا هندی) (both are different varieties of Qust) Qust Al Bahri is of light coloured & Qust Al Hindi is from India & it is dark coloured.
2. In Arabic it is called as Qust.
3. In English Qustul-Bahri is called as Sea Incense Costus & Qustul-Hindi is called as Indian costus.
4. In Hindi & Sanskrit it is called as Kusth.
5. In Latin it is called as *Saussurea lappa*.
6. It belongs to Asteraceae family.

It is mentioned in following books of Hadith (names of book of Hadith & reference are also given): - Bukhari; Tirmizi; Ibn Majah; An-Nasai; Musnad Ahmed; Mustadrak Hakim; Musnad Abi-yala.

### • **Basic encyclopedia of *Saussurea lappa*:-**



Saussurea lappa is a traditionally known and potent plant which is well considered for its medicinal uses in different indigenous Indian systems of medicine. It is popularly known as Kusth root or costus and used in various traditional system of medicine for its anti-ulcer, anti-convulsant, anti-cancer, hepatoprotective, anti-arthritis, anti-viral activities. Several of its activities are well proved and established through in-vitro, in-vivo methods which gave a rationale scientific approach to the traditional claims. Phytochemical compounds isolated from this plant such as costunolide, Isodihydrocostunolide, cynaropicrin etc. were proven to be bio-active and potential source for developing new molecules. Due to the significant proven activities Saussurea lappa is having considerable chance for new drug discovery. This review is an effort to explore the different phyto constituents and the pharmacological activities of Saussurea lappa. Saussurea costus falls within the Kingdom: Plantae, Phylum: Tracheophyta, Class: Magnoliopsida, Order: Asterales, Family Asteraceae.

It has a large number of names in other languages in Sanskrit Kusth; kust or qust in Arabic and Persian; kut or kur & pachak in Hindi & Bengali; kostham, gotham & potchuk in Tamil; upaleta & kur in Gujarati.

- **Saussurea lappa plant:** -

The plant is cultivated as a medicinal plant. Its growing region occurs mainly within India-Himachal Pradesh, Jammu-Kashmir- its native place of origin. A study by Parmaret. al. 2012 explored the effect of altitude on seed germination and survival percentage, proving that high altitudes flavoured high survival and seed germination percentages. This is why they thrive so abundantly in the Himalayan Region which is very mountainous. Cultivation is primarily focused upon the roots of the plants. Most of the roots are exported to China and Japan and as they serve as a big commodity for commerce in Kashmir. However, this type of trade is now being controlled by the state due to it being over-exploited. This plant has been greatly over-collected and recently was placed on the CITES I list of endangered species making it now illegal to dig them up for export. It is usually found at elevations of 2,500 to 3,000 m (8,200 to 9,800 ft) as in India; including the Himalayas, Kashmir, Jammu, Western Ghats, and the Kishenganga Valley.

Saussurea costus is an erect, robust, pubescent, perennial herb; with a stout simple stem 1–2 m high; it is a typical flowering season spans from July to August, with the seeds ripening from August to September. The plant can be grown in a wide variety of soils, ranging from light sandy, medium to heavy clay soils that are acid, neutral or basic, alkaline soils, preferring soils that are moist. The amount of sunlight the plant thrives upon can vary from semi-shaded (light woodland) areas or areas with no shade. It is classified as a perennial, with a typical growth of 1–2 m (3.3–6.6 ft) tall by 1 m (3.3 ft) wide. It has long lyrate leaves and heads of purple florets. Qustul-bahri (Sea Incense Costus) is light in colour & potency while Qustul-hindi in dark in colour & stronger.

- **Saussurea lappa leaves:** -

Leaf length is about 1m long & are lobate, membranous, scaberulous above, glabrate beneath, auricled at base, irregularly toothed with characteristic odour. Upper leaves are smaller, subsessile or shortly petioled; two small lobes at the base of these leaf almost clasping the stem.



The leaves take the shape of being auricled at base, with jagged, toothed patterns running down the sides of the leaves and are an average of 0.50–1.25 m (1.6–4.1 ft) long. The roots of the plant are stout and can travel up to 40 cm (16 in) in length.

- **Saussurea lappa flower: -**



The flowers are arranged in the form of small capitula, the colors may be white or even purple. Flower heads are stalk-less, bluish-purple to almost black, hard, rounded, 2.4–3.9 cm across, often 2–5 clustered together in the axils of leaves or terminal. Involucral bracts many, ovate-lanceolate, long pointed, purple, rigid, hairless. Receptacle bristles very long. Corolla about 2 cm long, tubular, blue-purple or almost black. Anther tails fimbriate. Achenes curved, compressed ca. 8 mm long, tip narrowed, with one rib on each face. Pappus brown, double feathery.

- **Saussurea lappa root: -**



Roots are stout, dark brown or grey, up to 40 cm long; the root of Qustul-bahri is lighter than Qustul-hindi; Root is about 60cm long and produce strong characteristic odour. Both root and stem of the plant

body are stout and fibrous. The dried root tastes slightly bitter. It is dirty grey to yellow in color and generally wrinkled and ridged. Roots are dark brown to grayish in colour, hard and attain length up to 40 cm.

- **Inflorescence:** -

The inflorescence of *Saussurea lappa* is arranged in terminal and axillary clusters, with dark bluish purple to black flowers.

- **Fruits:** -

Fruits of *S. lappa* are curved and cupped and about 3mm long. Fruits contain hairs on them.

- **Part use:** -

Mainly its root & essential oil is used medicinally.

- **Important:** -

*S. costus* is one of the most threatened medicinal plants of Kashmir Himalaya. This species is threatened due to the unregulated collection, over-exploitation, illegal trade, and loss of habitat. Habitat loss continues due to road construction and military establishments in many of the cultivation areas, decreasing its yield globally. Habitat destruction in the form of recreational activities and urbanization is as well limiting its ability to be cultivated, again decreasing global yield of this product. Another influence heavily affecting the survival rate of this species is the uncontrolled grazing of yak. The biggest threat, however, comes from the usage of the plant for its medicinal properties. It is listed as "endangered" by the Red data book of Indian plants. In another study, a camp workshop held in Lucknow assessed the plant as "Critically Endangered new" nationally in India, holding a population decline of 70% in the last 10 years. Another CAMP workshop for northern India assessed it as "Critically Endangered new" in the state of Jammu and Kashmir. Conservation efforts do exist to control the rate of depletion of the species. The legislations of Jammu and Kashmir have enforced a special Act, The Kuth Act, in 1978 for the regulation of trade of *S. costus*.

- **pH of it:** - It does not matter because it is taken in medicinal dose only.
- **Calories of it:** - It does not matter because it is taken in medicinal dose only.
- **Glycemic index & Glycemic load:** - It does not matter because it is taken in medicinal dose.
- **Gross health benefits of :** -

Qust and its active compounds have substantiated their potential antiviral, hepatoprotective, anti-inflammatory, immune-modulator, anti-microbial, antiulcer, gastro-protective, anticancer, anti-oxidant, anti-helminthic, hypolipidemic, hypoglycemic, anti-angiogenesis, antidiarrheal, spasmolytic and anticonvulsant activities in various in vitro, in vivo and clinical studies. The root has a distinguishing fragrance. It helps to strengthen the stomach and captures the secretion of bleeding. It helps to remove phlegm from bronchial tubes. The essential oil has antiseptic and disinfectant properties. Cholera: This herb helps to relieve cholera, fresh *Saussurea*, cardamom and water can be consumed for every half an hour in order to relieve the condition. The drug gives out a depressant action which helps brain in relieving the spasm. Throat infection: Root is chewed. Typhoid: Extraction from root is used for the treatment of typhoid fever. Ulcers: It was traditionally used to cure ulcers. Dysentery: Is used to treat dysentery. Scabies: Root paste is consumed with milk to treat scabies.

- **Clinical pharmacology of it:** -

*Saussurea lappa* has been shown to inhibit the mRNA expression of iNOS by lipopolysaccharide stimulated macrophages, thus reducing nitric oxide production. In rats, high doses of 50-200 milligrams per kilogram of crude ethanolic extract reduced observed inflammation in standard laboratory tests, and 25-100 milligrams per kilogram of the sesquiterpene fraction of the extract reduced several molecular markers of inflammation. Ethanol extracts were shown to have analgesic and anti-inflammatory effects at high doses of 75-300 milligrams per kilogram. As the slow-growing wild plant is endangered by collections, a substitute grown in tissue culture has been suggested, which is mostly equivalent.

Generally the analgesic and anti-inflammatory effects of the plant are much inferior to those of indometacin.

The acetone extract from *Saussurea costus* and costunolide, exhibited both cholagogic effect and inhibitory effect on the formation of gastric ulcer (induced by restraint in water) in mice (Yamahara et al., 1985)

Hypoglycaemic *Saussurea costus* was found most effective for obese diabetes when a detailed survey and clinical study on potent hypoglycaemic plants of different regions from India was undertaken to find antidiabetic plants used in Indian folklore and by different tribes

Hypolipidaemic Aqueous extract of *Saussurea costus* orally administered to twenty seven rabbits at a dose of 2 mg/kg body weight showed hypolipidaemic effect. Reduction in serum cholesterol and serum triglycerides was found to be significant

The inhibitory effects of the ethanol extract of *Saussurea lappa* on the growth, acid production, adherence, and water-insoluble glucan synthesis of *Streptococcus mutans* were examined (Yu et al., 2006). The growth and acid production of *Streptococcus mutans* were significantly inhibited by the presence of ethanol extract of *Saussurea lappa* (0.5–4 mg/ml).

The antiparasitic activity of *Saussurea costus* was evaluated against *Clonorchis sinensis*, *Trypanosoma cruzi* and some nematodal infections. Decoction of *Saussurea costus*, when administered orally into rabbits infected with *Clonorchis sinensis*, to study its in vivo clonorchicidal activity, was found to be somewhat effective by observing the suppression effects of the egg laying capacity from rabbits.

- **Modern uses of it: -**

Below are some points on how to take costus: -

**1tsp costus root powder, 1tsp honey in warm water, ideally on an empty stomach, once a day: -**

It is used to treat: stomach pains, stomach upsets, diarrherra, constipation, colon problems, blood clots, tumours, cancer, cholesterol, high blood pressure, asthma, breathing problems, cleanses the womb, increases fertility, strengthens muscles after labor, contracts the womb, aids weight loss (take twice daily; morning and evening), in diabetes without the honey.

**1tsp costus root powder, 1tsp honey, mix together and apply to the skin surface. Leave for 2 hours and then rinse off: -**

It is used to treat: acne, pimples, spots, scars, burns, nappy rash, mosquito bites, eczema, thrush, piles and as a face mask.

**1tsp costus root powder, 1 glass of water, boil together for 2 minutes and allow to cool shake and apply 3 drops in each nostril: -**

It is used to treat: nose bleeds, runny nose, disinfects cuts.

**1tsp costus root powder, apply directly to the skin: -**

It is used to treat athlete foot. Also used as a natural deodorant. Take orally with food or drink, once a week. It is also used to strengthen the immune system.

**1tsp costus powder, 1 glass of coconut oil. Place on low heat for 5 minutes and allow to cool shake well and apply to skin: -**

It is used to treat; dandruff, hair loss, arthritis, rheumatism, eczema, bites, spots, skin discoloring.

**For backache and chest pain:** -Root powder when taken with milk/decoction & honey helps in relieving pains. Root powder heated in oil is massaged on the affected area for quick relief.

**For Cough:** - Root powder taken with honey, warm water & extra virgin olive oil.

**Toothache:** Powder of root is used to relieve toothache.

**Epilepsy:** The roots powder is used with honey.

**Exhaustion:** Root pieces are burnt in hookah and the smoke inhaled.

**General weakness:** Root powder taken with cow's milk or ghee.

**Headache:** Root powder heated with root and use for headache. Headache: Paste of the root is applied.

**Leprosy:** Root powder is ingested. Lustre and growth of hair: Mustard oil is heated with root powder and that oil used on hair.

**Piles:** Root powder also used for piles Pustules: Fine root powder is wiped on the wound.

**Rheumatism:** Juice of roots is used with sweetener to cure rheumatism

**Painful joints:** Powder of Root is heated in ghee/butter and taken with milk. The above-mentioned ghee/butter is rubbed on the affected area and bandaged.

**Respiratory Disorder:** It is quite beneficial for the management of bronchitis, asthma and cough. The essential oil present in the plant helps in relaxing the bronchial muscle.

- **Contents/constituents of**

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.

**Active & major components of it:** - saussurine, kushtin, sesquiterpene lactones such as costunolide and dehydrocostus lactone.

**Chemical constituents of Root & oil of costus: -**

S. lappa has three anthraquinone compounds, namely, aloemodin-8-O- $\beta$ -d-glucopyranoside, rhein-8-O- $\beta$ -d-glucopyranoside, and chrysophanol. Four flavonoid glycosides have antibacterial function. Shikokiols have antitumor activity, whereas chlorogenic acid prevents oxidization. cedren-13-ol (5.06%) and  $\alpha$ -curcumene (4.33%). However,  $\beta$ -costol (13.55%) and  $\delta$ -elemene (12.69%),  $\alpha$ -selinene (5.02%),  $\beta$ -selinene (4.47%),  $\alpha$ -costol (4.02%), 4-terpinol (3.38%), elemol (3.21%),  $\alpha$ -ionone (3.13%),  $\beta$ -elemene (3.00%), (-)-yelemene (2.08%), p-cymene (1.96%) and 2- $\beta$ -pinene (1.57%), (-)- $\alpha$ -selinene, (+)-selina-4, 11-diene, (-)- $\alpha$ -transbergamotene, (-)- $\alpha$ -costol, (+)- $\gamma$ -costol, (-)-elema-1,3,11 (13)-trien-12-ol, (-)- $\alpha$ -costal, (+)- $\gamma$ -costal, (-)-elema1,3,11(13)-trien-12-al, (-)-(E)-trans-bergamota-2,12-dien14-al, (-)-ar-curcumene, (-)-caryophyllene oxide and 12-m ethoxydihydrodehydrocostuslactone, inulin (18%); Salt of valeric acid A fixed oil; an astringent principle; minor constituent's annins and sugars. Kuth root oil contains mainly high boiling sesquiterpenes and sesquiterpene alcohols. The following constituents have been reported: Costunolide (C<sub>15</sub>H<sub>20</sub>O<sub>2</sub>), primary sesquiterpene lactone, dehydrocostus lactone (DL), dihydro-dehydrocostus lactone, camphene, costol,  $\beta$ -sitosterol, stigmaterol, betulin, apotaxene,  $\beta$ -selinine,  $\beta$ -elemene,  $\alpha$  and  $\beta$ -ionones, a bicyclic sesquiterpenic acid, phellanderine, C13-ketone and certain unidentified constituent's including hydrocarbons, ketones and alcohols. Leaves: Alkaloid saussurine and taraxasterol along with resin, traces of bitter substances, small amount of tannins, inulin, potassium nitrate, sugar, fixed oil but not essential oil.

Costus oil contains 39 components the chief compounds are dehydrocostus lactone (46.75%), costunolide (9.26%), 8- cedren-13-ol (5.06%) and  $\alpha$ -curcumene (4.33%). However,  $\beta$ -costol (13.55%) and  $\delta$ -elemene (12.69%),  $\alpha$ -selinene (5.02%),  $\beta$ -selinene (4.47%),  $\alpha$ -costol (4.02%), 4-terpinol (3.38%), elemol (3.21%),  $\alpha$ -ionone (3.13%),  $\beta$ -elemene (3.00%), (-)-yelemene (2.08%), p-cymene (1.96%) and 2- $\beta$ -pinene (1.57%), (-)- $\alpha$ -selinene, (+)-selina-4, 11-diene, (-)- $\alpha$ -transbergamotene, (-)- $\alpha$ -costol, (+)- $\gamma$ -costol, (-)-elema-1,3,11 (13)-trien-12-ol, (-)- $\alpha$ -costal, (+)- $\gamma$ -costal, (-)-elema1,3,11(13)-trien-12-al, (-)-(E)-trans-bergamota-2,12-dien14-al, (-)-ar-curcumene, (-)-caryophyllene oxide and 12-m ethoxydihydrodehydrocostuslactone.

- **Its oil: -**

Essential oil (costus oil) is obtained from the roots through various methods which yields 0.8-5.8 % essential oil. Through steam distillation of which yields 1-2 % of essential oil which possesses a natural aroma. The solvent extraction of the roots with petroleum ether (b.p, 40-600) at low temperature yields of the oil being 6%. Oil is a pale yellow to brownish, very viscous liquid. It has a peculiar soft but tenacious odor reminiscent of orris root with a distinctly animal or sebaceous undertone. It is valued in high class perfumery and cosmetic and is expensive. It is used in the preparation of hair oil and in high quality perfumes. Costus oil is pale yellow to brownish in color and is also said to be valuable in treating leprosy.

**Each constituent explained separately: -**

Most of the constituents & compound present in costus are newly known & very less information is available & research is on to learn this new compounds.

The alkaloid saussurine, a biomarker of the plant Saussurea lappa which is pharmacologically active against asthma,

- **Inulin: -**

Inulins are a group of naturally occurring polysaccharides produced by many types of plants, industrially most often extracted from chicory. The inulin belongs to a class of dietary fibers known as fructans. Inulin is used by some plants as a means of storing energy and is typically found in roots or rhizomes. Most plants that synthesize and store inulin do not store other forms of carbohydrate such as starch. Inulin is a natural, storage carbohydrate present in more than 36,000 species of plants, including wheat, onion, bananas, garlic, asparagus, Jerusalem artichoke, and chicory. For these plants, inulin is used as an energy reserve and for regulating cold resistance. Because it is soluble in water, it is osmotically active. Certain plants can change the osmotic potential of their cells by changing the degree of polymerization of inulin molecules by hydrolysis. By changing osmotic potential without changing the total amount of carbohydrate, plants can withstand cold and drought during winter periods. Chicory root is the main source of extraction for commercial production of inulin. The extraction process for inulin is similar to obtaining sugar from sugar beets. After harvest, the chicory roots are sliced and washed, then soaked in a solvent; the inulin is then isolated followed by purifying and drying. Inulin may also be synthesized from sucrose. Inulin and its analog sinistrin are used to help measure kidney function by determining the glomerular filtration rate (GFR), which is the volume of fluid filtered from the renal (kidney) glomerular capillaries into the Bowman's capsule per unit time. Inulin enhances the growth and activities of bacteria or inhibits growth or activities of certain pathogenic bacteria.

- **Costunolide: -**

Costunolide is a naturally occurring sesquiterpene lactone, first isolated in *Saussurea costus* roots in 1960. It is also found in lettuce. It is anti-oxidative, anti-inflammatory, anti-allergic, bone remodeling, neuro-protective, hair growth promoting, anticancer, and anti-diabetic properties.

- **Beta-costol: -**

Beta-Costol is found in herbs and spices; it is a constituent of the essential oil of costus (*Saussurea lappa*); beta-Costol, also known as b-costol or sesquibenihiol, belongs to the class of organic compounds known as eudesmane, isoeudesmane or cycloeudesmane sesquiterpenoids. These are sesquiterpenoids with a structure based on the eudesmane skeleton. beta-Costol is an extremely weak basic (essentially neutral) compound (based on its pKa). It is under research.

- **Rhein: -**

Rhein, also known as cassic acid, it comes in the anthraquinone group obtained from rhubarb or senna; rhein is a cathartic; it is commonly found as a glycoside such as rhein-8-glucoside or glucorhein; it was first isolated in 1895; Rhein has been reevaluated as an antibacterial agent against *Staphylococcus aureus* in 2008. Synergy or partial synergy has been demonstrated between rhein and the antibiotics oxacillin and ampicillin.

Rhein has been shown to inhibit the fat mass and obesity-associated protein, an enzyme responsible for removing the methylation from N<sup>6</sup>-methyladenosine in nucleic acids. This makes senna helpful in obesity. The pharmacokinetics of rhein have not been intensively studied in humans, but at least one study in healthy male volunteers found that rhein was better absorbed from oral administration of rhubarb than from a retention enema. Rhein (at an oral dose of 50 mg twice per day) was shown to be safe when administered for five days to elderly patients with chronic congestive heart failure. It is antioxidant, anti-tumour, anti-viral & is under research.

- **Chrysophanic acid: -**

Chrysophanol, also known as chrysophanic acid, is a fungal isolate and a natural anthraquinone. Chrysophanol blocks the proliferation of colon cancer cells in vitro. It induces the necrosis of cells via a reduction in ATP levels. Chrysophanol attenuates the effects of lead exposure in mice by reducing hippocampal neuronal cytoplasmic edema, enhancing mitochondrial crista fusion, significantly increasing memory and learning abilities, reducing lead content in blood, heart, brain, spleen, kidney

and liver, promoting superoxide dismutase and glutathione peroxidase activities and reducing malondialdehyde level in the brain, kidney and liver.

- **Phellandrene: -**

In Marjoram alpha & beta phellandrene are present; it is a pair of organic compound that have a similar molecular structure & similar chemical properties; both alpha & beta are cyclic monoterpenes & are double-bond isomer. In alpha both double bond are endocyclic & in beta one double bond is exocyclic; both are soluble in water; they have a pleasant aroma & peppery taste.

Alpha is potential immune stimulator, anti-fungal, anti-inflammatory, anti-cancer, anti pain, develop natural killer (NK) in the body, boost immune system; beta is anti microbial, anti-fungal, antioxidant; both are believed to be excreted in stools,

Beta is present in oil of following bitter fennel, elemi, ginger-grass, ridolfiasegetum & alpha is present in oil of cinnamon, dill, turmeric, ceylon etc.

- **Caryophyllene: -**

It is a natural bicyclic sesquiterpene present in many essential oils like clove oil (syzygium aromaticum stem & flower oil), cannabis sativa oil, rosemary oil, hops oil, basil oil, lavender oil, cinnamon oil, black caraway, thyme oil. It is anti-inflammatory, analgesic, prevents atherosclerosis, osteoporosis, colitis, osteoarthritis, diabetes, cerebral ischemia, anxiety, depression, liver fibrosis, anti cancer. Its absorption & metabolism is not known.

- **Beta-caryophyllene: -**

It is the most commonly occurring form in many essential oils, particularly oil of cloves. It has a role as a non-steroidal anti-inflammatory drug, a fragrance, a metabolite and an insect attractant, analgesic, antipyretic, and platelet-inhibitory actions. They act by blocking the synthesis of prostaglandins by inhibiting cyclooxygenase, which converts arachidonic acid to cyclic endoperoxides, precursors of prostaglandins. Inhibition of prostaglandin synthesis accounts for their analgesic, antipyretic, and platelet-inhibitory actions; other mechanisms may contribute to their anti-inflammatory effects.

- **Pinene**

It is a bicyclic monoterpene chemical compound. There are two structural isomers of pinene found in nature:  $\alpha$ -pinene and  $\beta$ -pinene. As the name suggests, both forms are important constituents of pine resin; they are also found in the resins of many other conifers, pine tree, maktur tree oil, lime fruit peel, as well as in non-coniferous plants such as camphorweed (*Heterotheca*) and big sagebrush (*Artemisia tridentata*). It is anti-inflammatory, bronchodilator, antianxiety, anti-pain etc.

- **Selinene: -**

It is a group of isomeric chemical compounds amongst sesquiterpenes; it is found in 2 types alpha & beta; It is present in celery seed oil, marjoram oil etc; it is anti-inflammatory, antioxidant, anti gout (increase uric acid). Alpha-selinene is an isomer of selinene where the double bond in the octahydronaphthalene ring system is endocyclic (2R,4aR,8aR)-configuration.. It has a role as a plant metabolite. It is a selinene and a member of octahydronaphthalenes.

- **Camphene: -**

It is a bicyclic mono-terpene, soluble in water; volatile in nature in room temperature; has a pungent smell. Please do not get confused with camphin & camphene, both are different; it has a role as a plant metabolite & a fragrance; it has structure as exactly 2 rings which fused to each other so called as bicyclic. It is present in dill, caraway, hyssop, fennel, camphor oil, citronella oil, thyme oil, ginger oil, cypress oil, thyme oil etc; it is used in medicine, fragrance, flavouring in food. It is absorbed through skin, inhalation & ingestion; it is anti fungal, anti microbial, antioxidant, analgesic, reduces lipids, anti viral, expectorant, anti septic, anti biotic, heals wounds, reduces swelling, headache, migraine etc. Its absorption, metabolism in under research & not known yet.

- **Curcumene: -**

Alpha-Curcumene, also known as (R)-curcumene or L- $\alpha$ -curcumene, belongs to the class of organic compounds known as sesquiterpenoids. It is mainly present turmeric; it has lot of health benefits, such as the potential to prevent heart disease, Alzheimer's and cancer. It's a potent anti-inflammatory



and antioxidant and may also help improve symptoms of depression, arthritis; it is antibacterial, antiviral best cough & cold & infections.

- **Elemene: -**

Beta-elemene, also known as B-elemen or 2,4-diisopropenyl-1-methyl-1-vinylcyclohexane, is a member of the class of compounds known as elemene sesquiterpenoids. Elemene sesquiterpenoids are sesquiterpenoids with a structure based on the elemene skeleton. Elemene is a monocyclic compound consisting of a cyclohexane ring substituted with a methyl group.

- **Stigmasterol: -**

It is among unsaturated phytosterol; it maintains the structure & physiology of cell membrane; it reduces LDL & cholesterol, reduces risk of heart diseases, it prevents atherosclerosis.

**Main sources of stigmasterol: -**

Soybean, calabar bean, rape seed, legumes, nuts, milk, seeds, grape seed oil etc.

- **Betulin: -**

*Betulin* is an abundant, naturally occurring triterpene. It is commonly isolated from the bark of few trees. It an ingredient found in abundance in birch bark appears to have an array of metabolic benefits. In mice, the compound known as betulin lowered cholesterol, helped prevent diet-induced obesity, and improved insulin sensitivity.

- **Tannin: -**

It is of astringent (dry & puckery feeling in mouth) taste, it is a polyphenol present in many plants, fruits, plant's wood, bark, leaves, skin, seeds etc. It is also called as Tannic acid; it is of 2 types hydrolysable & condensed. Hydrolysable is decomposable in water & reacts with water & form other substance. Condensed form is insoluble & precipitates, it is called as tanner's reds. But most of tannic acid is water soluble.

**Main sources of tannin: -**

It is present berries, apple, barley, nut, tea, legumes, grapes, pomegranate, quince, oak wood, lemons, squash etc.

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

Its absorption, metabolism & excretion are yet not known & are under research. After ingestion its bioavailability is poor due to its large size, high affinity to bound to plasma protein & low lipid solubility. It gets hydrolyzed in glucose & release gallic acid & other compounds upon decomposition.

**Basic clinical pharmacology of tannin: -**

It is used internally & externally. Externally it cures & heals the condition when applied on cold sores, fever blisters, diaper rashes, bleeding gums, tonsillitis, skin rashes, white discharge, yellow discharge, minor burn etc. It is used as douche for vaginal disorders like white or yellow discharge.

In food it is used as flavoring agent & naturally present in fruits etc; it relieves & cures chronic diarrhea, dysentery, hematuria (blood in urine), pain in joints, persist cold, cancers *etc*; it reduces high blood pressure, high lipids in blood. It is also anti-aging, antioxidant, antibacterial, anti-enzymatic. It is used in medicated ointments for piles.

If used excessive it can give toxic effects on skin & internally may reduce absorption of vitamin, cause stomach irritation, nausea, vomiting, liver damage, kidney damage. It should not be used in pregnancy, breast feeding & constipation.

- **Bergamotene: -**

Bergamotenes are a group of isomeric chemical compounds with the molecular formula  $C_{15}H_{24}$ . The bergamotenes are found in a variety of plants; particularly in their essential oils. There are two structural isomers,  $\alpha$ -bergamotene and  $\beta$ -bergamotene, which differ only by the location of a double bond. Both of these isomers have stereoisomers, the most common of which are known as the *cis* and *trans*-isomers (or endo- and exo-isomers)  $\alpha$ -Bergamotene is found in the oils of carrot, bergamotene, bergamot, lime, citron, cottonseed & kumquat.

- **Valeric acid: -**

Valeric acid, or pentanoic acid, is a straight-chain alkyl carboxylic acid with the chemical formula  $CH_3(CH_2)_3COOH$ . Like other low-molecular-weight carboxylic acids, it has an unpleasant odor. It is found in the perennial flowering plant valerian (*Valeriana officinalis*), from which it gets its name. Its primary use

is in the synthesis of its esters. Salts and esters of valeric acid are known as valerates or pentanoates. Volatile esters of valeric acid tend to have pleasant odors and are used in perfumes and cosmetics. Ethyl valerate and pentyl valerate are used as food additives because of their fruity flavors.

- **Dehydrocostus lactone: -**

Dehydrocostus lactone is an organic heterocyclic compound and guaianolide sesquiterpene lactone that is acrylic acid; it is a trypanocidal drug, an antineoplastic agent, a cyclooxygenase 2 inhibitor, an antimycobacterial drug and an apoptosis inducer. It is a sesquiterpene lactone, a guaiane sesquiterpenoid, an organic heterocyclic compound and a gamma-lactone.

- **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, relieves bronchitis, migraine, asthma, fatigue, rheumatoid arthritis, improve hair quality, relieves prostate 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 etc.

- **Aplotaxene: -**

Aplotaxene belongs to the class of organic compounds known as alkatetraenes. These are acyclic hydrocarbons that contain exactly four carbon-to-carbon double bonds. Aplotaxene is possibly neutral. Aplotaxene has been detected, but not quantified in, burdocks. This could make aplotaxene a potential biomarker for the consumption of these foods. It is under research.

- **Beta carotene: -**

It is an anti oxidant that converts into vitamin A & plays a very important role in human health; it is responsible for the red, yellow, orange colouration in some fruits & vegetables. It promotes eye health & prevents eye diseases.

**Main sources of beta carotene: -**

It is present in pumpkin, carrot, sweet potato, dark leafy vegetables, apricot, red & yellow pepper, spinach, kale, grapes etc.

**Basic pharmacokinetics of beta carotene (based on human intake in natural food products):**

It is absorbed in intestine by passive diffusion & get convert into provitamin A in the presence of bile acids, the intestinal mucosa plays a key role in converting it into provitamin A. it is transported in blood plasma exclusively by lipoproteins. The complete absorption, metabolism & excretion is not known fully. It is stored in fats & liver.

**Basic clinical pharmacology of beta carotene: -**

It is anti oxidant, reduces risk of lung cancer & promote lung health, reduces free radicals thus prevents cancer & heart disease, diabetes, promotes skin health, improves complexion, hair health, eye health, brain health; reduces pimple, acne & other skin problems.

- **Carbohydrate: -**

It is a macronutrient needed by the body, the body receives 4 calories per 1 gram of it; carbohydrates includes sugar, glycogen, starch, dextrin, fiber & cellulose that contain only oxygen, carbon & hydrogen. It is classified in simple & complex; simple carbs are sugar & complex carbs are fiber & starch which take longer to digest. It is basic source of energy for our body.

**Main sources of carbohydrates: -**

It is present in watermelon (little), potato, sweet potato, bread, oats, butter, white rice, whole grain rice, pasta, lentils, banana, pineapple, quince, cucumber etc.

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

Its digestion begins in mouth; salivary glands releases saliva & salivary amylase (enzyme) which begins the process of breaking down the polysaccharides (carbohydrates) while chewing the food; now the chewed food bolus is passed in stomach through food pipe (esophagus); gastric juice like HCL, rennin etc & eaten material are churned to form chyme in the stomach; the chyme now is passed little by little down into duodenum, pancreatic amylase are released which break the polysaccharides down into disaccharide (chain of only sugars linked together); now the chyme passes to small intestine, in it enzymes called lactase, sucrase, maltase etc breakdown disaccharides

into monosaccharide (single sugar) & absorbed in upper & lower intestines, through villi present in small intestine & send into liver through venous blood present into portal veins, as per bodies need it is releases in the blood stream & pancreas release insulin to use it as source of energy for the body, & extra is stored is converted into glycogen by liver & stored in liver & little is stored in muscles & tissues. Liver can reconverts glycogen in to sources of energy if body lacks for other source of energy, the undigested carbohydrates reaches the large intestine (colon) where it is partly broken down & digested by intestinal bacterias, the remains is excreted in stools.

#### **Clinical pharmacology of carbohydrates: -**

Carbohydrates are main sources of body energy, it helps brain, kidney, heart, muscles, central nervous system to function, it also regulates blood glucose, it acts on uses of protein as energy, breakdown of fatty acids & prevent ketosis. If we eat less carbohydrate it may lead to hypoglycemia, ketosis, frequent urination, fatigue, dizziness, headache, constipation, bad breath, dehydration etc.

Excessive intake of carbohydrates may lead to vascular disease, atherosclerosis (leads to narrowing of arteries, stroke, diabetes, obesity, fatty liver, blood pressure etc.

- **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, pumpkin, grapes 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, pumpkin, grapes 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.

• **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, cucumber 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; cucumber 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, chilli, 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, cucumber 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 act 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.

- **Phosphorus: -**

It is an essential mineral; its symbol is P & atomic no. 15, it is needed for many parts & functions of the body.

**Main sources of phosphorus: -**

It is present in watermelon, quince, meat, nuts, beans, fish, chicken, dairy products, soy, grains, lentils, cucumber etc.

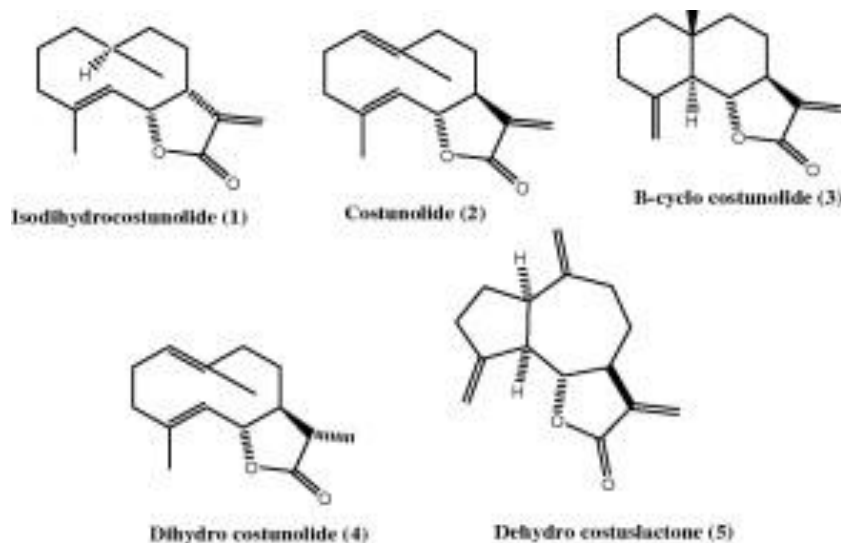
**Basic pharmacokinetics of phosphorus (based on human intake in natural food products): -**

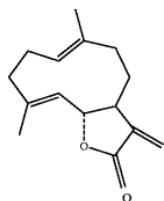
It is absorbed 70-85%, it is absorbed 30% in duodenum, 20% in jejunum, 35% in ileum; it is absorbed in inorganic phosphate form by 2 separate process first when the phosphorus intake is high mainly after meals by paracellular sodium independent passive diffusion pathway & second is transcellular sodium dependant carrier-mediated pathway this falls under the control of vitamin D & etc. When calcium level is too high in the body phosphorus is less absorbed, optimum calcium : phosphorus ratio is helpful in its absorption (excess of anyone decreases the absorption of both). It is stored in bones 85% & rest in tissues; it is excreted 80% in urine & rest in stools (excretion of it is a regulatory action of parathyroid hormone (PTH), vitamin D, and fibroblast).

**Basic clinical pharmacology of phosphorus: -**

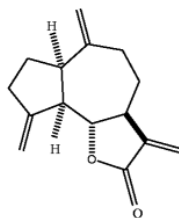
It is present in nature combined with oxygen as phosphate. It acts on growth of teeth, bones, repairs of cells & tissues. It plays an important role in metabolism of carbohydrate, fats, protein & ATP. It works with B-complex vitamins & helps kidney function, muscles contraction, normal heart beats, nerve impulse etc.

- **Main chemical structures of costus: -**

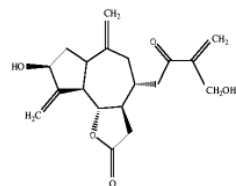




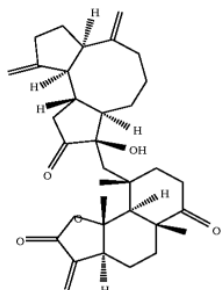
**COSTUNOLIDE (1)**



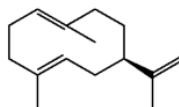
**DEHYDROCOSTUS LACTONE (2)**



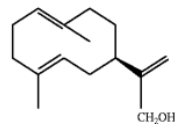
**CYNAROPICRIN (3)**



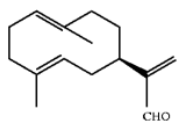
**LAPPADILACTONE (4)**



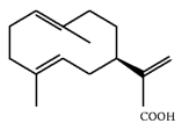
**(+)-GERMACRENE A (5)**



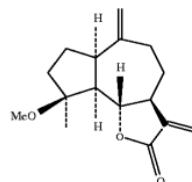
**GERMACRA1(10),4,11(13) - TRIEN-12-OL (6)**



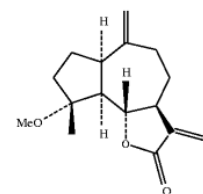
**GERMACRA-1(10),4,11(13)- TRIEN-12-AL (7)**



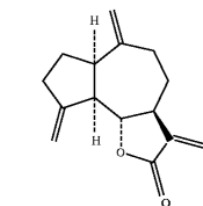
**GERMACRA-1(10),4,11(13)-TRIEN-12 OIC ACID (8)**



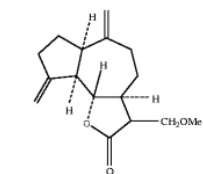
**4α METHOXY DEHYDRO COSTUSLACTONE (9)**



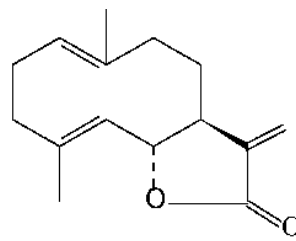
**4β-METHOXY DEHYDRO COSTUSLACTONE (10)**



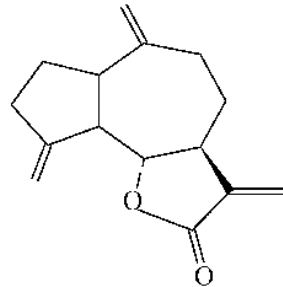
**SAUSSUREAL (11)**



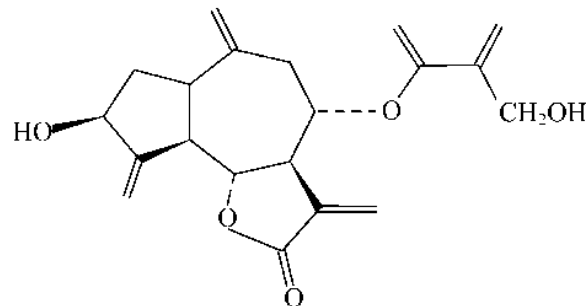
**12-METHOXY DIHYDRO COSTUS LACTONE (12)**



Costunolide



Dehydrocostus lactone



Cynaropicrin

• **References: -**

- ^ "Saussurea costus". Germplasm Resources Information Network (GRIN). Agricultural Research Service (ARS), United States Department of Agriculture (USDA). Retrieved 2008-02-12.
- ^ Jump up to:a b Chandra P. Kuniyal, Yashwant S. Rawat, Santaram S. Oinam, Jagdish C. Kuniyal and Subhash C. R. Vishvakarma (2005). "Kuth (Saussurea lappa) cultivation in the cold desert environment of the Lahaul valley, northwestern Himalaya, India: arising threats and need to revive socio-economic values". *Biodiversity and Conservation*. 14 (5): 1035. doi:10.1007/s10531-004-4365-x.
- ^ "Aplotaxis lappa". Germplasm Resources Information Network (GRIN). Agricultural Research Service (ARS), United States Department of Agriculture (USDA). Retrieved 4 January 2018.
- ^ "Saussurea costus (Falc.)Lipsch". *The Plant List v.1.1*. Royal Botanic Gardens, Kew and Missouri Botanical Garden. Retrieved 21 January 2015.
- ^ Birgit Lohberger; Beate Rinner; Nicole Stuedl; Heike Kaltenecker; Bibiane Steinecker-Frohnwieser; Eva Bernhart; Ehsan Bonyadi Rad; Annelie Martina Weinberg; Andreas Leithner; Rudolf Bauer & Nadine Kretschmer (2013). "Sesquiterpene Lactones Downregulate G2/M Cell Cycle Regulator Proteins and Affect the Invasive Potential of Human Soft Tissue Sarcoma Cells". *PLOS ONE*. 8 (6): e66300. Bibcode:2013PLoSO...866300L. doi:10.1371/journal.pone.0066300. PMC 3682952. PMID 23799090.
- ^ A.V.S.S. Sambamurthy (2005). *Taxonomy of Angiosperms*. I. K. International Pvt. Ltd. p. 417. ISBN 9788188237166.
- ^ Jump up to:a b c Saha, D., Ved, D., Ravikumar, K. & Haridasan, K. 2015. *Saussurea costus*. *The IUCN Red List of Threatened Species 2015*: e.T50126641A50131430
- ^ Kour, Sumeet, et al. "Conservation Strategies of Saussurea Costus, Critically Endangered Medicinal Herb Growing in Kashmir Himalaya- A Review ." *International Journal of Science and Research (IJSR)* .
- ^ Davidson, Tish. "Aucklandia." *The Gale Encyclopedia of Alternative Medicine*, edited by Laurie J. Fundukian, 4th ed., vol. 1, Gale, 2014, pp. 197-198. Gale Virtual Reference Library, Accessed 20 Nov. 2017.
- ^ Jump up to:a b K. Madhuri; K. Elango & S. Ponnusankar (2011). "Sausaria lappa (Kuth root): review of its traditional uses, phytochemistry and pharmacology". *Oriental Pharmacy and Experimental Medicine*. 12 (1): 1–9. doi:10.1007/s13596-011-0043-1.
- ^ Jump up to:a b c d e One or more of the preceding sentences incorporates text from a publication now in the public domain: Rines, George Edwin, ed. (1920). "Putchock" . *Encyclopedia Americana*.
- ^ Jump up to:a b c d e "Archived copy". Archived from the original on 2011-06-16. Retrieved 2011-01-15.
- ^ Jump up to:a b N. Kumar, A. Kumar Durlabhhotichamatkaricaushadhi-Kuth Sachitra Ayurveda, 1 (1989), pp. 25-29
- ^ Jump up to:a b c d Lipsch. *Saussurea Costus* . *Plants for a Future* , 2012, www.pfaf.org/user/Plant.aspx?LatinName=Saussurea+costus.
- ^ P. K. Hajra, R. R. Rao, D. K. Singh, B. P. Uniyal *Flora of India*, vol. 12, BSI, Calcutta (1995) p. 187
- ^ Bruchhausen, F. Y., Dannhardt, G., Ebel, S., Frahm, A. W., Hackenthal, E., Holzgrabe, U., 1994. *Hagers Handbuch der Pharmazeutischen Praxis. Band 9, Stoffe P-Z Bandwerk Hager: Hdbpharmaz. Praxis (5. Aufl.) 5., vollständige Neubearb. Aufl., XXX, 1255 S., Geb.*
- ^ O. P. Upadhyay, J. K. Ojha, S. K. Datta *Pharmacognostic study of the root of Saussurea lappa C. B. Clarke Sachitra Ayurveda*, 8 (1993), pp. 608-612
- ^ Jump up to:a b Reynolds, Francis J., ed. (1921). "Putchock" . *Collier's New Encyclopedia*. New York: P. F. Collier & Son Company.



^ Jump up to: a b Schippmann, Uwe. Medicinal Plants Significant Trade Study . German CITES Scientific Authority: German Federal Agency for Nature Conservation, 2001, Medicinal Plants Significant Trade Study.

^ Nayar and Sastry 1988

^ Molur and Walker 1998

Saussurea costus pictures at Google Images

Genus Saussurea phytochemical and pharmacological: Yang J.L. Wang R. Liu L.L. Shi Y.P. "Phytochemicals and biological activities of Saussurea species. [Review]" [153 refs] Journal of Asian Natural Products Research. 12(2):162-75, 2010 Feb.

"Saussurea costus". Plants for a Future.

Caldecott, Todd (2006). Ayurveda: The Divine Science of Life. Elsevier/Mosby. ISBN 978-0-7234-3410-8. Contains a detailed monograph on Saussurea lappa (Kushta) as well as a discussion of health benefits and usage in clinical practice. Available online

at <https://web.archive.org/web/20110616193431/http://www.toddcaldcott.com/index.php/herbs/learning-herbs/300-kushta>

USD A Plants: Classification: Saussurea DC. [Monograph online] [Cited 2015 May 27]. Available from: <http://plants.usda.gov/java/ClassificationServlet>. 2. The

Wealth of India. Saussurea DC. India: Publication and Information Directorate. CSIR. 1972;9:240-3. 3. Ibne S. Al-Qanoon Fit-Tibb [Kantoori GH, Trans]. New

Delhi: Aijaz Publishing. 2010;3(1):854-62, 869-78. 4. Jurjani AH. Zakheerakhwarzimshahi, [Khan HH, Trans]. Lucknow: MunshiNawal Kishore Publishing.

Year???2(7):368-82. 5. Khan H. IkseereAzam [H. Kabiruddin, Trans]. New Delhi: Aijaz Publishing. 2010;489, 505-15. 6. Razi AB. Kitabul-Hawi [Urdu

translation]. New Delhi: Central council for research in Unani Medicine. 2000;7:47-50, 52-73, 119-45. 7. Medicinal plants in the folklores of Kashmir

Himalayas. New Delhi: Central council for research in Unani Medicine. 2001;194. 8. Medicinal plants in the folklores of Northern India. New Delhi: Central

council for research in Unani Medicine. 2006;2:245-66. 9. The Unani Pharmacopea of India: Qust. New Delhi: Central council for research in Unani medicine.

2007;1:74-6. Part 1st 10. Lubhaya R. GoswamiByan-ul-Advia. New Delhi: GoswamiKutubKhanaGaliKasimJaan. 1975;2:66-8, 124-6. 11. Kabiruddin. Makhzan-

ul-MufradatMaarookhwas-ul-Adviah. New Delhi: Aijaz Publishing House. 1930;80. 12. Razi Z. KitabulAbdal.3rd ed. New Delhi: Central council for research

in Unani Medicine. 2000;43. 13. Indian Materia Medica. 3rd ed. India: Popular Prakashan Pvt. Ltd. 2013;141-2, 1108-113. 14. Kirtikar KR, Basu BD. Indian

Medicinal Plants. 2nd ed. India: International book distributors. 1988;2:1420-23, 1398-1400. 15. Pandey MM, Rastogi S, Rawat AKS. Saussurea costus:

Botanical, chemical and pharmacological review of an ayurvedic medicinal plant. Journal of Ethnopharmacology. 2007;110(3):379-90. 16. NMCD (Natural

Medicine Comprehensive Database): Costus. 2015. [Monograph online] [Cited 2015 May 27]. Available from:

<http://naturaldatabase.therapeuticresearch.com/nd/Search.aspx?pt=100andid=855andAspxAutoDetectCookieSupport=1>.

#### • **Research: -**

A research on Qust for pleurisy (zatul Jamb) & other lungs disease: -

Anti-bacterial effect of Indian costus (Qust ul Hind) and sea-Qust and their water extracts on some pathogenic bacteria of the human respiratory system AL-Kattan, Manal Othman Faculty of Science (Girls), Department of Microbiology, King Abdul Aziz University, Jeddah, Saudi Arabia. (Accepted on 4 May, 2012).

The pathogenic bacteria of the human respiratory system are characterized by resistance to most antibiotics. Staphylococcus aureus and Klebsiella pneumonia are some of the pathogenic bacteria of the human respiratory system which often cause pneumonia, pleurisy and meningitis. Moreover, they are the most prominent strains of bacteria in most hospitals. Bacterial resistance to antibiotics occurs as a result of excessive usage of antibiotics in the treatment of diseases. For that reason, it is necessary to seek for medical alternatives that are safer for the treatment of these bacteria. Alternative medicine, especially, has revealed many plants and herbs that are used in the treatment for some diseases including respiratory diseases.

The purpose of this study is to determine the effect of the Indian Costus and sea-Qust on the pathogenic bacteria; Escherichia coli, Pseudomonas aeruginosa, S. aureus and K. pneumonia. In addition, the effect of the water extracts of the Indian costus and sea-Qust on S. aureus and K. pneumonia was also determined.

#### **Result of the research: -**

The results showed antibacterial effect of two types of dried Costus roots on all tested bacteria, especially in high concentrations. Also, the cold or hot water extract of Indian Costus was highly effective against tested bacteria at 20 to 25% concentration, while the hot extract of sea-Qust was more effective against tested bacteria than its cold extract in all the concentrations used

**Objective:** The objective of our study is to investigate the effect of the ethanolic extract of *Saussurea lappa* against paracetamol-induced hepatorenal toxicity in male rabbits.

**Methods:** Eighteen male rabbits were used for this study and were divided into three groups of six rabbits each. Group 1: Rabbits were the normal (negative control), Group 2: (Positive control) Rabbits were administered paracetamol at dose 300 mg/kg body weight (B.W) for 14 day, and Group 3: Rabbits received paracetamol at dose 300 mg/kg B.W then treated with ethanolic extract of *S. lappa* at dose 300 mg/kg B.W for 14 day.

**Results:** The obtained results showed a significant decrease ( $p \leq 0.05$ ) in B.W, red blood cells count, white blood cells count, neutrophil, total protein, and albumin with significant ( $p \leq 0.05$ ) increase in lymphocyte, alanine aminotransferase, aspartate aminotransferase, creatinine, urea, and malondialdehyde in rabbits of positive control group, histological studies showed many pathological changes in liver and kidney when compared with negative control group. The oral administration of the ethanolic extract of *S. lappa* significantly protected the hepatic and kidney cells from damage, the hematological and biochemical parameters were also almost normal in extract treated rabbits compared to the control group.

**Conclusion:** Our study indicates that the roots of *S. lappa* act as antioxidant substance and have hepato and renal-protective effect against toxicity induced by paracetamol.

A research on Qust for pleurisy (zatul Jamb) & other lungs disease: -

Anti-bacterial effect of Indian costus (Qust ul Hind) and sea-Qust and their water extracts on some pathogenic bacteria of the human respiratory system AL-Kattan, Manal Othman Faculty of Science (Girls), Department of Microbiology, King Abdul Aziz University, Jeddah, Saudi Arabia. (Accepted on 4 May, 2012).

The pathogenic bacteria of the human respiratory system are characterized by resistance to most antibiotics. Staphylococcus aureus and Klebsiella pneumonia are some of the pathogenic bacteria of the human respiratory system which often cause pneumonia, pleurisy and meningitis. Moreover, they are the most prominent strains of bacteria in most hospitals. Bacterial resistance to antibiotics occurs as a result of excessive usage of antibiotics in the treatment of diseases. For that reason, it is necessary to seek for medical alternatives that are safer for the treatment of these bacteria. Alternative medicine, especially, has revealed many plants and herbs that are used in the treatment for some diseases including respiratory diseases.

The purpose of this study is to determine the effect of the Indian Costus and sea-Qust on the pathogenic bacteria; Escherichia coli, Pseudomonas aeruginosa, S. aureus and K. pneumonia. In addition, the effect of the water extracts of the Indian costus and sea-Qust on S. aureus and K. pneumonia was also determined.

- **Result of the research: -**

The results showed antibacterial effect of two types of dried Costus roots on all tested bacteria, especially in high concentrations. Also, the cold or hot water extract of Indian Costus was highly effective against tested bacteria at 20 to 25% concentration, while the hot extract of sea-Qust was more effective against tested bacteria than its cold extract in all the concentrations used

- **Conclusion: -**

More than 300 variety of Saussurea are available throughout the globe. Qust (Saussurea lappa, CB clarke) is one of the root to be used as medicinal important in Unani medicine. Many medicinal active compounds have been isolated from the qust. Sesquiterpene lactones of which dehydrocostus lactone and costulonide are the major active constituents responsible for most of the pharmacological activities. Qust has been used in Unani medicine in the form of decoction or powder or oil, alone or in combination with other drugs. It has been used successfully by Unani physician in the treatment of hepatitis, jaundice, splenomegaly, cough, asthma, chronic bronchitis, paralysis, tremors, epilepsy, hysteria, arthritis, chronic rheumatism, sciatica, gout, intestinal worms, amenorrhea, fevers, malaria, leukoderma, erysipelas, ring worm, chronic itching, scabies, dysentery, dyspepsia, cholera, melasma, alopecia, chronic ulcer, hair fall and scorpio/ snake bite. Qust oil has also been used in perfumery and cosmetics and also for prophylactic use. Qust and its active compounds have substantiated their potential antiviral, hepatoprotective, anti-inflammatory, immunomodulator, anti-microbial, antiulcer, gastroprotective, anticancer, anti-oxidant, anthelmintic, hypolipidemic, hypoglycemic, anti-angiogenesis, antidiarrheal, spasmolytic and anticonvulsant activities in various in vitro, in vivo and clinical studies. Various critical reviews analyzed pharmacological benefits of qust but insufficient to produce and correlate diverse benefits available in Unani literature with current studies. Its neurotonic, antifungal, vasodilator, nephroprotective, cardiac stimulant, hair vitalizer/ tonic, joint repairment, skin rejuvenating effects have not been studied which requires investigation. Some of the adverse effect of qust have also been reported by Unani scholars which are developed when the concentrated extract of the root is taken in higher dosage for long term. The adverse effects are depression of cerebral centers, gastrointestinal disturbances, headache, giddiness, irritation of urethra and allergic dermatitis upon local use. Due to presence of active compounds and their widespread usage especially in international societies also, high demand puts the herb into endanger and extinction. Thus, scientifically governed proper steps should be taken for its harvesting, conservation and limited utilization under biotechnology expertise.

S. lappa possesses numerous significant medicinal and traditional properties. It is used to cure various diseases and disorders in ethnobotany such as headache, stomach ache, epilepsy, leprosy, typhoid and chemicals extracted from the roots of the plant show several pharmacological activities like anticancerous, Anti-inflammatory and antimicrobial etc. The examination of literature on this plant concluded that it is medicinally important and is endangered due to high demand and consumption and illegal exploitation. From various evidences it is revealed that S. lappa is safe and effective when used in traditional dosage. It also shows some other properties except medicinal one, such as perfumery and antiparasite. Due to its significant pharmacological and ethnobotanical uses from long time and presence of many significant bioactive substances which can lead to extraction and identification of some new chemical compounds, it is concluded that S. lappa can help in future clinical and chemical researches.