

## Lesson no. 23 Jujube (sidr) (Ber)



Jujube tree is very famous for its fruits which is very nutritive & full of health benefits; all parts of the tree has medicinal properties & health benefits, it is cheap, easy available all season; can be eaten by all age; its fruit is eaten fresh, dried, roasted, its jam, pickle, vinegar, oil etc are prepared & used. It is of many types in different countries depending on the climate, soil, cultivation, season etc. It is of many different shapes & taste, but all are beneficial for health. It is mentioned in Quran at 3 verses detail is given below; also mentioned in books of Hadith as a plant of it will be present in Jannah to which will have no thorns & fruits will be present in place of thorns, & it will have different taste & colour; in other Hadith it is mentioned that there is no comparison of its tree as it has benefits; in one Hadith it is mentioned that Adam (a.s) ate Sidr (jujube) it as the first fruit on earth; in Hadith it mentioned to bath the death body with its boiled water & also it was advise to a new Muslim to bath with its water. Also The ***Sidrat al-Muntahā*** (Arabic: *بِسْطَرَّةِ الْمُنْتَهَا*; "Lote-Tree of the Utmost Farthest Boundary") is a large enigmatic lote tree or Sidr tree that marks the end of the seventh heaven, the boundary which no creation can pass, according to Islamic beliefs. During the Isra and Mi'raj, Prophet Muhammad (s.a.w), being the only one allowed, traveled with the archangel Gabriel to the tree (where the angel stopped) beyond which it is said that Allah (s.t) assigned the five daily prayers. Please read my English book Tibb e Nabawi part 2 lesson no. 35, page 59, onward for more Islamic detail on jujube (sidr) or visit my website [www.tib-e-nabi-for-you.com](http://www.tib-e-nabi-for-you.com) or direct link to lesson jujube (sidr) on my website <http://www.tib-e-nabi-for-you.com/sidr.html>

- **NAMES: -**

1. In Hadees & Quran it is called Sidr (السدر).
2. In English it is called as Jujube, lote tree, lotus tree.
3. Botanical name is *Ziziphus spinachristi* and *Ziziphus jujube*.
4. In Hindi it is called as Ber.
5. In Arabic it is called as Sidr & Rubeida.
6. Its family is Rhamnaceae.

- **Quranic references: -**

1. **Chapter No. 34 (Surah) Saba verse no. 16: -**

فَاعْرَضُوا فَاَرْسَلْنَا عَلَيْهِمْ سَيْلَ الْعَرِمِ وَبَدَّلْنَاهُمْ بِجَنَّتَيْهِمْ جَنَّتَيْنِ ذَوَاتِ اُكْلِ خَمْطٍ وَاَثَلٍ وَّشَيْءٍ مِّنْ سِدْرٍ قَلِيلٍ ﴿١٦﴾

But they turned away (from the obedience of Allah ﷻ), so We sent against them Sail Al'Arim (flood released from the dam), and We converted their two gardens into gardens producing bitter bad fruit, and tamarisks, and some few lote-trees.

2. **Chapter No. 56 (Surah) Waaqia verse no. 27 & 28: -**

وَأَصْحَابُ الْيَمِينِ ﴿٢٧﴾ مَا أَصْحَابُ الْيَمِينِ ﴿٢٨﴾ فِي سِدْرٍ مَّخْضُودٍ ﴿٢٩﴾

And those on the Right Hand, Who will be those on the Right Hand? (They will be) among thorn-less lote-trees,

3. **Chapter No. 53 (Surah) Najm verse no. 14 & 16: -**

عِنْدَ سِدْرَةِ الْمُنْتَهَى ﴿١٤﴾ عِنْدَهَا جَنَّةُ الْمَأْوَى ﴿١٥﴾ إِذْ يَغْشَى السِّدْرَةَ مَا يَغْشَى ﴿١٦﴾

Near Sidrat-ul-Muntaha [lote-tree of the utmost boundary (beyond which none can pass)], Near it is the Paradise of Abode. Near it is the Paradise of Abode.

It is mentioned in following books of Hadith (names of book of Hadith & reference are also given): - Bukhari; Tirmizi; Abu Nuaim; Fathul Bari; Tafseer Ibn Kaseer; Al Tibb Al Nabawi.

- **Basic encyclopedia of Jujube: -**

- **Jujube tree: -**

It is a small deciduous tree or shrub reaching usually with thorny branches; its precise natural distribution is uncertain due to extensive cultivation, but is thought to be in southern Asia, between Lebanon, northern India, and southern and central China, and possibly also southeastern Europe though more likely introduced there. This tree is harvested mainly for its fruit jujube; its family is Rhamnaceae; there are many types of jujube tree but mainly 3 types very common: Ziziphus jujube & Ziziphus spina-christi, Ziziphus mauritiana.

Please note: -The Sidrat al-Muntahā Arabic: (سِدْرَةُ الْمُنْتَهَى); "Lote-Tree of the Utmost Farthest Boundary") is a large enigmatic lote tree or Sidr tree that marks the end of the seventh heaven, the boundary which no creation can pass, according to Islamic beliefs. During the Isra and Mi'raj, Prophet Muhammad (s.a.w), being the only one allowed, traveled with the archangel Gabriel to the tree (where the angel stopped) beyond which it is said that Allah (s.t) assigned the five daily prayers.

Farooqi, in his book "Plants of the Qur'an" discusses at length the different names of the Qur'an's lotus tree: he suggests *Z. spina-christi* as an option, but on the other hand *Z. lotus* and *Z. spina-christi* are wild plants in Arabia. Another possibility he mentions is the Lebanon cedar (*Cedrus libani* L.), which is also called "sidr in Arabic. Farooqi concludes that the lotus tree of the Quran was indeed the Lebanon cedar, and the historical misunderstanding has perpetuated the mistaken name until the present day

- **Ziziphus jujube tree: -**



It is also known as the Chinese date, is native to China. This medium-sized tree can grow up to 40 feet, has glossy green, deciduous leaves and light gray bark. The oval-shaped, single-stoned fruit is green to start with and becomes dark brown over time. It is a small deciduous tree or shrub reaching a height of 5–12 meters (16–39 ft), usually with thorny branches. The jujube tree can tolerate saline, alkaline or slightly acidic soils but grows best in soil with pH 4.5–8.4.

- **Ziziphus jujube leaf:** -



The leaf are shiny-green, ovate-acute, 2–7 centimeters (0.79–2.76 in) long and 1–3 centimeters (0.39–1.18 in) wide, with three conspicuous veins at the base, and a finely toothed margin.

- **Ziziphus jujube flower:** -



The flowers are small, 5 mm (0.20 in) wide, with five inconspicuous yellowish-green petals; flower occur from April to May, and the seeds ripen in October. The species is hermaphrodite (has both male and female organs) and is pollinated by Insects. The plant is self-fertile.

- **Ziziphus jujube fruit:** -



The fruit is an edible oval drupe 1.5–3 centimeters (0.59–1.18 in) deep; when immature it is smooth-green, with the consistency and taste of an apple with lower acidity, maturing brown to purplish-black and eventually wrinkled, looking like a small date. There is a single hard kernel, similar to an olive pit, containing two seeds. Jujube fruit, also known as red date or Chinese date; it is native to Southern Asia but has become popular around the world. It is small round fruits with a seed-containing pit grow on large flowering shrubs or trees (*Ziziphus jujube*). When ripe, they're dark red or purple and may appear slightly wrinkled. Its fruit has sweet taste and chewy texture; mostly eaten dried and fresh less eaten.

- **pH of it is not known.**

- **Calories of Ziziphus jujube:** -

Fresh 100 grams give 79 calories & dried 100 grams give 350 calories.

- **Different types of Ziziphus jujube: -**



- **Gross health benefits of Ziziphus jujube: -**

In alternative medicine, they're widely utilized to improve sleep and decrease anxiety, it is antioxidant, helpful in controlling blood pressure, promotes bone health, improves blood circulation, removes anxiety, helpful in diabetic neuropathy, nerve weakness, increase energy, stamina. Ziziphus jujube is used for improving muscular strength and weight, for preventing liver and bladder diseases, stress ulcers, and as a sedative. It is also used to reduce constipation, also used for various skin conditions including dry and itchy skin, purpura, wounds, and ulcers; digestive problems including lack of appetite and diarrhea; and circulatory problems, high cholesterol, and anemia. Other uses are for diabetes, fatigue, hysteria, anxiety, insomnia, seizures, fever, obesity, cancer, inflammation, asthma and other lung disorders, and eye diseases. In newborns, it is used for jaundice (yellowing of the skin).

- **Ziziphus spina-christi tree: -**



It is also known as the Christ's thorn jujube, is an evergreen tree or plant native to northern and tropical Africa, Southern and Western Asia. It is native to the Levant, East Africa and some tropical countries. Fruit and leaves from the tree have been used in Ancient Egyptian food and medicine. Modern research has shown that compounds extracted from the tree's leaves could be used to decrease severe inflammation. Additionally, honey from bees that feed on the tree's nectar has anti-bacterial properties that inhibit infectious diseases, especially when compared to other types of honey.

Ziziphus spina-christi is a spiny (Thorny), ever green shrub or tree that starts branching low down on the bole and forms a thick, tangled crown; it can grow up to 18 meters tall, but is usually considerably smaller. The short bole can be 60cm in diameter. It is a lower canopy tree confined to patches of upland dry forest at elevations between 1,550 - 2,150 meters, between the lower edges of montane conifer forest, grassland and open woodlands at lower elevations. The plant is harvested for source of food, medicines and materials. It is cultivated for its fruit in the oases of the Sahara, Tunisia, Algeria, Niger, E Africa, Sinai and also in Iran and India; occasionally also in other areas such as Cuba. It is also grown for ornamental purposes and to provide shade.

*Z. spina-christi* is drought hardy, very resistant to heat and can be found in desert and arid areas with a mean annual rainfall from 50 mm to 500 mm and a mean annual temperature in the range 19–28°C. It prefers alluvial plains with deep soils, but it also grows on clay (where water is available) as well as on moderately saline soils, usually at elevations between sea level and 2000 m. This species is frost tender and is able to withstand water logging for up to 2 months; it can also tolerate a dry season of 8–10 months; evergreen where water supply is adequate & it is deciduous during the dry season in arid areas.

Its bark is light-grey, very cracked, scaly; trunk twisted; very branched, crown thick; shoots whitish, flexible, drooping; thorns in pairs, one straight, the other curved.

- **Flower of ziziphus spina christi: -**



Flowers of *Z. spina-christi* are small, yellow-green and hermaphrodite, and are visited and pollinated by insects, especially bees (Nuru et al., 2012). In Saudi Arabia, *Z. spina-christi* has been recorded flowering in September. Flowering time in Sudan is August to December, and fruiting extends from October to April (Saied et al., 2008). In a study of the phenology of the flowers of *Z. spina-christi* in Saudi Arabia, most opened early in the morning. Anthers started to dehisce between 06:00 h and 10:00 h. By 10:00 h, flowers started to secrete considerable amounts of nectar, peaking at 14:00 h. The stigma then starts to become shiny and receptive between 14:00 h and 18:00 h. Nectar secretion was positively correlated with temperature, indicating the adaptation of this tree species to hot climates.

- **Leaves of ziziphus spina christi: -**



Its leaves are glabrous on upper surface, finely pubescent below, ovate-lanceolate or ellipsoid, apex acute or obtuse, margins almost entire, lateral veins conspicuous.

- **Fruit of ziziphus spina christi: -**



It is of various shapes, taste, size & colour according to its spices & region; all types are full of health benefits; fruits can be eaten fresh, dried, soup, tea or juice form. Its benefits are mentioned below.

- **pH of it is not known.**

- **Calories of Ziziphus spina christi: -**

Fresh 100 grams give 79 calories & dried 100 grams give 314 calories.

- **Gross health benefits of Ziziphus spina christi: -**

It is good for skin, complexion, wound healing, infections, bleeding, also good in diarrhea, loose motions, uterus problems, lung diseases, digestive diseases, anti-worms (anti-helminthic), eye inflammation; It also

have following properties anti-inflammatory, antioxidant, anti-cancer, antiviral, antifungal, antibiotic, antimicrobial, good for bones, heart, liver health etc.

- **Ziziphus mauritiana tree: -**



It is also known as Chinese date, Chinese apple, Indian plum, Indian jujube and dunks; it is a tropical fruit tree species belonging to the family Rhamnaceae. Its tree is a spiny, evergreen shrub or small tree up to 15 m high, with trunk 40 cm or more in diameter; spreading crown; stipular spines and many drooping branches. *Ziziphus mauritiana* is a medium-sized tree that grows vigorously and has a rapidly developing taproot, a necessary adaptation to drought conditions. The species varies widely in height, from a bushy shrub 1.5 to 2 m tall, to a tree 10 to 12 m tall with a trunk diameter of about 30 cm. It may be erect or wide-spreading, with gracefully drooping thorny branches, zigzag branchlets, thornless or set with short, sharp straight or hooked spines. It is a quick growing tree starts producing fruits within three years. It is a hardy tree that copes with extreme temperatures and thrives under rather dry conditions with an annual rainfall of 6 to 88.5 in (15–225 cm). In Fiji, sometimes naturalized Ber trees grow along roadsides and in agricultural land, usually near sea level but occasionally up to an elevation of about 600 m. It also grows well on laterite, medium black soils with good drainage, or sandy, gravelly, alluvial soil of dry river-beds where it is vigorously spontaneous. In Australia, this species grows on a wide variety of soil types, including cracking clays, solodic soils and deep alluvials, in the tropics and sub-tropics where the average annual rainfall is in the range 470-1200mm. In the drier parts of this range, it grows best in riparian zones. Commercial cultivation usually extends up to 1000 m; beyond this elevation trees do not perform well, and cultivation becomes less economical. It is mainly of 2 types Chinese & Indian.

- **Ziziphus mauritiana leaves: -**



The leaves are alternate, ovate or oblong elliptic with rounded apex, with 3 depressed longitudinal veins at the base. The leaves are about 2.5 to 3.2 cm long and 1.8 to 3.8 cm wide having fine tooth at margin. It is dark-green and glossy on the upper side and pubescent and pale-green to grey-green on the lower side. Depending on the climate, the foliage of the *Z. mauritiana* may be evergreen or deciduous.

- **Ziziphus mauritiana flower: -**



The flowers are tiny, yellow, and 5-petalled and are usually in two or three in the leaf axils. Flowers are white or greenish white.

- **Ziziphus mauritiana fruit: -**



Fruits are orange to brown, 2–3 cm long, with edible white pulp surrounding a 2-locular pyrene. The fruit is a soft, juicy, drupe that is 2.5 cm diameter, though in some cultivars the fruit size may reach up to 6.25 cm long and 4.5 cm wide. The form may be oval, obovate, round or oblong; the skin smooth or rough, glossy, thin but tough. The fruit ripen at different times even on a single tree. Fruits are first green, turning yellow as they ripen. The fully mature fruit is entirely red, soft and juicy with wrinkled skin and has a pleasant aroma. The ripe fruit is sweet and sour in taste. Both flesh texture and taste are reminiscent of apples. When under ripe the flesh is white and crispy, acid to sub-acid & sweet in taste. Fully ripe fruits are less crisp and somewhat mealy; overripe fruits are wrinkled, the flesh buff-coloured, soft, spongy and musky. At first the aroma is apple like and pleasant but it becomes peculiarly musky when overripe. There is a single, hard, oval or oblate, rough central stone which contains 2 elliptic, brown seeds, 1/4 in (6mm) long.

- **Calories of Ziziphus mauritiana: -**

Fresh 100 grams give 79 calories & dried 100 grams give 350 calories.

- **Glycemic index & Glycemic load of all 3: -**

It is not known properly but dried of all 3 above is high in sugar content so diabetic patients should not eat much, fresh have less sugar content due to more water content in it.

- **Clinical pharmacology of all three types of jujube: -**

Jujube fruit is low in calories but rich in fiber, vitamins, and minerals. 100-gram serving of raw jujube, or about 3 fruits, provides Calories: 79; Protein: 1 gram; Fat: 0 grams; Carbs: 20 grams; Fiber: 10 grams; VitaminC: 77%; Potassium: 5% etc.

Due to their high fiber content and low calorie count, jujubes make an excellent, healthy snack. They contain small amounts of several vitamins and minerals but are particularly rich in vitamin C, an important vitamin with antioxidant and immune-boosting properties. They also contain a fair amount of potassium, which plays vital roles in muscle control and electrolyte balance. In addition, jujube fruits contain carbs in the form of natural sugars, which provide our body energy. However, dried jujubes, which are more commonly eaten and used in cooking in many parts of the world, are much higher in

sugar and calories than the fresh fruit. During drying, the sugars in the fruit become concentrated, and additional sugar may be added during processing.

Jujube fruits have long been used in alternative medicine to treat conditions like insomnia and anxiety. Animal and test-tube studies indicate that the fruit may offer impressive health benefits for your nervous system, immunity, and digestion. It is rich in antioxidant elements like flavonoids, polysaccharides, and triterpenic acids. They also contain high levels of vitamin C, which acts as an antioxidant as well. Antioxidants are compounds that can prevent and reverse damage caused by excess free radicals, free radical damage is thought to be a major contributor to several chronic conditions, including type-2 diabetes, heart disease, and some cancers. Due to their ability to fight free radicals, antioxidants may offer several health benefits. One animal study found that the antioxidant activity of jujube flavonoids helped reduce stress and inflammation caused by free radical damage in the liver. In fact, most of the benefits of jujube fruits are credited to their antioxidant content.

It may improve sleep and brain function; jujubes are widely used in alternative medicine to improve sleep quality and brain function. Emerging research suggests their unique antioxidants may be responsible for these effects.

Jujube fruit and seed extracts have been found to increase sleep time and quality in rats. Also, the fruit is often prescribed by alternative medicine practitioners to decrease anxiety.

Furthermore, animal and test-tube studies indicate that it may improve memory and help protect brain cells from damage by nerve-destroying compounds.

Research in mice even suggests that jujube seed extracts may help treat dementia (a brain disorder) caused by Alzheimer's; the seeds themselves are not usually eaten. More human research is needed to fully understand how jujube extract may affect your brain and nervous system.

It may boost immunity and fight cancer cells; jujube may boost immunity and fight the growth of cancer cells. One test-tube study noted that jujube polysaccharides, which are natural sugars with antioxidant properties, may fend off free radicals, neutralize harmful cells, and decrease inflammation.

Decreased levels of inflammation and free radicals can help prevent chronic diseases, such as type 2 diabetes. Another study found that jujube lignin, a type of fiber with antioxidant properties, promoted the production of immune cells and increased the rate at which these cells neutralized harmful compounds. In a rat study, jujube extract boosted immune cells called natural killer cells, which can destroy harmful invader cells.

Vitamin C is thought to have powerful anticancer properties. One mouse study found high-dose vitamin C injections killed thyroid cancer cells. Plus, test-tube studies have found that jujube extracts kill several types of cancer cells, including ovarian, cervical, breast, liver, colon, and skin cancer,

Researchers believe that these benefits are primarily a result of the antioxidant compounds in the fruit. Still, most of these studies were conducted in animals or test tubes, so more research in humans is needed before any firm conclusions can be drawn.

Jujube's high fiber content may help improve digestion. About 50% of the carbs in the fruit come from fiber, which is known for its beneficial digestive effects).

This nutrient helps soften and add bulk to our stool. As a result, it speeds up the movement of food through your digestive tract and reduces constipation; jujube extracts may help strengthen the lining of our stomach and intestines, decreasing your risk of damage from ulcers, injury, and harmful bacteria that may reside in our gut.

In one study, jujube polysaccharide extracts strengthened the intestinal lining of rats with colitis, which improved their digestive symptoms allowing them to grow and overtake harmful bacteria.

- **Modern uses of it: -**

1. **For maintaining normal health: -**



Eat little jujube fruit dried with little watermelon because both are opposite to each other in potency & eating together will neutralize both; eat on empty stomach once or twice a week only lifelong.

**2. For prevent heart, lungs diseases: -**

Take few jujube fruits remove the seeds, take few pieces of watermelon, dates, beetroot & add little water mix all & grind to make a juice & drink the juice on empty stomach once or twice a week lifelong.

**3. A bath for infection: -**

Take little water & few leaves of jujube & boil both or a little time on low flame & add this boiled water in your bath water & bath once or twice a week.

**4. For wounds: -**

Take powder of jujube leaves & henna leaves mix both add little olive oil & prepare a paste & apply this paste on lesion.

**5. For hair problem: -**

Take little jujube oil, coconut oil & olive oil mix all in a proportion of 1:3:3; & apply on hair but take pure oil of all three.

A good quality of all contains very little amount of main amino acids.

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

- **Contents/constituents of ziziphus jujube fruit, seed, leaf & bark: -**

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 ingredient of it: -**

Alphitolic acid, maslinic acid, pomoric acid, pomolic acid, jujuboside B, jujahasapenin etc

- **Other constituents of it: -**

Water 78% in fresh fruit of it, Rutin, tetracosanoic acid, beta-sitosterol, daucoserol, heptadecanoic acid, hydroxyursolic acid, benthamic acid, terminic acid, oleanic acid, betulinic acid, quercetin, traumatic acid, swertisin, magnoflorine, sodium, potassium, carbohydrate, sugar, vitamin A, C, B1, B2, B3, B6, calcium, iron, magnesium, phosphorus, zinc etc.

- **Contents/constituents of ziziphus spina christi fruit, seed, leaf & bark: -**

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 ingredient of it: -**

Quercetin, alkaloids, sterols like  $\beta$  sitosterol, flavonoids, triterpenoids, sapogenins and saponins.

- **Other constituents of it: -**

Water 80% in fresh fruit of it, linoleic acid, stigmasterol, tetradecene, 3-dodecene, butylhydroxytoluene, hexadecanol, octadecanoic acid, pyrrolidine, betulin, beta-sitosterol, lanceol, heptacosane, campesterol, little sodium, potassium, carbohydrate, sugar, vitamin B1, B2, B3, calcium, iron, magnesium, sulfur, manganese, copper, zinc, phosphorus etc.

- **Contents/constituents of ziziphus mauritiana fruit, seed, leaf & bark: -**

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 ingredient of it: -**

Flavonoids, alkaloids, glycosides, terpenoides, saponins, fibers, tannins and phenolic compounds.

- **Other constituents of it: -**

Triterpenoid, pyridine, glacial acetic acid, beta-sitosterol, betulinic acid, ceanothic acid, franguloline, spinosin, stearic acid, palmitoleic acid, water 81% in fresh fruit of it, carbohydrate 17%, sugar 5 to 10%, dietary fiber, little protein, Vitamin B1, B2, B3, calcium, iron, phosphorus etc.

- **Each content explained separately: -**
- **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 bacteria, 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.

- **Glucose: -**

It is among simple type of natural sugar present in fruits & vegetables; it is a source of energy for our body & related to many function & digestion.

- **Sugar (fructose): -**

Sugar present in beetroot is fructose; (but diabetic patients should not eat much of it).

#### **Main sources of fructose: -**

It is present in watermelon, honey, banana, apple, mango, cherry, strawberry, orange, kiwi, pears, pomegranate, apricots, carrots, yogurt, bread, lemon, lime, green beans, beetroot etc.

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

Fructose digestion begins in the small intestine (more in upper jejunum) via active transport or facilitated transport (not known properly). Our body cannot absorb intact polysaccharide molecules. Therefore, if fructose is present in the form of sucrose, sucrase, an enzyme, must first break up sucrose into separate glucose and fructose components. Single fructose molecules then enter the lining of the small intestine through a special channel and exit out the other side into the bloodstream, once in the bloodstream, fructose travels with all other absorbed nutrients to the liver for metabolism and processing.

#### **Metabolism: -**

Fructose metabolism occurs entirely in the liver. Through a complicated process called fructolysis, fructose undergoes several chemical and structural changes with the help of aldolase B (an enzyme in the liver).

Extra fructose needs to be changed into glycogen by liver & stored in liver, once the storage is full in liver then liver convert it into triglycerides & triglycerides are further converted by liver into very low-density lipoprotein (VLDL) & stored in fat cells & muscles. Excessive fructose is excreted in urine.

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

Fructose has low glycemic index & results in moderate release of insulin in the blood stream relative to glucose & sucrose; fructose gives the least dental caries among other types of sugars, fructose is more sweeter than other types of sugar; it does not raises blood sugar much as glucose does, it is used as sources of energy in the body, excessive intake of it may cause fatty liver, metabolic disorder, blood pressure, increase lipids, increase in uric acid level, increase in free radicals etc.

- **Sucrose: -**

Sucrose is common sugar. It is a disaccharide, a molecule composed of two monosaccharides: glucose and fructose. Sucrose is produced naturally in plants, sucrose is digested quickly. A serving of food rich in sucrose can cause a sharp increase in blood sugar that is often followed by a sharp decrease. The sudden rise and fall in blood sugar often affects mood, causing sudden bouts of irritability and fatigue. But vegetables & fruits contain little amount of sucrose.

- **Dietary fiber: -**

It is an eatable part of vegetables & fruit; our body cannot digest it just passes the small intestines & colon & excrete in stools; it is of two types 1) soluble fiber 2) insoluble fiber.

Soluble fiber dissolve in water & form a gel like material & helps in controlling blood cholesterol & blood glucose; it is found in apple, carrot, barley, oats, peas, beans watermelon etc.

Insoluble fiber do not dissolve & promotes excretion & increase bulk of the stool thus relief constipation & helps in elimination of toxins also. It is found in wheat flour, beans, cauliflower, potato, green beans, watermelon, beetroot, beet leaves etc.

This is the reason it is helpful in constipation conditions, it can be eaten in pregnancy to relief constipation and get other benefits of it also.

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

Soluble fibers get dissolve in water & become a gelatinous substance; do not get digested; it helps to slow the digestion & help the body to absorb vital nutrient from eaten food.

Insoluble fibers do not dissolve in water but remain in fibrous form, and do not get digested; it helps the food pass through the digestive system and increase the bulk of stool & eliminate toxins also.

#### **Basic clinical pharmacology of dietary fiber: -**

It helps in slow down the digestive process thus gives a good control in blood glucose, improves insulin sensitivity, reduces risk of diabetes, maintains weight, helpful in obesity, reduces blood pressure, reduces cholesterol, reduces inflammation, reduces risk of heart disease, relieves constipation thus helpful in piles, fistula & other rectal disorders & disease, improves bowel movement thus improves bowel health, slowdowns the digestion thus improves quality of digestion, reduces risk of many types of cancer.

- **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 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.

- **Vitamin B1 (Thiamin): -**

It is called as Thiamin also; it is a water soluble vitamin, it belongs to B-complex family, it is an essential micro nutrient which cannot be made by our body.

### **Main sources of vitamin B1: -**

It is present in watermelon, spinach, legumes, banana, quince, wheat germ, liver, egg, meat, dairy products, nuts, peas, fruits, vegetables, cereals, rice, breads, oats, cucumber etc.

### **Basic pharmacokinetic of vitamin B1 (based on human intake in natural food products): -**

Intestinal phosphates hydrolyze thiamin to make it free & absorbed in duodenum, jejunum mainly through active transport in nutritional doses & passive diffusion in pharmacological doses, very little is known about its absorption; it is metabolized in liver; it is excreted in urine & stored little in liver, heart, kidney, brain, muscles.

### **Clinical pharmacology of vitamin B1: -**

It is needed for metabolism of glucose, amino acids (proteins), lipids (fats) etc; every cell of the body require it to form ATP (adenosine triphosphate) as a fuel for energy, also it enables the body to use carbohydrates as sources of energy; also nerve cells, heart cells, muscles cell require it to function normally; its deficiency causes beri-beri heart disease, weight loss, confusion, malaise, optic neuropathy, irritability, memory loss, delirium, muscles weakness, loss of appetite, tingling sensation in arms & legs, blurry vision, nausea, vomiting, reduce refluxes,

shortness of breath etc; it is helpful to immune system; excessive intake of carbohydrates, protein, glucose (specially in body builders, athletes etc) increases the need of vitamin B1.

- **Vitamin B2: -**

It is also called as Riboflavin, it is a water soluble vitamin, it is an essential micro nutrient, it helps many systems of the body; it is not synthesized in human body.

**Main sources of vitamin B2: -**

It is present in watermelon, liver, milk, dairy products, nuts, egg, fish, leafy vegetables, almonds, mushroom, lean meat and quince, cucumber.

**Basic pharmacokinetic of vitamin B2 (based on human intake in natural food products): -**

It is phosphorylated in the intestinal mucosa during absorption; mainly absorbed in upper gastrointestinal tract; the body absorbs little from a single dose beyond of 27mg; when excessive amount is eaten it is not absorbed; very little is known about its absorption. The conversion of it into its coenzymes takes place mainly in cells of small intestines, heart, liver, kidneys & throughout the body in many cells; it is excreted in urine & stored little in liver, heart, kidneys & in tissues of the body.

**Basic clinical pharmacology of vitamin B2: -**

It is needed by the body to keep skin, eyes, nerves, red blood cells healthy, it also helps adrenal gland, nerve cells, heart, brain to function; it also act in metabolism of food, amino acids (protein), fats, helps to convert carbohydrate into energy (Adenosine triphosphate formation- the energy body runs on). It plays an important role in functioning of mitochondria.

Its deficiency is called as Ariboflavinosis & causes weakness, throat swelling, soreness of mouth & tongue, cracks on skin, dermatitis, anemia, weak vision, itching & irritation in eyes, migraine.

- **Vitamin B3: -**

It is called as Niacin or Nicotinic acid; it is in 2 forms niacin & nicotinamide acid; it is water soluble vitamin; it is an essential micro nutrient; it plays a role in over 200 enzymatic reactions in the body; It is produced in the body in small amount from tryptophan which is found in protein containing food & sufficient amount of magnesium, vitamin B6 & B2 (are needed to produce it).

**Main sources of vitamin B3: -**

It is present in watermelon, green peas, peanuts, mushroom, avocados, meat, egg, fish, milk, cereal, green vegetables, liver, chicken, coffee, potato, corn, pumpkin, tomato, almonds, spinach, enriched bread, carrots, quince, cucumber etc.

**Basic pharmacokinetic of vitamin B3 (based on human intake in natural food products): -**

If eaten in natural form it is absorbed in stomach & small intestines by the process of sodium-dependent carrier-mediated diffusion in 5 to 20 minutes; if taken in therapeutic doses get absorbed by passive diffusion in small intestines. Its uptake in brain requires energy, in kidneys & red blood cells requires a carrier. It is metabolized in liver in 2 ways either is conjugated with glycine or niacin is form into nicotinamide; it is stored little in liver unbounded to enzymes. It is excreted in urine.

**Basic clinical pharmacology of vitamin B3: -**

It regulates lipid level in the body; it acts on carbohydrate to form energy sources for the body, it ease arthritis, boost brain function, every part of body needs it to function properly, it helps convert food into energy by aiding enzymes & cellular metabolism, it acts as an antioxidant. It prevents heart disease. Deficiency of it causes pellagra, high blood cholesterol, memory loss, fatigue, depression, diarrhea, headache, skin problems, lesion in mouth, tiredness etc.

- **Vitamin B5 (pantothenic acid): -**

It is also called as pantothenic acid, it is water soluble vitamin, it is a micro nutrient, it is necessary for making blood cells; acts to convert eaten proteins, carbohydrate, fats into energy; it is a component of coenzyme A; it is used in synthesis of coenzyme A. (coenzyme A acts on transport of carbon atoms within the cell).

**Main sources of vitamin B5: -**

It is present in watermelon, quince, meat, chicken, liver, kidney, fish, grains, milk, dairy products, legumes, pumpkin, grapes etc.

### **Basic pharmacokinetic of vitamin B5 (based on human intake in natural food products): -**

It is converted into free form by intestinal enzymes & in nutritional doses it is absorbed in intestinal cells via sodium dependent active transport system in jejunum & pharmacological doses are absorbed by passive diffusion; after absorption the free form of it is now transported to erythrocytes via plasma, in cells pantothenic acid is converted into CoA, all the body tissues can convert it into CoA & ACP (acyl carrier protein), after these two complete their jobs they are degraded to form free pantothenic acid & other metabolites. It is excreted in urine & stools & little is exhaled in carbon dioxide.

### **Basic clinical pharmacology of vitamin B5: -**

It promotes skin, hair & eyes health, proper functioning of nervous system & liver, formation of red blood cells, making of adrenal hormones, sex hormones; it is very helpful in constipation, rheumatoid arthritis, acne, allergies, asthma, baldness, colitis etc.

Its deficiency causes fatigue, nausea, vomiting, irritability, neurological weakness, numbness, abdominal cramps, sleep disturbances, hypoglycemia etc.

- **Vitamin B6: -**

It is also called as pyridoxine; it is involved in many aspects of macronutrients metabolism; it is present in many food products naturally.

### **Main sources of vitamin B6: -**

It is present in watermelon, quince, chicken, bread, egg, vegetable, soyabean, whole grain cereals, brown rice, fish, legumes, beef, nuts, beans, liver, citrus fruits, starchy vegetables, potato, cucumber etc.

### **Basic pharmacokinetic of vitamin B6 (based on human intake in natural food products): -**

It is absorbed in small intestines, but before absorption a phosphate group has to be removed making vitamin B 6 in free form & absorbed by passive transport, now reaches liver via portal vein, in liver to get metabolized & flown into the blood stream it is bound with albumin & some are taken up by red blood cells, once getting in blood it can function & promote health & it is excreted mainly in urine & little is excreted in stools, it is very little stored in tissues, muscle tissues, liver, brain, kidneys, spleen.

### **Basic clinical pharmacology of vitamin B6: -**

It is needed for proper development & function of brain in children; it is needed for neurotransmitter, histamine, haemoglobin synthesis & function. It serves as coenzyme (cofactor) for many reactions in the body, it is the master vitamin for processing amino acids & some hormones, it is needed by the body to prepare serotonin, melatonin & dopamine, it is better to intake it during treatment of tuberculosis. It supports adrenal glands to function; it acts as a coenzyme in the breakdown & utilization of fats, carbohydrates, protein, it is important for immune system, it helps in treatment of nerve compression like carpal tunnel syndrome, premenstrual syndrome, depression, arthritis, high homocysteine level, diabetes, asthma, kidney stones etc.

Its deficiency causes seborrheic dermatitis (eruption on skin), atrophic glossitis with ulceration, conjunctivitis, neuropathy, anaemia etc.

- **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, 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.

- **Sulfur: -**

Sulfur is an essential element for all life, but almost always in the form of organo-sulfur compounds or metal sulfides. Three amino acids (cysteine, cystine, and methionine) and two vitamins (biotin and thiamine) are organo-sulfur compounds. Many cofactors also contain sulfur, including glutathione, thioredoxin, and iron-sulfur proteins. Disulfides, S-S bonds, confer mechanical strength and insolubility of the protein keratin, found in outer skin, hair, and feathers. Sulfur is one of the core chemical elements needed for biochemical functioning and is an elemental macronutrient for all living organisms. Sulfur (in British English, sulphur) is a chemical element with the symbol S and atomic number 16. Elemental sulfur is a bright yellow; Sulfur is the third most abundant chemical in the human body. The element is also found in a number of foods such as garlic, onions, eggs, and protein-rich foods. Sulfur is necessary for the synthesis of the essential amino acids cysteine and methionine. It is helpful in osteoarthritis, muscles soreness, hair fall, antibacterial, antiviral, dandruff 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.

- **Iron: -**

It is an essential mineral for our body; its symbol is Fe & atomic no. 26; it is an important component of haemoglobin (haemoglobin 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, cucumber 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; Heparin 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 haemoglobin. 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 Haemoglobin (haemoglobin 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 haemoglobin 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.

- **Copper: -**

It is an essential micronutrient mineral; its symbol is Cu & atomic no. 29; there are a 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 cardio-vascular disease, genetic defects, inflammation of optic nerve 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.

- **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 processes 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.

- **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, cucumber 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 & metallophilonein. 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. Metallophilonein binds to zinc to make it unavailable & excrete it in stools when zinc is excess in the body, & production of metallophilonein 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, synthesize 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 hyper activity disorder (ADHD), osteoporosis, pneumonia 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.

- **Flavonols: -**

Flavonols are polyphenols & belong to class of flavonoids; they are colourless molecules that accumulate mainly in the outer & aerial tissues (skin & leaves) of the fruits & vegetables because their biosynthesis is stimulated by light

so absent in inner parts of fruits & vegetables. There are more than 7000 flavonoids discovered yet & many more are to be discovered.

**Main sources of flavonols: -**

It is present in tea, leek, onion, broccoli, kale, berries, grapes, quince, cucumber etc.

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

Its absorption, metabolism & excretion in natural form are not yet known & are under research. Flavonoids are mostly absorbed in small intestine, after absorption flavonoids conjugates with glucuronic acid or sulfate or methylation may occur; no free flavonoids are found in plasma or urine except catechin; the part of it which remains undigested is degraded into phenols in colon (large intestines) by microorganisms & absorbed, the absorbed part is further metabolized in liver; it is excreted via urine & bile.

**Basic clinical pharmacology of flavonols: -**

All types of flavonols are anti oxidant, anti inflammatory, anti cancer, reduce oxidative stress, maintains heart health, helpful in asthma, stroke, helps in regulating cellular signaling 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 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.

- **Quercetin: -**

It is a plant flavonol from the flavonoid group of polyphenols; it is bitter in taste.

**Main sources of quercetin: -**

Red onion, green tea, apples, ginkgo biloba, grapes etc.

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

Its absorption, metabolism & excretion are yet not known & are under research.

**Basic clinical pharmacology of quercetin: -**

It is good for heart diseases, coronary heart disease, prevents cancer, arthritis, bladder infection, diabetes; it is anti oxidant, anti inflammatory, reduces benign prostatic hyperplasia, cholesterol, blood pressure, asthma, symptoms of rheumatoid arthritis.

- **Rutin: -**

It is also called as Rutoside, it is a citrus flavonoid found in many plants including citrus fruits & it is soluble in water & alcohol.

**Main sources of rutin: -**

It is present in green tea, quince, apple, asparagus, black tea, citrus fruits, grapes, cherries, apricot, noni, leaves of eucalyptus, buck wheat, ginkgo biloba, raisins etc.

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

Its absorption, metabolism & excretion are yet not known & are in research.

**Basic clinical pharmacology of rutin: -**

It reduces high blood pressure, bleeding, bleeding piles, it strengthens the blood vessels, it reduces risk of cancers due to its anti oxidant & anti free radicals activity, reduces bruise, inflammation, protects heart, brain etc; it is chelator of metal ions.

- **Phytosterol: -**

It is plant sterol & stanol esters; it is a group of naturally occurring compound found in plant cell membranes. It is structurally similar to our body's cholesterol & it competes with cholesterol during digestion & blocks absorption of it thus reduces blood cholesterol & is good for heart.

**Main sources of phytosterol: -**

Vegetable oil, seeds, nuts, grapes, cereals, nuts, legumes etc.

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

It is absorbed only in trace amount only; it inhibits the absorption of intestinal cholesterol & biliary cholesterol.

**Basic clinical pharmacology of phytosterol: -**

It reduces cholesterol, risk of coronary heart disease, cancer cells growth, prevent diseases, maintain prostate gland health, it is anti inflammatory, maintain health of nails, hair etc.

- **Phenolic compounds: -**

Phenolic compounds includes simple phenols, phenolic acid, hydroxycinnamic acid derivatives & flavonoids, tannins, etc all are bioactive substances present in plants.

**Main sources of it: -**

Apples, tea, coffee, berries, mango, citrus fruits, plums, cherries, kiwi, onion, flour of whole wheat, rice, corn, oats etc.

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

They are absorbed extensively & modified in the body & excreted in urine (but it is in research & the complete metabolism will be known after the research). Its storage in the human body is not known.

**Basic clinical pharmacology of phenolic constituents: -**

They are powerful anti-oxidant (prevent cancer and deadly disease) by acting as a free radicals scavengers & radical chain breaker. It prevents heart disease (reduces cholesterol & LDL & prevent hardening of heart arteries-atherosclerosis), metabolic disease, diabetes, cancers of many types (it acts on anti-oncogenic pathway thus the growth of tumour cells & cancer cells is inhibited), they protect the brain damage; they are anti-microbial specially bacteria of lungs & intestines. They are also metal chelator (metal stabilizer & make metal soluble).

- **Glycosides: -**

Glycosides are organic compound present in plants & animal sources in which sugar group bounded to its carbon are bounded to another functional molecule. When it is hydrolyzed with enzymes give one or more sugar moiety & this is called as glycone. The word glycosides refer to any sugar or group of sugar (lactose, fructose, glucose etc) (please note glucose only is called as glucoside; please see the difference gly & glu).

**Main sources of glycosides: -**

It is present in many plants, fruit, vegetable & herbs & is called with different name as per present in which plant (example: - glycoside present in senna herb is called as sennosides).

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

Its absorption, metabolized & excretion are not yet known & are in research.

**Basic clinical pharmacology of glycosides: -**

It is anti oxidant, anti cancer, anti tumour, anti inflammatory, helpful to liver function, anti viral, anti bacterial, anti fungal, helpful in heart diseases, cardiac arrhythmia, heart failure, congestive heart failure.

- **Steroid saponins: -**

It is natural glycosidic compounds of amphiphilic character. It is present in fenugreek, yucca, ginseng, asparagus, yams, alliums, legumes, beans, onion, garlic etc.

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

It is poorly absorbed in intestine due to large molecular mass, high hydrogen bonding capacity, unfavourable physicochemical traits, poor membrane permeability, rapid & extensive biliary (stool) excretion many saponins are excreted in urine also.

**Basic clinical pharmacology of steroid saponin: -**

It reduces cholesterol, LDL, increases testosterone, libido & muscle mass; it maintain 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.

- **Oleanolic acid:-**

It is also called oleanic acid. It is naturally occurring pentacyclic triterpenoid recreated to betylinic acid. It is present in olive oil, marjoram, jujube, fruit peel, olive leave and olive fruit. It is anti-inflammatory, antioxidant, reduces lipids, anti-cancer, it modulates immune response.

- **Triterpenes: -**

It is a natural group of plant product (saponins); it is of two types simple & complex, simple are components of surface waxes & specialized membranes & act as signaling molecules; complex are glycosylated & provide protection to the plant against pathogen & pests.

**Main sources of Triterpenes: -**

Olive oil, olive leaves, olive fruits, rosemary, cucumber, it is present in plant surface such as stem bark, leaf, fruit waxes of many plants specially of Lamiaceae family.

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

Before absorption it is hydrolyzed by intestinal enzymes or by bacterial enzymes in large intestine and absorbed; it has low absorption rate; not much is known about its digestion.

**Basic clinical pharmacology of Triterpenes: -**

It is anti tumour, anti viral, anti bacterial, anti oxidant, anti diabetes, cardio protective, anti obesity, anti cancer, anti ulcer, anti inflammatory, immune-modulator, resolve immune diseases.

- **Stearic acid: -**

It makes up 0.5% to 5 % of extra virgin olive oil; it is saturated fatty acid. It is also known as octadecanoic acid.

**Main sources of stearic acid: -**

It is mainly present in olive oil, also present in butter, whole milk, yeast bread, egg & etc.

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

Its absorption, metabolism & excretion are under research.

**Basic clinical pharmacology of stearic acid: -**

It cleans the skin & removes dirt, sweat & excessive sebum from skin & hair. The colour of olive oil is due to pigments of stearic acid like chlorophyll, pheophytin & carotenoid that's why extra virgin olive oil has colour of its own which refined & pomace do not have.

- **Palmitoleic acid: -**

It is an omega 6 monounsaturated fatty acid; it is present in all tissues of human body & also in adipose tissues & in liver in high concentration.

**Main sources of palmitoleic acid: -**

It is mainly present in pumpkin seed oil, breast milk, vegetable oil, marine oil, macadamia oil, salmon oil, grape seed oil.

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

Its absorption, metabolism & excretion are under research.

**Basic clinical pharmacology of palmitoleic acid: -**

It is anti thrombotic thus helpful in stroke, it is anti inflammatory, reduces cholesterol & other lipids, high blood glucose, prevents cardio vascular disease, obesity and improves 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 anti aging, anti oxidant, anti bacterial, 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.

- **Sapogenin: -**

It is lipophilic saponin which protect the plant from bacterial, fungal & other infecting. It is bitter in taste.

### **Main sources of sapogenin: -**

Fenugreek seed, desert date, quinoa seeds.

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

Its absorption, metabolism & excretion are yet not known & are under research.

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

It reduces LDL, cholesterol, reduces bile salt reabsorption in colon.

- **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.

- **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, grapes seed oil, onion, potato, lemon grass etc.

- **Tetracosanoic acid: -**

*Tetracosanoic acid* is a C24 straight-chain saturated fatty acid. It has a role as a volatile oil component, a plant metabolite, a human metabolite and a *Daphnia tenebrosa* metabolite. It is a very long-chain fatty acid and a straight-chain saturated fatty acid. It is a conjugate acid of a tetracosanoate. It is called as Lignoceric acid; it is anti-ageing.

- **Maslinic acid: -**

Maslinic acid is a compound derived from dry olive-pomace oil (an olive skin wax) which is a byproduct of olive oil extraction. It is a member of the group of triterpenes known as oleananes. It is helpful in HIV, cancers, skin complexion.

- **Daucosterol: -**

Daucosterol is a steroid saponin that is sitosterol attached to a beta-D-glucopyranosyl residue at position 3 via a glycosidic linkage. It has been isolated from *Panax japonicus* var. major and *Breynia fruticosa*. It has a role as a plant metabolite. It is a strong anticancer.

- **Heptacosane: -**

*Heptacosane* is a straight-chain alkane with 27 carbon atoms. It has a role as a volatile oil component and a plant metabolite. It is a strong anticancer, anti-clots in arteries.

- **Heptadecanoic acid: -**

*Heptadecanoic acid*, or *margaric acid*, is a saturated fatty acid. Its molecular formula is  $\text{CH}_3(\text{CH}_2)_{15}\text{CO}_2\text{H}$ . Classified as an odd-chain fatty acid, it occurs as a trace component of the fat and milk-fat of ruminants,

but it does not occur in any natural animal or vegetable fat at high concentrations. It is good for heart health.

- **Hydroxyursolic acid: -**

*Hydroxyursolic acid* is a pentacyclic triterpenoid that is ursolic acid substituted by an additional hydroxy group at position 23. It protects against atherosclerosis (block in arteries) obesity & reduces lipids.

- **Jujubogenin: -**

*Jujubogenin* (uncountable) is a saponin extracted from the seeds of *Ziziphus jujube*; it is antifungal. It is under research.

- **Jujuboside B: -**

*Jujuboside B* (JuB) is a saponin isolated from *Semen Ziziphus spinosa* (SZS) used in Traditional Chinese Medicine. It is anti-tumour.

- **Alphitolic acid: -**

*Alphitolic acid* is a potent Hh/GLI signaling inhibitor, it shows an important relationship between Hh/GLI signaling inhibitions; it is best to heal oral cancers & other types of cancers & it is anti-inflammatory.

- **Pomolic acid: -**

Pomolic acid is a potent inhibitor of the aggregation of human platelets; it has anti-cancer, anti-inflammatory and apoptotic activities. It is also called as Benthamic acid.

- **Pomonic acid: -**

Pomonic acid, also known as pomonate, belongs to the class of organic compounds known as triterpenoids. These are terpene molecules containing six isoprene units. It has many health benefits but is under research.

- **Betulinic acid: -**

*Betulinic acid* is a naturally occurring pentacyclic triterpenoid which has antiretroviral, antimalarial, and anti-inflammatory properties, as well as a more recently discovered potential as an anticancer agent, by inhibition of topoisomerase.

- **Traumatic acid: -**

Traumatic acid is a potent wound healing agent in plants ("wound hormone") that stimulates cell division near a trauma site to form a protective callus and to heal the damaged tissue. It may also act as a growth hormone, especially in inferior plants (e.g. algae).

- **Magnoflorine: -**

*Magnoflorine* is an aporphine alkaloid that is (S)-corytuberine in which the nitrogen has been quaternised by an additional methyl group. It has a role as a plant metabolite. It is antioxidant, cardio-protective and immune system regulator.

- **Swertisin: -**

*Swertisin* is a flavone C-glycoside that is 7-O-methylapigenin in which the hydrogen at position 6; it is helpful in diabetes & pancreatic diseases.

- **Pyridine: -**

Pyridine is a basic heterocyclic organic compound; it is used to dissolve other substances. It is also used to make many different products such as medicines, vitamins, food flavorings etc.

- **Glacial acetic acid**

Acetic acid that contains a very low amount of water (less than 1%) is called anhydrous (water-free) acetic acid or glacial acetic acid. The main use of glacial acetic acid in cooking is in form of vinegar. It is generally used in cooking, making salads, and pickling and canning. Marinating meat in dilute acetic acid kills bacteria and tenderises the meat.

- **Ceanothic acid: -**

It is also called as alpha-Camphorene, also known as  $\alpha$ -camphorene or dimyrcene, belongs to the class of organic compounds known as sesquiterpenoids. It is under research.

- **Spinosin**:-

*Spinosin* is a flavone C-glycoside that is flavone substituted by hydroxy groups at positions 5 and 4; it has neuro-protective, anxiolytic and anti-inflammatory effects, improves memory.

- **Tetradecene**:-

*Tetradecene* belongs to the class of organic; it is an un-branched fourteen-carbon alkene with one double bond between C-1 and C-2. It is under research.

- **Butylhydroxytoluene (natural)**:-

BHT (butylatedhydroxytoluene) also prevents oxidative rancidity of fats. It is used to preserve food odor, color, and flavor.

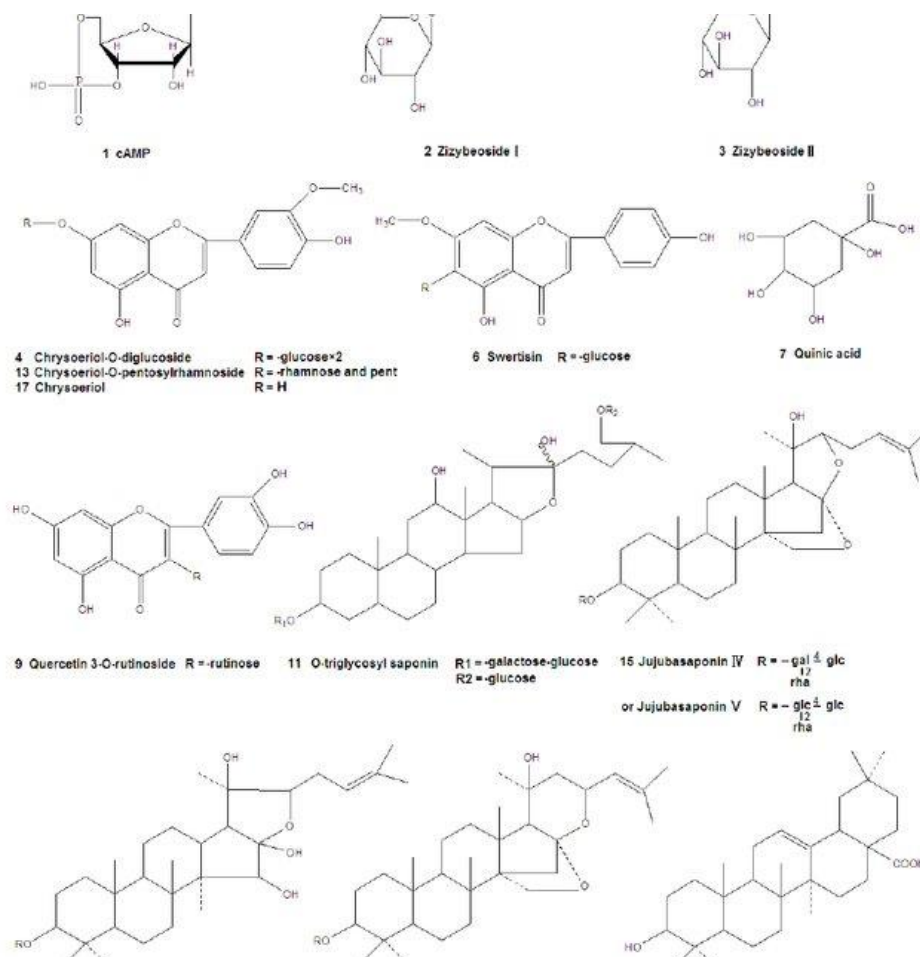
- **Hexadecanol**:-

Hexadecanol is a synergistic component of the honeybee retinue response signal of worker honey bee; it is under research.

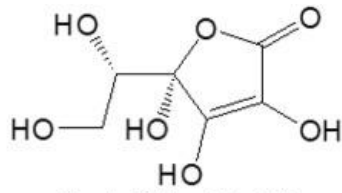
- **Betulin**:-

*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.

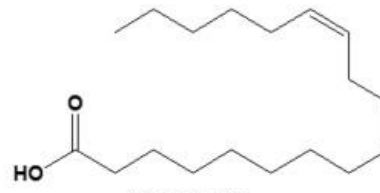
- **Main chemical structures of jujube**:-



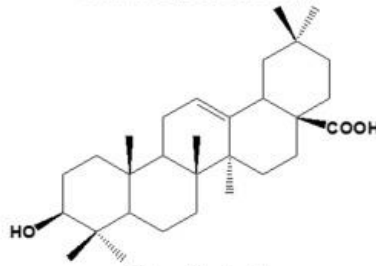




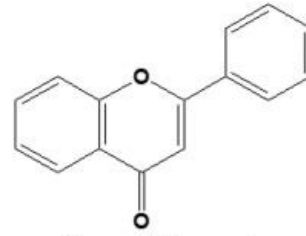
Vitamin C (Ascorbic Acid)



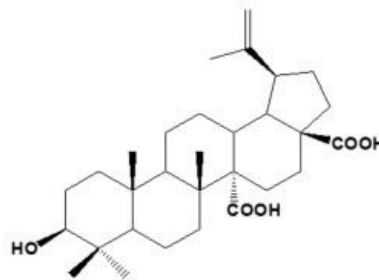
Linoleic Acid



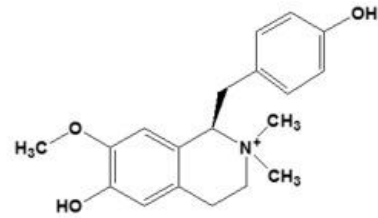
Oleanolic Acid



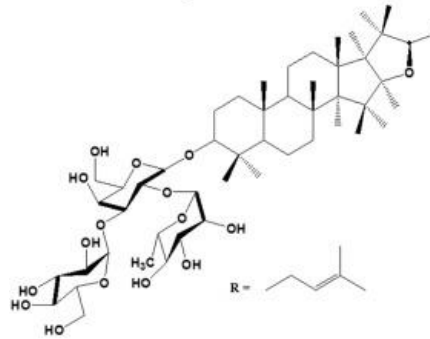
Flavonoid Compound



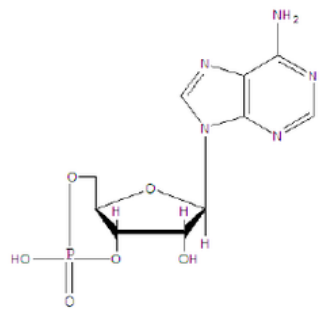
Triterpenoic Acid



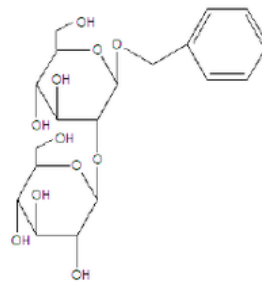
Lotusine



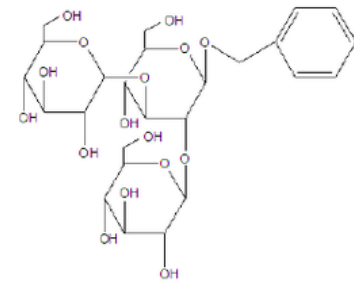
Jujuboside (Lotoside)



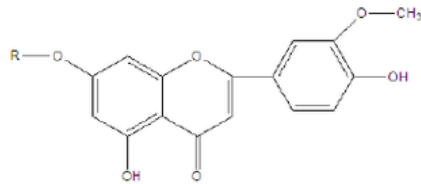
1 cAMP



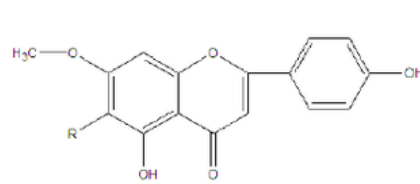
2 Zizybeoside I



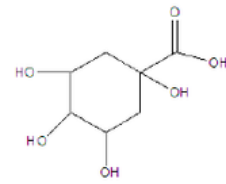
3 Zizybeoside II



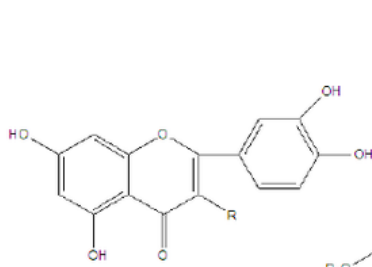
4 Chrysoeriol-O-diglucoside R = -glucose×2  
13 Chrysoeriol-O-pentosylrhamnoside R = -rhamnose and pent  
17 Chrysoeriol R = H



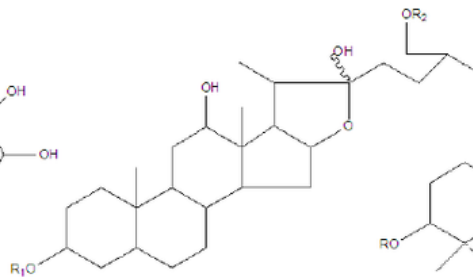
6 Swertisin R = -glucose



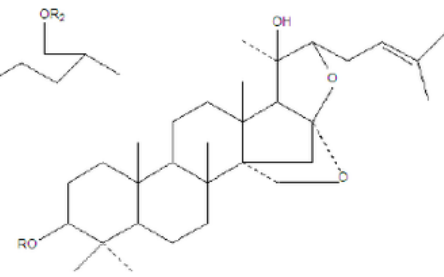
7 Quinic acid



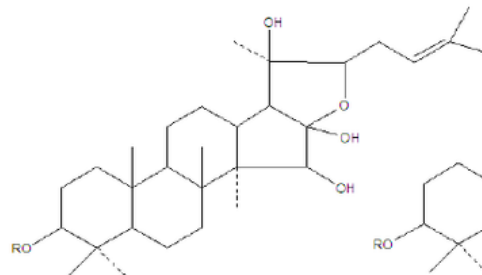
9 Quercetin 3-O-rutinoside R = -rutinose



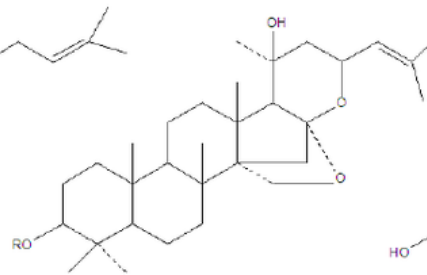
11 O-triglycosyl saponin R1 = -galactose-glucose  
R2 = -glucose



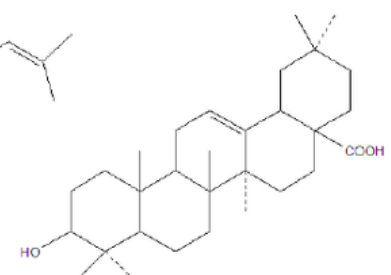
15 Jujubasaponin IV R = -gal<sup>4</sup><sub>12</sub> rha  
or Jujubasaponin V R = -glc<sup>4</sup><sub>12</sub> rha



16 Lotoside I R = -rha<sup>2</sup><sub>13</sub> glc gal  
or Lotoside II R = -rha<sup>2</sup><sub>13</sub> glc



18 Zizyphus saponin I R = -ara<sup>3</sup><sub>12</sub> glc 6-deoxy-talose  
or Zizyphus saponin II R = -ara<sup>3</sup><sub>12</sub> rha



22 Oleic acid

21 Jujuboside B R = -ara<sup>3</sup><sub>12</sub> glc<sup>2</sup> xyl rha

100 gram of fresh ziziphus jujube have following:

Energy	331 kJ (79 kcal)
Carbohydrates	20.23 g
Fat	0.2 g
Protein	1.2 g

Vitamins	Quantity%DV <sup>†</sup>
Vitamin A equiv.	5% 40 µg
Thiamine (B1)	2% 0.02 mg
Riboflavin (B2)	3% 0.04 mg
Niacin (B3)	6% 0.9 mg
Vitamin B6	6% 0.081 mg
Vitamin C	83% 69 mg
Minerals	Quantity % DV <sup>†</sup>
Calcium	2% 21 mg
Iron	4% 0.48 mg
Magnesium	3% 10 mg
Manganese	4% 0.084 mg
Phosphorus	3% 23 mg
Potassium	5% 250 mg
Sodium	0% 3 mg
Zinc	1% 0.05 mg
Other constituents	Quantity
Water	77.86 g

Ziziphus spina-christi	FRUIT	SEED	LEAF
Carbohydrates %	63.8	21.8	25.8
Protein %	3.1	29.6	6.8
Fat %	2.2	3.9	3.3
Calcium mg/100g	177	154	1270
Iron mg/100g	0.6	4.4	7.2
Phosphorus mg/100g	135	1090	85.4
Sulphur mg/100g	94.5	1180	195
Potassium mg/100g	1910	1130	673
Magnesium mg/100g	56.3	301	169
Zinc mg/100g	0.8	9.2	1.5
Copper mg/100g	0.6	1.6	0.3
Manganese mg/100g	0.4	3.5	3.5
Sodium mg/100g	9	14.1	22

100 grams of fresh ziziphus mauritiana have following:	
Energy	244.76 kJ (58.50 kcal)
Carbohydrates	17 g
Sugars	5.4-10.5 g
Dietary fiber	0.60 g
Fat	0.07 g

Protein	0.8 g
Vitamins	Quantity % DV <sup>†</sup>
Thiamine (B1)	2% 0.022 mg
Riboflavin (B2)	2% 0.029 mg
Niacin (B3)	5% 0.78 mg
Minerals	Quantity % DV <sup>†</sup>
Calcium	3% 25.6 mg
Iron	8% 1.1 mg
Phosphorus	4% 26.8 mg
Other constituents	Quantity
Water	81.6-83.0 g

- **Research: -**

According to historical usage in China, one of the main functions of jujube was considered to benefit our brain by calming down the mind and improving quality of sleep. In modern science, benefiting our brain is usually related to neuro beneficial effects, for example, neuro protection effect and neuro-trophic action. In neurological disorders, for example, neurodegenerative diseases, insomnia, and depression, several common pathological conditions among them are found, that is, neurogenesis impairment, neuro-trophic factor deficiency, and oxidative stress. Hence, the traditional function of jujube in benefiting the brain may be closely related to its neuro beneficial effects. The *neuro-protection effects of jujube*. Jujube induces neurite outgrowth and neuro-trophic factor expression via cAMP-dependent PKA signaling. Jujube possessed neuro-protection against oxidative stress via enhancing cellular Nrf2-dependent ARE-driven gene expressions. Jujube improves the choline acetyltransferase (ChAT) activity and shows inhibitory activity against acetylcholinesterase (AChE). Jujube increases the level of acetylcholine (ACh) in the brain. Jujube stimulates the transcriptional expression of GABA receptor subunits in rat hippocampal neurons.

In the process of neuro-degeneration, the functions of neuron are markedly decreased. In Parkinson and Alzheimer diseases, oxidative stress, as the main considerable factor, is believed to cause neuronal damage in progress of diseases. In cultured cells, jujube water extract was reported to protect neuronal cells against *tert*-butyl hydroperoxide- (tBHP-) induced oxidative injury. In addition, it was found that jujube water extract could inhibit tBHP-induced ROS (reactive oxygen species) formation in cultured PC12 cells. The Nrf2 (nuclear factor (erythroid-derived 2-) like 2-) dependent ARE (antioxidant response element-) driven genes, including glutamate-cysteine ligase (GCL), glutathione S-transferase (GST), and NAD(P)H quinoneoxidoreductase (NQO1), have been demonstrated to play an important role in protecting cells against oxidative stress. Jujube water extracts stimulated the ARE-mediated transcriptional activity, indicating the activation of Nrf2 pathway. Besides, the application of jujube induced the amounts of NQO1, GCLC (catalytic subunit of GCL), GCLM (modifier subunit of GCL), and GST mRNA levels in cultured astrocytes. Jujube was also revealed to protect ischemic damage in gerbil hippocampus via its antioxidant effect, that is, the upregulation of superoxide dismutase (SOD) 1 and reduction of lipid peroxidation.

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- ***Conclusion of research:-***

Jujube is both a delicious fruit and an effective herbal remedy. It aids weight gain, improves muscular strength and increases stamina. In Chinese medicine it is prescribed as a tonic to strengthen liver function. Japanese research has shown that jujube increases immune-system resistance. In one clinical trial in China 12 patients with liver complaints were given jujube, peanuts and brown sugar nightly. In four weeks their liver function had improved. It is antidote, diuretic, emollient & expectorant. The dried fruits contain saponins, triterpenoids and alkaloids. They are anodyne, anticancer, pectoral, refrigerant, sedative, stomachic, styptic and tonic. They are considered to purify the blood and aid digestion. They are used internally in the treatment of a range of conditions including chronic fatigue, loss of appetite, diarrhoea, pharyngitis, bronchitis, anaemia, irritability and hysteria. The seed contains a number of medically active compounds including saponins, triterpenes, flavonoids and alkaloids. It is hypnotic, narcotic, sedative, stomachic and tonic. It is used internally in the treatment of palpitations, insomnia, nervous exhaustion, night sweats and excessive perspiration. The root is used in the treatment of dyspepsia. A decoction of the root has been used in the treatment of fevers. The root is made into a powder and applied to old wounds and ulcers. The leaves are astringent and febrifuge. They are said to promote the growth of hair. They are used to form a plaster in the treatment of strangury. The plant is a folk remedy for anaemia, hypertonia, nephritis and nervous diseases. The plant is widely used in China as a treatment for burns.