Lesson no. 24 Cress.

Cress in a worldwide famous herb, grown & eaten all over the world, it is famous for its health benefits; it can be eaten raw as salad, cooked & eaten, its seeds are cooked & eaten, seeds are also used for fumigation, its oil is also very famous & full of health benefits; it is of many types but mainly of 3 types 1) garden cress 2) upland cress 3) water cress; we will learn all three types; it is mentioned in Hadith that cress is bitter but has healing properties also in Hadith it is advised to fumigate our homes with it along with loban (benzoin) & mur (thyme). For more detail Islamic study of it please read my English book Tibb e Nabawi part 2 page 108 onwards lesson no. 44; or visit my website www.tib-e-enabi-for-you.com or direct link to lesson cress http://www.tib-e-nabi-for-you.com/cress.html

- ***NAMES: -***

1. Latin name of garden cress is Lepidium sativum.
2. Latin names of watercress is Nasturtium officinale
3. Latin name of upland cress is Barbareaverna.
4. English name is Cress.
5. Arabic name is Al-Rashad (Hubbur Rashad).
6. Hadees name for its seeds is As-Safa (الثفاء) & its plant is called as Hurf.
7. In Syria it is called as Al-Baqdosnis Al-Haad.
8. Hindi and Urdu name is chandrashoor, kachri Methi.
9. Its seeds are called in Hindi & Urdu as Halim, Chandrashoor etc.
10. Garden cress belongs to Cruciferae family; upland cress belongs to Brassicaceae family; water cress belongs to Brassicaceae family.

It is mentioned in following book of Hadith & tib e nabi, Baihaqi: 5678 & 5679 & Al-Tibb Al-Nabawi (Al-Jawzi); page no. 640.

- ***Basic encyclopedia of it: -***
- ***Garden Cress: -***

Garden cress in Latin is called as Lepidium sativum & belongs to Cruciferae family; it is widely grown in India, Europe, USA & many part of the world; it is famous since Vedic era for its health benefit & medicinal properties; its seed oil & powder contain lot of proteins, fat, minerals, fibers & phyto-chemicals;

- ***Garden cress plant: -***



Garden cress plant is ac fast growing annual herb cultivated all over the world for its health benefits, its seed also for oil prepared from its oil; In India locally it is called as Chandrasur; the plant is an erect, glabrous, annual, herbaceous; it grows up to the height of 15 to 45 cm. It can be sown & harvested several times throughout the year; although January, February & November are most suitable months of the year to sow in a Mediterranean climate; the whole plant is edible. It has peppery and tangy flavor and aroma. Edible shoots can typically be harvested already in one to two weeks after planting. In addition to being eaten as sprouts, Garden cress is added to soups, sandwiches and salads for its tangy flavor. Cress will grow best in a well-draining loam soil with a pH between 6.0 and 6.7. The plants should be grown in full sun or partial shade in areas where temperatures get very high. If left undisturbed, the plant can grow to a height of two feet with minimal maintenance. When mature, garden cress produces white or light-pink flowers, and small seed pods. Plants cut back to ½ inch will quickly regrow. Cress is most tender at the early seed-leaf stage; harvest cress well before it matures. Sprouts can also be used fresh. It is also called as pepper-grass.

- ***Flower & seed pod of garden cress: -***

Its flowers are small white or pink; long racemes; the seeds pods are broad, obovate, elliptic, emarginated, notched at apex & winged. Size of flowers is 2mm & is in clusters.

- ***Seeds of garden cress: -***

Its seed possesses several health benefits like anti-anaemic, antioxidant, galactogogues; Garden cress seeds are used for treating patients suffering from iron deficiency called anaemia. Regular consumption of these seeds helps to boost haemoglobin levels. In India locally called as Halim seeds are characterized by peppery, aromatic and tangy flavor. They can be eaten raw in salads and sandwiches or used as herbs for food seasoning. Garden cress seeds can be eaten to reduce the symptoms of constipation and indigestion. Garden cress seeds can be chewed, blended or even mixed with honey, which is taken as an expectorant for treating cold, headache, asthma, sore throat and cough.

- ***Benefits of garden cress: -***

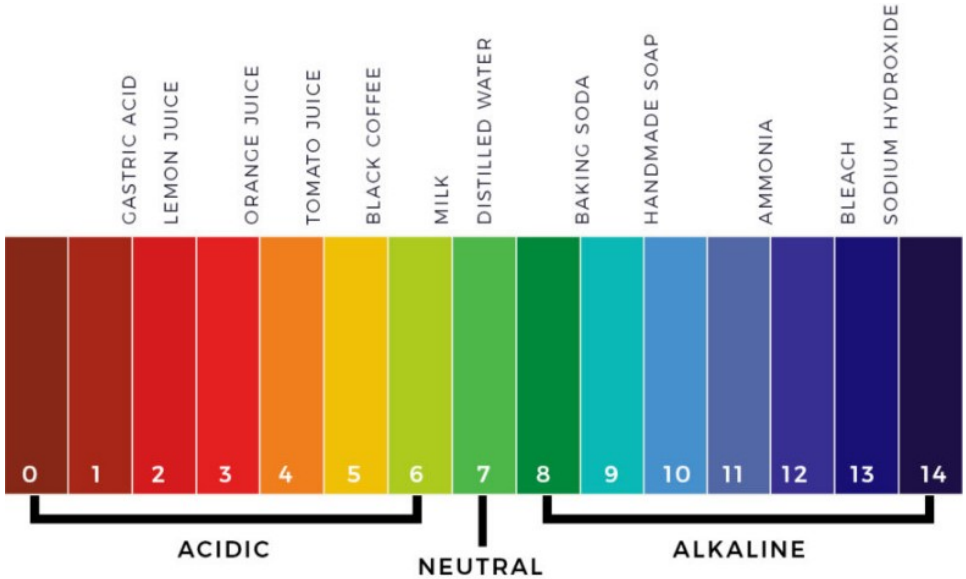
It is rich in protein (amino acids), minerals, vitamins & many phyto-nutrients which have a lot of benefits like relief constipation, gives energy & strength, good for brain & nerves, insomnia, increases milk in lactating mothers, good for menstrual problems, it is antioxidant, anti-inflammatory, anti-cancer, anti viral, anti bacterial, anti-fungal; very helpful in digestive disorders, diarrhea, dysentery, anemia, helpful in hyperthyroidism, bones weakness, fractures, diabetes etc & much more benefits of its contents are explained separately below.

- ***Benefits of garden cress seeds: -***

Garden cress seeds are considered as a memory booster due to the presence of arachidic and linoleic acids. They help to increase the lean body mass because they are a good source of iron and protein. The absorbility of iron increases when GCS is soaked in lime water, which helps in strengthening of hair. It is best in anemia, digestive disorders, bones, menstrual disorders, antioxidant, anti-inflammatory etc.

- ***pH of it is: -***

Its pH is not known but it contains amino acids, carbohydrates, little fats so it is likely to be little acidic.
pH is a measure of hydrogen ion concentration, a measure of the acidity or alkalinity of a solution. The pH scale usually ranges from 0 to 14. Aqueous solutions at 25°C with a pH less than 7 are acidic, while those with a pH greater than 7 are basic or alkaline& 7 is neutral; only aqueous solutions have pH levels, vegetable oil has no pH value. Likewise, other oils such as animal and petrochemical oils also have no pH value. Fatty acids are organic molecules often found in foods, including vegetable oils.
The pH of pure water is 7. In general, water with a pH lower than 7 is considered acidic, and with a pH greater than 7 is considered alkaline. The normal range for pH in surface water systems is 6.5 to 8.5, and the pH range for groundwater systems is between 6 and 8.5. We can add normal water to reduce the acidity.
It is Sunnat of Prophet Muhammad (s.a.w) to mix acidic with Alkaline to make it neutral or less acidic that why He use eat dates with watermelon or cucumber or dry dates with little butter; so you can mix one acidic with alkaline; also it is Sunnat to drink honey mixed in water; also dates or raisins soaked in water over night & drink the syrup (sharbat). Remember do not soak dates & raisin together at one time; soak at separate time & drink.



- ***Calories of it: -***

Fresh raw 100 grams of garden cress gives 32 calories & cooked gives 23 calories & seeds give 30 calories.

- ***Glycemic index & Glycemic load of it: -***

Glycemic load of raw 100 grams is only 3 & glycemic index is also very low & it is good for diabetic patients.

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

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

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

- ***Watercress: -***

Watercress is also called as yellow cress; it is an aquatic plant; its botanical name is Nasturtium officinale & family is Brassicaceae.

- ***Watercress plant, stem & flower: -*** all are edible




Watercress is a rapidly growing, aquatic or semi-aquatic, perennial plant native to Europe and Asia, and one of the oldest known leaf vegetables consumed by humans; watercress and its relative like garden cress, mustard, radish, and wasabi are all noteworthy for their piquant flavors. The hollow stems of watercress will float; the leaf structure is pinnately compound. Small, white and green flowers are produced in clusters and are frequently visited by insects, especially hoverflies such as *Eristalis* flies. In some regions, watercress is regarded as a weed, in other regions as an aquatic vegetable or herb. Watercress has been grown in many locations around the world. Cultivation of watercress is practical on both a large-scale and a garden-scale. Being semi-aquatic, watercress is well-suited to hydroponic cultivation, thriving best in water that is slightly alkaline. It is frequently produced around the headwaters of chalk streams.




Watercress prefers a position in light shade, but will grow well in a sunny position, providing the soil or compost is wet. It needs to be kept moist all year round, so grows well in damp or wet soil or a container that sits in a deep saucer filled with water. It has floating stems and are best grow in clean slow flowing water but can also be grown in the garden as long as soil is kept wet. It has hot mustard flavour. It can be cooked but most commonly used fresh in salads and as a garnish & also has medicinal uses. Its seeds are an excellent source of folic acid, vitamin C, A & E, dietary fiber, iron, calcium, protein, and folate. The seeds of garden cress are nutritive and contain various healthy compounds. The edible whole seeds are known to have health promoting properties; hence, it was assumed that these seeds

can serve as raw materials for functional foods contributing its peppery, tangy flavor, and aroma. Its seeds are also called as Halim in India & other countries.

- ***Calories of it: -***100 gram of water cress gives 12 calories & seed may give 20 calories.
- ***Glycemic index & Glycemic load: -*** is zero because it contains little protein, little carbs & no fats so it is safe for diabetic patients.
- ***Benefits of watercress & its seeds: -***

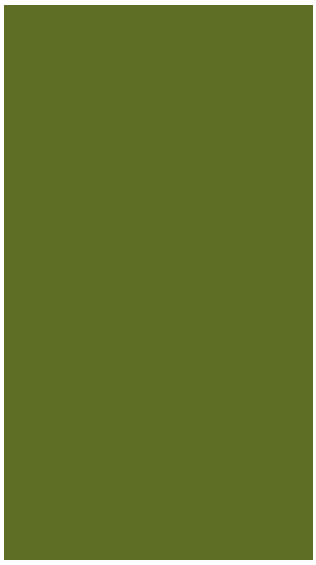
Both are best for bone, heart, liver, lungs health & are antioxidant, anti-inflammatory, anticancer, best hair, skin health, helpful to maintain blood pressure, both are anti breast cancer, good in anemia, weakness, during recovery period or infections; increases energy level & much more benefits of its contents are explained separately below.

- ***Upland cress: -***




Its Latin name is Barbareaverna; it is also called as land cress; it is of many types; it also has a lot of health benefits & harvested in many countries for its medicinal benefits. Upland Cress is also called Winter Cress, or Creasy Greens in the South. It is from Brassicaceae family.

- ***Upland cress plant, stem & flower: -***



It is an easy rapidly growing annual plant; easy to cut-and-grow again; the plant grows to about 4-6" tall with mildly peppery leaves. Leaves, shoots, and flower buds are all delicious. The upland cress belongs to the family Crucifer and genus Barbarea. The flower stalk of this herb grows up to 30 cm to 90 cm (about 12 inches to 36 inches) in height; the leaves are delicate leaves resembling the curled parsley, the foliage is not as dense, but slighter. In addition, there is another variety of upland cress whose leaves are not very lacy, but are wider; taste is similar to water cress & garden cress; the leaves can be harvested once the plant is about 4 inches high, simply pluck the leaves from the plant, leaving the stem and roots intact to form more leaves. Cutting the plant encourages additional growth.

- ***Calories of it: -*** 100 gram of upland cress gives 40 calories & seed may give 30 calories.
- ***Glycemic index & Glycemic load: -*** is zero because it contains little protein, little carbs & no fats so it is safe for diabetic patients.

- ***Benefits of upland cress & seeds: -***

Both are good sources of energy, good in recovery period or during infection, boost the immune system, both are antioxidant, anti-inflammatory, antiviral, antifungal, anticancer, good for hair, heart, liver, digestion; beneficial in diseases condition of skin, heart, liver, stomach etc.

- ***Clinical pharmacology of garden cress: -***

A number of clinical trials have been conducted on rats that also support the efficacy of garden cress seeds (GCSs). The seed of garden cress was used in the fortification of different food items but due to the lack of their physicochemical properties and medicinal value, the exploration of the potential of garden cress seed was limited. In the present review, we discuss the proximate chemical composition, physicochemical, medicinal properties, and the food product development with garden cress seed. The functional properties of garden cress seed stimulate us to review its different valuable properties and the fortified products developed by incorporating garden cress seeds. Although, fruit and vegetable juices are rich sources of vitamin and minerals, but these are limited in protein and fat content. For the compensation of these components, garden cress extract or powder can be added. As garden cress also acts as thickening agent, the combination of both juices and extract may lead to the formation of health promoting beverages having good textural, sensory attributes, and nutritional properties. Proximate composition (%) of *L. sativum* seeds reported by Zia-Ul-Haq et al. indicates the presence of appreciable amounts of protein (24.2 ± 0.5), lipids (23.2 ± 0.2), carbohydrates (30.7 ± 1.2), fiber (11.9 ± 0.4), ash (7.1 ± 0.1), and moisture (2.9 ± 0.1). Proximate composition varies depending upon plant variety, agronomic practices, and stage of collection of seeds and climatic and geological condition of area from where seeds are collected. The low moisture content is an index of stability, quality, and increased shelf life of seeds. Higher protein and lipid contents indicate that GCS have high food energy. All essential amino acids are present in high amounts in garden cress, except tryptophan and S-containing amino acids, methionine and cysteine. Glutamic acid and aspartic acid are the major nonessential amino acids in the GCS. The total essential amino acid percentage (47.08%) suggests that this seed may contribute significantly to the supply of essential amino acids in the diet. Essential amino acid score is 28.53% with methionine being the most limiting amino acid. Aspartic and glutamic acids are present in significant amount in this oilseed. Glutamic acid is an important excitatory neurotransmitter, and it plays a vital role in the metabolism of sugars and fats. The body uses methionine to derive the brain food and choline. It also aids in digestion, as well as serving as a fat burner. It can interact with other substances to detoxify harmful agents and is essential for the production of cysteine and taurine. It is also necessary for the production of niacin and is used by the body to make neurotransmitter and serotonin. These play a very important role in human nutrition. Lysine helps in proper maintenance of nitrogen balance. L-Tryptophan acts as a sleep aid. The presence of tryptophan and cystine in GCS is also reported

- ***Clinical pharmacology of water cress: -***

Watercress, along with beetroot and other leafy greens, contains a very high level of dietary nitrate, which increases nitric oxide and can have positive effects on health. A 2019 study on rats showed that a high intake of dietary nitrate could lower blood pressure. A study of the effects of a high dose of dietary nitrates on humans demonstrated that it may reduce the amount of oxygen a person needs during exercise and enhance athletic performance. Water cress is a mineral-rich, green leafy vegetable. It is a cruciferous plant that is native to Europe and Asia. This nutritious vegetable falls under the Brassicaceae family. Its health benefits are obtained from the high content of vitamins, minerals, and antioxidants. The phyto-nutrients are where the health benefits of watercress are contained. According to the USDA, watercress contains vitamin A, vitamin B6, vitamin B12, iron, magnesium, calcium, and phosphorus. It is low in calories and so makes for a great addition to many weight-loss diets. Cruciferous vegetables like watercress are shown to be beneficial in lowering LDL or bad cholesterol. Studies show that the including of calcium-rich food such as watercress works in reducing the risk of osteoporosis. Including different vegetables in your diet can help you take your health to a great level. Foods like watercress have a considerable amount of carotenoids. These compounds can prevent the occurrence of chronic conditions like stroke as they have antioxidant and anti-inflammatory properties.

- ***Clinical pharmacology of upland cress: -***

Upland cress is a very healthy plant to eat. It has twice the vitamin A as broccoli, and three times the vitamin C found in oranges. It also contains vitamins B and E, iron and calcium. Land cress has a peppery spinach kale like flavour. They can be cooked or eaten raw in salads. Like all brassicas, the yellow flowers are edible too. Land Cress

contains lots of vitamin A powerful antioxidant, B's vitamins for vitality and to prevent birth defect, vitamin C a powerful antioxidant, vitamin E for heart health, and vitamin K important for clotting. Also iron for anemia and calcium for strong bones. Land Cress is fat free, great for weight loss. It is cholesterol free, making important for cardiovascular health. It does not contain any sodium making it great for those on salt restricted diets. Land Cress is a mild diuretic helping to get rid of excess water collection in the body leading to oedema; it contains lots of lutein which is important for preventing macular degeneration. Land It has hardly any carbs making it a wonderful weight loss food etc.

- ***Modern uses of cress: -***

Take any type of cress easy available in your area & use them in your food as salad, sandwich, cooked with gravy, daal, rice etc as an additive; also you can eat raw in little quantity once or twice week.
You can take some dried leaves & seeds of it & fumigate for house with it along with other fumigating substances.
You can soak the whole plant & seeds in some water over night & drink the water early morning empty stomach once or twice a week.

- ***Contents/constituents of garden cress: -***

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.
A good quality of garden cress contains little amount of amino acids mentioned in table below: -
The above ingredients are based on scientific study, means these has been identified, known & learnt by modern science, it does not means that it contains only these ingredients, there may be many more ingredients which are yet to be discovered, learnt & known by modern science.
The details given below are based on natural ingredients found in garden cress.
Active compounds of all 3 types of cress are amino acids, minerals & fatty acids.

100 grams of garden cress contains following amino acids:

Essential amino acids	
Histidine	3.87 ± 0.14
Threonine	2.66 ± 0.09
Arginine	4.51 ± 0.03
Valine	8.04 ± 0.03
Methionine	0.97 ± 0.02
Phenyl alanine	5.65 ± 0.03
Isoleucine	5.11 ± 0.03
Leucine	8.21 ± 0.01
Lysine	6.26 ± 0.39
Nonessential amino acids	
Aspartic acid	9.76 ± 0.03
Glutamic acid	19.33 ± 0.19
Serine	4.96 ± 0.09
Glycine	5.51 ± 0.07
Alanine	4.83 ± 0,02
Tyrosine	2.69 ± 0.09
Proline	5.84 ± 0.38

100 grams of garden cress contains:	
Calcium	266.35
Copper	5.73
Iron	8.31
Magnesium	339.23
Manganese	2.00
Phosphorus	608.63
Potassium	1236.51
Sodium	19. 65
Zinc	6.99
Fatty acid profile (%)	
Palmitic acid (16:0)	10.30 ± 0.12
Palmitoleic acid (16:1)	0.70 ± 0.30
Stearic acid (18:0)	1.90 ± 0.19
Oleic acid (18:1)	30.50 ± 0.16
Linoleic acid (18:2)	8.60 ± 0.38

100 grams of garden cress contains following amino acids:

Linolenic acid (18:3)	32.18 ± 0.59
Arachidic acid (20:0)	2.10 ± 0.57
Eicosaenoic acid (20:1)	13.40 ± 0.66
Vitamin C, E, A, B6, Fiber, sugar	

100 grams of water cress

Water [g]	95.11
Energy [kcal]	11
Energy [kJ]	46
Protein [g]	2.3
Total lipid (fat) [g]	0.1
Ash [g]	1.2
Carbohydrate, by difference [g]	1.29
Fiber, total dietary [g]	0.5
Sugars, total including NLEA [g]	0.2
Calcium, Ca [mg]	120
Iron, Fe [mg]	0.2
Magnesium, Mg [mg]	21
Phosphorus, P [mg]	60
Potassium, K [mg]	330
Sodium, Na [mg]	41
Zinc, Zn [mg]	0.11
Copper, Cu [mg]	0.08
Manganese, Mn [mg]	0.24
Selenium, Se [µg]	0.9
Vitamin C, total ascorbic acid [mg]	43
Thiamin [mg]	0.09
Riboflavin [mg]	0.12
Niacin [mg]	0.2
Pantothenic acid [mg]	0.31
Vitamin B-6 [mg]	0.13
Folate, total [µg]	9
Folate, food [µg]	9
Folate, DFE [µg]	9
Choline, total [mg]	9
Vitamin A, RAE [µg]	160
Carotene, beta [µg]	1914
Vitamin A, IU [IU]	3191
Lutein + zeaxanthin [µg]	5767
Vitamin E (alpha-tocopherol) [mg]	1
Vitamin K (phylloquinone) [µg]	250
Fatty acids, total saturated [g]	0.03
16:0 [g]	0.02

100 grams of water cress	
18:0 [g]	0
Fatty acids, total monounsaturated [g]	0.01
16:1 [g]	0
18:1 [g]	0.01
Fatty acids, total polyunsaturated [g]	0.04
18:2 [g]	0.01
18:3 [g]	0.02
Tryptophan [g]	0.03
Threonine [g]	0.13
Isoleucine [g]	0.09
Leucine [g]	0.17
Lysine [g]	0.13
Methionine [g]	0.02
Cystine [g]	0.01
Phenylalanine [g]	0.11
Tyrosine [g]	0.06
Valine [g]	0.14
Arginine [g]	0.15
Histidine [g]	0.04
Alanine [g]	0.14
Aspartic acid [g]	0.19
Glutamic acid [g]	0.19
Glycine [g]	0.11
Proline [g]	0.1
Serine [g]	0.06

- ***Contents of 3 types of cress explained separately: -***
- ***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, quince, pumpkin 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, fig, quince etc.

Pumpkin has fiber & 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.

- ***Carbohydrate: -***

It is a macronutrient needed by the body, the body receives 4 calories per 1 gram of it; carbohydrates include 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 reconvert 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.

- ***Beta carotene: -***

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

Main sources of beta carotene: -

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

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

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

Basic clinical pharmacology of beta carotene: -

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

- ***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 speacially 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 K: -***

It is a fat soluble vitamin; it is essential for normal blood clotting; it occurs naturally in two forms, vitamin K1 (phylloquinone) which is widely distributed in plants; it is present in it; Leafy vegetables are good sources of K1; vitamin K2 (menaquinones) is synthesized in alimentary tract by bacteria (Escherichia coli & other bacteria).

Main sources of vitamin K1: -

It is present in olive oil & also present in green leafy vegetables (spinach, kale etc) cauliflower, cabbage, broccoli, sprout, fish, liver, meat, egg, cereals, pumpkin, grapes etc.

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

It is absorbed in small intestine; bile is required for it absorption & stored in fatty tissues & liver; it is excreted 40% to 50% in stools & 30% to 40% in urine.

Basic clinical pharmacology of vitamin K: -

It acts on synthesis of certain proteins that are prerequisites (necessary) of blood coagulation (means act on stop bleeding) & body also needs it to control the binding of calcium in bones & other tissues. Deficiency of it makes bones weaker, calcification of arteries & other tissues thus takes care of bones, joints & heart; it reduces tumour growth & is helpful in cancers.

- ***Vitamin E: -***

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

Main sources of vitamin E: -

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

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

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

Basic clinical pharmacology of vitamin E: -

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

- ***Vitamin C: -***

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

Main sources of vitamin C: -

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

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

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

Basic clinical pharmacology of vitamin C: -

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

- ***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 phosphatases 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 (speacially 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 acts 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 in 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.

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

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

Main sources of folate: -

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

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

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

Basic clinical pharmacology of folate: -

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

Its deficiency may cause anaemia, tiredness, palpitation, breathlessness, hairfall, neural tube defect in baby during pregnancy etc.

- ***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.

- ***Selenium: -***

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

Main sources of selenium: -

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

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

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

Basic clinical pharmacology of selenium: -

It is important for many body functions, immune system, fertility (both male & female); it contributes in thyroid hormone metabolism, DNA synthesis; it protects the body from oxidative damages & infection, it is found in tissues, skeletal muscles; it helps testies & seminal vesicles in their function; it reduces the risk of miscarriages,

liver disease, cancer, asthma, cardio vascular disease; deficiency of it causes pain in muscles & joints, weaken the hair, nails, white spots on nails are found etc.

- ***Copper: -***

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

Main sources of copper: -

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

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

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

Basic clinical pharmacology of copper: -

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

Deficiency of copper: -

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

- ***Iron: -***

It is an essential mineral for our body; its symbol is Fe & atomic no. 26; it is an important component of heamoglobin (heamoglobin 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+2 directly which can be transported from intestine to blood steam through Fe+2 transporter ferroportin (this binds with transferring & 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 transferring (each transferring can carry 2 atoms of iron); ceruloplasmin (protein) also helps in binding of iron; Hepcidin 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 heamoglobin. 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 (heamoglobin 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.

- ***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 process first when the phosphorus intake is high mainly after meals by paracellular sodium independent passive diffusion pathway & second is transcellular sodium dependent 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 is food sources is called as exogenous zinc. Its absorption depends on 2 proteins- Albumin & metallophinonein. 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. Metallophinonein binds to zinc to make it unavailable & excrete it in stools when zinc is

excess in the body, & production of metallophinonein 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.

- ***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.

- ***Choline: -***

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

Main sources of choline: -

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

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

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

Basic clinical pharmacology of choline: -

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

- ***Lutein & zeaxanthin: -***

Both are important carotenoids found in nature, they are related with beta carotene & vitamin A, they give plants, fruits & vegetables yellow or red colour, they are absorbed best in human when taken with high-fat meal because it needs bile for digestion. Both are colour pigment found in human eye (macula & retina) they get deposited in macula & retina thus prevents many diseases of eyes.

Main sources of both: -

They are present in carrot, broccoli, kale, spinach, grapes, pumpkin, yellow vegetable, egg yolk, green leafy vegetable, orange, kiwi, corn etc.

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

They are absorbed with the help of bile by mucosa of small intestine via passive diffusion & send to the liver via lymphatic system & in liver it is incorporated into low density & high density lipo proteins & transported to target tissues (retina etc) by specific lutein binding protein mediates the selective uptake of it. The absorption depends on the amount & sources of intake; it is 70 % absorbed; it is excreted in bile & urine & stored in liver & adipose tissues of the body.

Basic clinical pharmacology of both: -

They are powerful anti oxidant, anti diabetic, anti cancer. They prevent age-related macular degeneration, cataract, retinitis pigmentosa, retinopathy, macular degeneration, they work as light filter & protect the eye tissues from sunlight damages, they block blue light from reaching the underlying structure in the retina of eyes thus reduces the risk of light induce oxidative damage that could lead to age-related macular degeneration (AMD).

They also prevent free radicals thus prevents colon cancer, cervical cancer, lungs cancer, breast cancer, prostate cancer, vision loss, improves mental function, respirative infections, reduce high blood pressure, reduce soreness of muscles after exercise, reduce eye strain, controls diabetes, prevent heart diseases etc.

- ***Palmitic acid: -***

It makes up 7% to 13% of extra virgin olive oil; it is a common saturated fatty acid; it is the first fatty acid produced during lipogenesis (fatty acid synthesis) & from which longer fatty acids can be produced.

Main sources of palmitic acid: -

It is present in olive oil, flaxseed oil, soyabean oil, sunflower oil, palm oil, cocoa butter, meat, milk & etc.

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

Its absorption, metabolism & excretion are under research.

Basic clinical pharmacology of palmitic acid: -

It softens the skin & keeps it moist thus good for psoriasis & eczema. It coats the skin, it is powerful anti-oxidant; it maintains the health of hair & skin from aging, cleans them from dirt, sweat, excessive sebum (main cause of acne and boil on face & other parts of the body).

- ***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.

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.

- ***Oleic acid: -***

Its short hand notation is C18:1, it is a non-essential (means it is produce naturally in the body) monounsaturated omega 9 fatty acid, it makes up 55% to 85% or more of extra virgin olive oil, It is insoluble in water & soluble in alcohol. It increases absorption of many drugs through skin by disrupting the lipids under the skin and penetration of the drugs, so olive oil is best to be used with other applications on skin and used in cosmetic formulas. It is advised in Hadith to eat it & massage with it just notice the importance of it.

Main sources of oleic acid: -

It is present in extra virgin olive oil is the best, also present in avocado oil, camellia oil, shea nut oil, apricot oil, sweet almond oil, whole egg, nuts, argan oil etc.

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

It is believed that it is absorbed by different tissues mediated via passive diffusion to facilitate diffusion (this is under research) after taken up by the tissues it is stored in the form of natural triglycerides or oxidized, it is transported by lymphatic system; it is also believed to penetrate through skin (it is under research), its excretion is in stool. It is stored 98% in adipose tissues depots in form of triglycerides. Its metabolism & plasma half-life is yet not known.

Basic clinical pharmacology of oleic acid: -

It increases bioavailability of following medicines cortisol, hydrocortisone, betamethasone, 17 benzoate betamethasone, 17 valerate (betamethasone), ketarolac (anti inflammatory), metronidazole, progesterone & estradiol. So I advised to mixed powder of prednisolone mixed in extra virgin olive oil and apply on eczema & psoriasis and get good results in cheaper rates.

Oleic acid prevents cardio vascular disease, blood pressure, skin disease, breast cancer, colon cancer, prostate cancer, stomach cancer, diabetes, gall stones, gastrointestinal disease and pancreatic disease. It reduces cholesterol, triglycerides, LDL, inflammation, swelling etc.

- ***Linoleic acid: -***

It is a carboxylic acid, it makes up 3% to 15% of extra virgin olive oil, It is polyunsaturated with omega 3 & 6 fatty acids; its short hand notation is 18:2, it is an essential fatty acid that must be consumed for health.

Main sources of linoleic acid: -

It is present in olive oil, evening primrose oil, sunflower oil, walnut oil, hemp oil, grape seed oil, safflower oil, egg yolk, butter & etc.

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

It is first hydrolyzed from dietary fats & pancreatic enzymes & then with the help of bile it is absorbed in small intestine; metabolism & excretion are under research.

It gets converted into gamma linoleic acid (GLA) in the body, GLA is converted in the body into dihomo GLA (20 carbon chain) & it is converted into Arachidonic acid which is converted into Docosatetraenoic (long chain fatty acid with 22 carbons) acid.

Basic clinical pharmacology of linoleic acid: -

It acts on prostaglandin system of the body thus is anti-inflammatory, blood thinner, vasodilator (expand the blood vessel) it is very helpful in treatment of rheumatoid arthritis, breast lumps, fibro-adenoma (nodes in breast), cancers, reduces cholesterol, it prevents heart disease, diabetes, skin ulcers, irritable bowel syndrome etc.

- ***Linolenic acid (ALA): -***

It is an omega 3 fatty acid, it essential fatty acid necessary for health & cannot be produced in human body, it is also called as ALA (alpha linolenic acid). It is the substrate for the synthesis of longer-chain, more unsaturated fatty acids eicosapentaenoic acid (EPA) & docosahexaenoic acid (DHA) required for tissue function.

Main sources of linolenic acid (ALA): -

Flax seed oil, rape seed oil, soybean, pea leaves, fish oil, evening primrose oil, vegetable oil, walnut, meat, grape seed oil.

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

Same as omega 6

Basic clinical pharmacology of ALA: -

It is useful to prevent heart disease, control blood pressure, control cholesterol, prevents &reverse atherosclerosis, it is anti inflammatory, anti obesity, anti cancer, reduces fibroadenoma, breast lumps, good & helpful for skin, nail, hair, brain, organs.

- ***Arachidic acid: -***

It is also called as Eicosanoic acid; it is among omega 6 fatty acid; human body uses it as a starting material in synthesis of 2 kinds of essential substances (prostaglandin & leukotrienes both are unsaturated carboxylic acid).

Main sources of arachidic acid: -

It is present in meat, fish, seafood, egg, chicken, peanut oil, corn oil etc.

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

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

Basic clinical pharmacology of arachidic acid: -

It is eaten by body builders to gain muscles due to its inflammatory action in the body; it leads to increase production of eicosaniods that help raise immunity, inflammatory response in human body, it also reduces depression, increases lean muscles.

- ***Absorption & digestion of amino acid.***

When we eat high-protein foods, body breaks down protein into amino acids and peptides through digestive enzymes, such as pepsin & pancreas produces trypsin, chymotrypsin and other that aid in protein digestion.

Pepsin is the primary enzyme responsible for digesting protein; it acts on the protein molecules & breaks the bonds – called peptide bonds – that hold the protein molecules together. Next, these smaller chains of amino acids move in the stomach & then in small intestine where they're further broken down by enzymes released by the pancreas. Small intestine contains finger-like extensions called micro-villi. These structures enhance its ability to absorb dietary nutrients. Now the semi digested material pass through brush border and baso-lateral membranes of small intestine & di-tripeptides are absorbed by passive transport (facilitated or simple diffusion) or active transport (Na+ or H+ co-transporters)

pathways. Di and tripeptides are more efficiently absorbed than free amino acids which in turns are better absorbed than oligopeptides. They're released into the bloodstream and used for various biochemical reactions.

Each amino acid has a different role in the human body. Upon absorption, some amino acids are incorporated into a new protein. Some fuel your muscles and support tissue repair. Others are used as a source of energy.

Tryptophan and tyrosine, for example, promote brain health. These amino acids support the production of neurotransmitters, leading to increased alertness and optimum nerve responses. Tryptophan also assists with serotonin production, lifting your mood and keeping depression at bay.

Phenylalanine serves as a precursor to melatonin, epinephrine, dopamine and other chemicals that regulate your mood and bodily functions. Methionine helps your body absorb selenium and zinc, two minerals that promote overall health. Some amino acids, such as isoleucine, play a vital role in hemoglobin production and glucose metabolism.

- ***Tryptophan: -***

It is an amino acids (protein) that is useful in bio-synthesis of protein; it is essential in human because body cannot make it); it is a precursor of neuro-transmitter serotonin, melatonin, vitamin B3; it is a sedative also.

Main sources of tryptophan: -

Salmon oil, egg, spinach, milk, seeds, fenugreek seed, soy products, nuts, fish, meat, wheat, banana etc.

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

It is absorbed in small intestine & reached the blood circulation, it passes the blood brain barrier & in brain cells it is metabolized into indolamine neuro-transmitter, niacin, a common example of indolamine is serotonin derivative from tryptophan. Tryptophan is converted into serotonin in the brain & body; it is believed that tryptophan supplements should be taken with carbidopa, which blocks the blood brain barrier. (Serotonin (5HTP) 5 hydroxytryptamine, is a monoamine neuro-transmitter. It contributes in feelings of well-being, happiness, reward, learning, memory, many physiological functions).

In the pathway of tryptophan/serotonin, melatonin hormone is produced. Melatonin regulates sleep-wake cycle. It is primarily released by pineal gland in brain. It controls circadian (daily clock) rhythms.

Pineal gland releases it at night more & very little in day light. It improves immune system function.

Natural sources of melatonin are tomato, pomegranate, olive, grapes, broccoli, cucumber, barley, seeds, nuts etc.

Fructose malabsorption causes improper absorption of tryptophan in intestine thus leading to low level of it & may cause depression.

Basic clinical pharmacology of tryptophan: -

It is necessary for normal growth of infants; nitrogen balance in adults, it aids in sleep pattern, mood. It is necessary for melatonin & serotonin formation in body, it enhances mental & emotional well being, manages pain tolerance, weight etc. it also helps in build muscle tissue, essential for vitamin B3 production, relives insomnia, reduces anxiety, depression, migraine, OCD, helps immune system, reduces cardiac spasms, improves sleep patter etc.

- ***Threonine: -***

It is an amino acid used in biosynthesis of proteins; it is an essential amino acid important for tooth enamel, collagen, elastin, nervous system, fats metabolism, it prevents fats buildup in liver, useful in intestinal disorders, anxiety, and depression.

Main sources of threonine: -

Cheese, chicken, fish, meat, lentil, black seed, nuts, soy etc.

Basic clinical pharmacology of threonine: -

It is useful in nervous system disorders, multiple sclerosis, spinal spasticity, makes bones, joints, tendons, ligament stronger, it helps the immune system, promotes heart health.

- ***Isoleucine: -***

It is an amino acid that is used in the biosynthesis of proteins, it is an essential amino acid means the body cannot make it & we depend on food sources, it plays & helps many functions of the body.

Main sources of isoleucine: -

Meat, mutton, fish, cheese, egg, seeds, nuts, soybeans, milk, legumes, fenugreek seed etc.

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

It is absorbed in small intestine by sodium-dependent active transport. It is metabolized in liver.

Basic clinical pharmacology of isoleucine: -

It promotes glucose consumption & uptake, it is anti-catabolic, enhances athletic performance & best for pre-workout, it acts on wound healing, detox of nitrogenous waste in the body, stimulates immune system, promotes secretion of many hormones, helps in heamoglobin formation, regulating blood glucose, energy in the body, built muscles, helpful to brain for its function.

- ***Leucine: -***

It is branched chain amino acid (BCAA) it is ketogenic amino acid; it is necessary when we do exercise, it stimulates protein synthesis & assists in muscle building.

Main sources of leucine: -

Cheese, soyabean, meat, nuts, chicken, seeds, fish, seafood, beans.

Basic clinical pharmacology of leucine: -

It helps regulate blood glucose, promotes growth, recovers the muscles & bone tissues, acts on production of growth hormones, repairs the tissues, essential for muscle building, it burns fats, controls obesity, promotes lean muscles growth.

- ***Lysine: -***

It is an essential amino acid, which our body cannot prepare and we need to eat it from food sources. It necessary for many body functions, acts in building blocks of protein (muscles).

Main sources of lysine: -

Red meat, chicken, egg, fish, beans, lentils, wheat germ, nuts, soybeans, spirulina, fenugreek seed, shrimp, pumpkin seed, tuna, cheese, milk etc.

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

It is absorbed from the lumen of the small intestine into the enterocytes by active transport, it undergoes first pass metabolism in liver & is metabolized in liver.

Basic clinical pharmacology of lysine: -

It helps the body in tissue growth, repair muscles injury, promote collagen formation, help the body to produce enzymes, antibodies, hormones, supports immune system, its deficiency causes fatigue, irritability, nausea, hair loss, anorexia, inhibited growth, anemia, problems with reproductive system, it is very helpful in treating cold sores (herpes), control blood pressure, diabetes, osteoporosis, helps athletes performance, helpful in treating cancers, reduces anxiety, increase absorption of calcium, improves digestion & prevent leaky gut, helpful in pancreatitis.

- ***Methionine: -***

It is a sulfur containing amino acid; it is essential; it plays a critical role in the metabolism & health; it act on normal cell functioning, growth & repair. It is also a chelating agent for heavy metals; due to its sulfur contain it is helpful in hair, nail health & growth & good for skin health; it reduces cholesterol by increase the production of lecithin in liver & reduces fats formation in liver, also protects kidneys, liver from hepatotoxins, it is an antioxidant. It is absorbed in lumen of small intestines into enterocytes by active transport & metabolized in liver.

Main sources of methionine: -

Meat, mutton, fish, chicken, cheese, egg, beans, milk, nuts, shellfish etc.

- ***Cystine: -***

It is the oxidized dimer form of amino acid, it is nonessential; the body uses it to produce taurine & other amino acids; it is a sulfur containing amino acid; our body uses vitamin B6 with the help of cystine; it heals burns, wounds, bronchitis, assist in supply of insulin, it increases level of glutathione in liver, lungs, kidneys & bone marrow. It is anti aging, anti inflammatory, anti arthritis, anti rheumatoid arthritis.

Main sources of cystine: -

Meat, egg, milk, garlic, onion, broccoli, oats, wheat germ, lentils etc.

- ***Phenylalanine: -***

It is an aromatic essential amino acid in human; it plays a key role in biosynthesis of other amino acids; it is important in the structure & function of many proteins & enzymes. It is precursor of melanin, dopamine, noradrenalin hormone, thyroxin hormone. It is converted in tyrosine & used in biosynthesis of dopamine & noradrenalin. It improves memory, reduces pain of hunger; it is anti-depressant; it is also a building block protein; it is useful in vitiligo, depression, ADHA, parkinson's, multiple sclerosis, pain, osteoarthritis, rheumatoid arthritis, fat burn & helpful in alcohol withdrawal symptoms.

Main sources of phenylalanine: -

Pumpkin seed, nuts, seeds, soy, meat, fish, chicken, egg, beans, milk etc.

- ***Tyrosine: -***

It is a nonessential amino acid; it is also called as 4-hydroxyphenylalanine; it is useful in cell synthesis of protein; it is a building block protein; body prepares it from phenylalanine. It is a precursor & used to produce noradrenalin, dopamine, & thyroxin & melanin hormones. It reduces stress, improves memory, it promotes growth, mental health, skin health, fat burn. It acts as a mood elevator, anti-depressant, improves memory, mental alertness, its deficiency can cause hypothyroidism leading to low blood pressure, low body temperature (hypothermia), stress, fatigue, narcolepsy; it helps thyroid gland, adrenal gland, pituitary gland to function properly. It is absorbed in small intestine by sodium-dependent active transport; after absorption it reaches the blood & crosses the blood brain barrier (BBB) & enters the brain cells & gets metabolized into catecholamine (noradrenalin). Human body regulates it amount by eating it by food sources & making inside the body (nonessential). The body does not store it much for later uses.

Main sources of tyrosine: -

Meat, fish, egg, milk, nuts, beans, oats, wheat, black seeds etc.

Dopamine: -

It regulates reward & pleasure centers in brain; it is a chemical important for memory, motor skills & etc.

Nor-adrenaline & adrenaline: -

These hormones are responsible for fight & flight response in stressful situation & also controls many functions of the body; it is secreted by adrenal glands.

Thyroxin: -

It is secreted by thyroid gland; it regulates metabolism, blood pressure, digestion, energy etc.

Melanin: -

It is pigmented hormone, gives our skin, hair, eye their colour; dark skinned people have more melanin in their skin than light skin people (depend on exposure to sunlight).

- ***Valine: -***

It is an essential nutrient for vertebrates, biosynthesis of protein; it is an aliphatic & extremely hydrophobic essential amino acid; it is branched chain of amino acid (BCAA); it is important for growth, repair, blood glucose regulation, for energy; it stimulates CNS, proper mental function.

Main sources of valine: -

Cheese, soy, beans, nuts, fish, meat, chicken, mushroom, seeds, nuts, whole grains etc.

- ***Histidine: -***

It is an amino acid used in biosynthesis of protein; it is semi essential amino acid, needed by human for production of histamine & also for growth & tissue repair, it is helpful in maintaining myelin sheaths that covers the nerves & protects the nerves.

Main sources of histidine: -

Meat, mutton, fish, milk, egg, seeds, nuts, chicken, cheese, soy, beans, whole grains, fenugreek seeds.

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

It is absorbed in small intestine via active transport requiring the presence of sodium.

Basic clinical pharmacology of histidine: -

It plays many roles in immunity, gastric secretion & sexual functions. It is also required for blood cell formation & protects tissues against damage of radiation & heavy metals. It keeps normal pH of 7 in the body, useful in rheumatoid arthritis, allergy, ulcer & anemia caused by kidney failure or dialysis. It is an antioxidant, anti inflammatory, reduces cholesterol.

- ***Arginine: -***

It is among conditional essential amino acid the body needs to function properly; it is made in liver; it plays an important role in building protein thus helpful in body building.

Main sources of arginine: -

Chicken, pumpkin seeds, spirulina, dairy products, red meat, fish, egg etc.

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

It is absorbed in jejunum mainly from oral diet.

Basic clinical pharmacology of arginine: -

It releases nitric oxide in the blood & nitric oxide dilates the blood vessels thus increases the blood supply & controls high blood pressure, it improves erection, builds muscle etc. it also act on release of growth hormone, insulin & other substances in the body. It also improves heart health, athlete performance, stimulates immune system; citrulline present in watermelon is converted into arginine in kidneys, please refer lesson on watermelon.

- ***Alanine: -***

It is a non-essential amino acid that is present in blood plasma in its free state in high levels; it is involved in sugar & acid metabolism, protein synthesis, it increases immunity, provides energy for muscles tissues, brain & CNS, it act on tryptophan, vitamin B6 metabolism; it is an important sources of energy for muscles; it helps the body to convert simple sugar (glucose) into energy; it is produced in the body. It increases exercise capacity; reduces muscle fatigue, boost immunity, it is antioxidant; anti-aging; increases muscle growth; ideal pre & post workout, reduce blood sugar, prevent liver disease, helps the liver to eliminate toxins, improves CNS functioning, helpful in benign prostate hypertrophy. It is digested in small intestine; it is converted into pyruvic acid by alanine aminotransferase-1; during fasting condition alanine derived from protein breakdown is converted into pyruvate & used to synthesis glucose by gluconeogenesis in liver, it is excreted in urine via urea cycle. It is stored little in skeletal muscles.

Main sources of alanine: -

Meat, fish, egg, milk, aleovera, honey, black seeds, nuts etc.

- ***Aspartic acid: -***

It is a non-essential amino acid; it is over all negatively charged & plays an important role in synthesis of other amino acid, citric acid & urea cycles; it is found in animals, plants, sugarcane, sugarbeet. It may be a neurotransmitter; it strengthens the muscles, improves heart function, helps in maintaining mental health, reduces tiredness, improves athletic performance, increases muscle size, reduces depression & fatigue. It is absorbed in small intestine by active transport.

Main sources of aspartic acid: -

Meat, oysters, seeds, oats, avocado, sugar beet, milk, egg, nuts, cereals etc.

- ***Glutamic acid: -***

It is a nonessential amino acid. It is an excitatory neuro-transmitter; it is necessary for biosynthesis of proteins; body uses it for several key functions within the body like making other neuro-transmitters such as GABA; it promotes brain health, muscles health, intelligence, mood & mental alertness. It is called as chemical messenger. It plays an important role in body's disposal of excessive waste like nitrogen. It is absorbed in lumen of small intestine into enterocytes by active transport & excreted in urine mainly. It is almost about 2 kgs, storage in natural form in brain, kidneys, liver, muscles etc.

Main sources of glutamic acid: -

Meat, chicken, fish, egg, milk, wheat, mushroom, soy, broccoli, walnut, peas etc.

- ***Glycine: -***

It is a nonessential amino acid that body needs for growth &maintenance of tissue & need to prepare hormones & enzymes. It is inhibitory neurotransmitter. It helps in preparing glutathione (a powerful antioxidant & reduces free radicals, delay aging). It is helpful in preparing of creatine (provides energy to muscles to perform exercise etc & acts on muscle contraction), beneficial for brain health, bone health, alzheimer's, schizophrenia, sleep disorder, stroke, burns, protects kidney & liver from harmful side effects of drugs used after organ transplant, heals wound & ulcers, it is anti inflammatory, improves skin health.

Main sources of glycine: -

Meat, fish, milk, legumes etc.

- ***Proline: -***

It is a protein-genic amino acid used in biosynthesis of proteins. It heals cartilages, cushion joints, tendons, ligament, heart muscles, connective tissues & helps in formation of collagen.

Main sources of proline: -

Soy, pumpkin seed, lentils, black beans, quinoa etc.

- ***Serine: -***

It is a nonessential amino acid, important for synthesis of protein, fats metabolism, muscle growth, immune system; it is a precursor of many amino acids, helpful in enzyme catalyze its reaction, overall health, physical & mental health.

Main sources of serine: -

Soybean, egg, lentils, meat, fish, nuts, almonds, walnut etc.

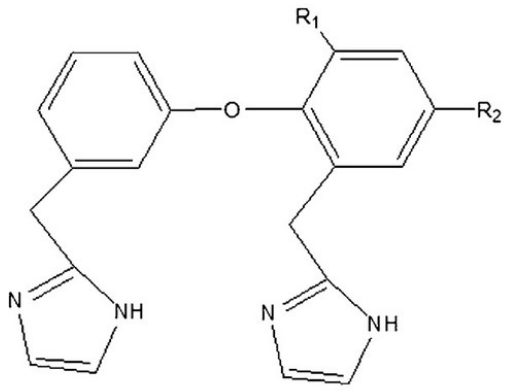
- ***Asparagine: -***

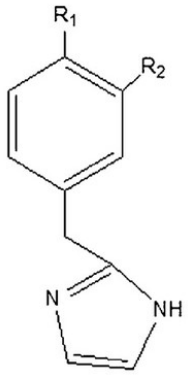
It is a non-essential amino acid; it acts on biosynthesis of proteins; it is a nontoxic carrier of residual ammonia to be eliminated from the body; it acts as diuretic also; it helps cell, nerve, brain to function. It is helpful to nervous system, reduces fatigue, helps in building muscles, improves liver function, protects liver, beneficial for nerve cells & brain; increases stamina, help in synthesis of various enzymes, proteins, glycoprotein etc.

- ***Main sources of asparagine: -***

Milk, meat, egg, fish, soy, potato, legumes, nuts, seeds etc.

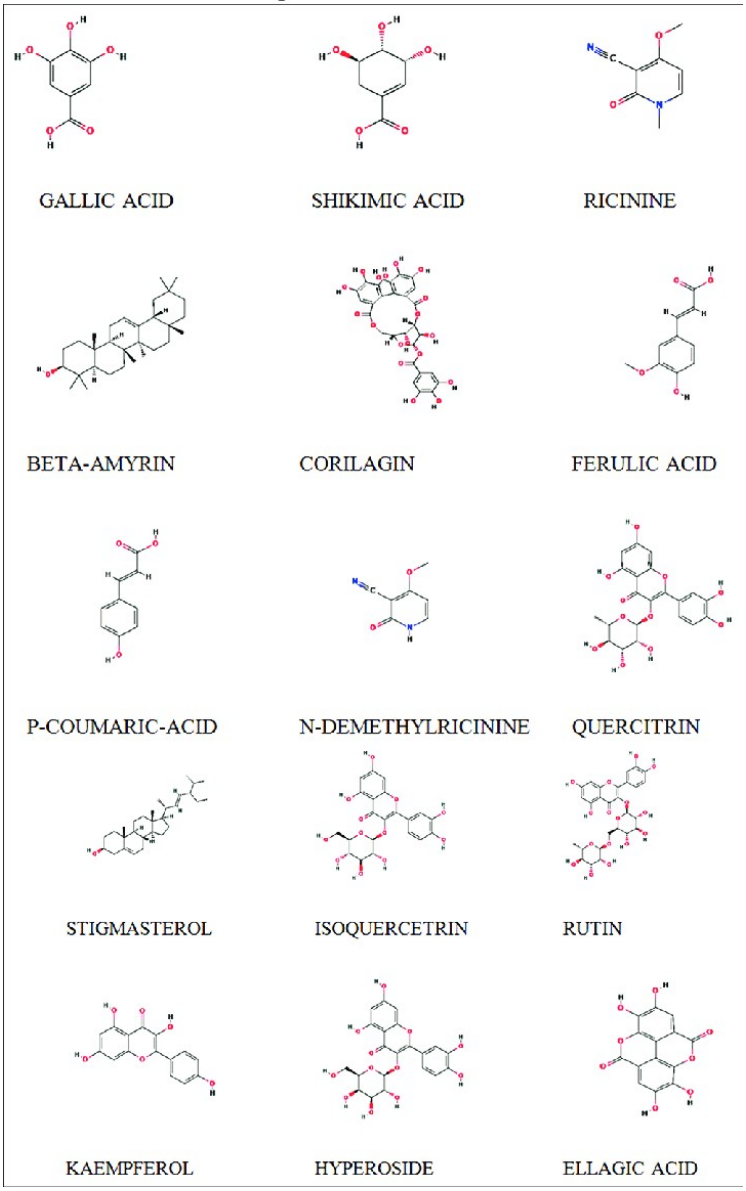
- ***Main chemical structures of cress: -***

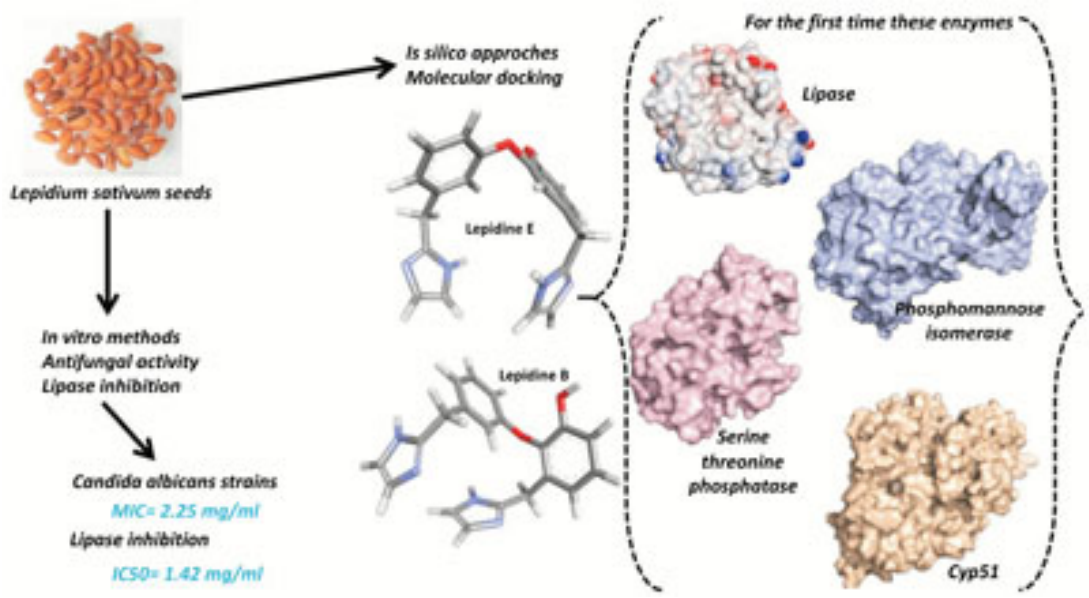




	R_1	R_2
Lepidine A	OCH_3	H
Lepidine B	OH	H
Lepidine C	H	OCH_3

	R_1	R_2
Semilepidine A	OH	H
Semilepidine B	OH	OCH_3





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Meenakshi Nagdeve, Co-Founder, Organic Facts is a health and wellness enthusias*t*

- ***Research: -***

Iron-rich biscuit was prepared by combining garden cress and rice flakes to prevent the anemia in adolescent girls from urban, rural, and tribal areas of Marathwada region of Maharashtra state. The sensory properties of iron-rich biscuits were tested by sensory panel members. The high score sample were tested for proximate composition. The hemoglobin value of selected adolescent girls was found in the range of 8.7–10.96 mg/100 g. By comparing these values, they found the least value of hemoglobin content in tribal and low income group girls. The proximate composition of selected biscuits, which was

highly accepted for all sensory attributes; it is evident from the study that the acceptability score ranged from 1.80 to 4.20. The mean values of different sensory characters reported that color scored maximum followed by taste and texture.

Physicochemical parameters provide important information regarding storage, stability, and quality of the product. The physicochemical properties of garden cress seed oil (GCSO) extracted by the different methods. Extracted oil by solvent extracted, supercritical CO_2, and cold expression were 21.54, 18.15, and 12.60%, respectively. The Soxhlet method yields the maximum oil content (21.54%). Oil yield of GCS is low when compared to the other oil seeds of Cruciferae family like mustard (25–40%), rapeseed (40–45%), and camelina or false flax (40–45%). The pungency of GCSO and mustard oil are similar, while the content is lower. The physicochemical properties of GCSO as summarized in establish the potential of garden cress for the development of novel products with several functional properties.

Viscosity of the GCSO ranges from 53.8 to 64.3. The cold-pressed GCO was more viscous than the oil extracted by the other two methods. Increasing extraction temperature up to a certain value increased viscosity, but at higher extraction temperatures viscosity decreased. The reduction of gum viscosity with temperature might be the result of irreversible change in molecular conformation. It was concluded that high pH, low water, seed ratio, and mild extraction temperatures will give a high viscosity for *L. sativum* extract. It decides the flow behavior of the products and is considered much during the formulation of any liquid or semisolid products.

Cruciferous vegetables (broccoli and other mustard family members) contain many compounds that may prevent cancer. Phenethylisothiocyanate (PEITC), a hydrolysis product of glucosinolates found in cruciferous vegetables, has many well-documented anticancer activities. Seeds of upland cress (*Barbarea verna*), another member of the Cruciferae, are a rich herbal source of PEITC as well as other potentially chemopreventive constituents. We utilized a mouse model of intestinal tumorigenesis, the *Apc^{min}* (adenomatous polyposis coli, multiple intestinal neoplasia) mouse, to compare the effect of an upland cress seed preparation to a synthetically produced form of PEITC in inhibiting intestinal tumorigenesis. In particular, we evaluated if the herbal preparation is more effective than synthetic PEITC in reducing intestinal polyp formation in the *Apc^{min}* mouse fed a pro-carcinogenic background diet, the New Western Diet (NWD; high in fat, and low in vitamin D, calcium, fiber, and methyl donors relative to AIN-76A). In this study, *Apc^{min}* mice were fed NWD (control; n=21), herbal (n=30), or PEITC (n=16) diets for 10 weeks. The herbal and PEITC diets had an equivalent concentration of PEITC at 6 μM each. At the end of the treatment period, the gastrointestinal tracts were scored for polyp number and tumor load (the sum of polyp area) by segment (4-cm portions of proximal, medial, and distal small intestine, and the entire large intestine) and values were summed over the total tract. One-tailed *t*-tests were used to compare results of each PEITC diet against NWD alone and treatment differences were considered significant at $p<0.05$. The PEITC treatments had the greatest effect in the proximal small intestine. Both herbal cress and synthetic PEITC diets significantly reduced polyp number in the proximal small intestine (by 45% and 42% relative to NWD, respectively). The synthetic PEITC diet decreased polyp number in the large intestine (by 58%), although the herbal preparation did not relative to the NWD. However, feeding the herbal extract, but not the synthetic PEITC diet, decreased tumor load in both the proximal (by 40%) and medial small intestine (by 27%). Overall, the herbal treatment decreased both polyp number (by 20%) and tumor load (by 23%) when these outcomes were summed over the entire intestine, while the synthetic PEITC diet did not. The dietary treatments did not affect body weight gain, and body weights over the groups were equivalent at 10 weeks. Feed intake was relatively stable over the treatment period, although there was a small decline in intake in the NWD- and PEITC-treated groups in the last week, which was not seen in the herbal-treated mice. These data suggest that a natural herbal source of PEITC and other isothiocyanates may have a protective effect against intestinal tumorigenesis. *Supported by NIH AT00151 and CA42710.*

- ***Conclusion: -***

The content of biologically active compounds, as well as the antioxidant capacity of L. sativum has been investigated by several researchers and their findings indicated that seeds of garden cress plants are good source of amino acids, minerals, fatty acids and have the ability to act as in vivo as well as in vitro antioxidants due to their high content of phenolic compounds. The functional health benefits of GCS may be exploited by incorporating it in several food formulations and health drink preparations. Therefore, garden cress plant, seed as well as oil present us with wide scope for further investigations for their potential preventive effects toward chronic diseases and also as interesting ingredients for new functional food formulations.

Watercress is, however, a high-value crop grown by a few specialist growers who can organize relatively easily to lobby for and fund research. One of the main constraints on watercress breeding research is the necessity of using an experimental watercress bed with a source of high-quality water. This coupled with the fact that the total value of the crop does not warrant a high investment in breeding research, means that in the near future it is unlikely that breeding methodology will change from that described above, or that biotechnology will make much of a contribution to the genetic improvement of watercress. For the foreseeable future the main improvement is likely to be finding and incorporating resistance to crook-root and/or WYSV, probably by a combination of backcrossing and pedigree or mass selection.