

Lesson no. 14 Marjoram



In English it is called sweet marjoram, knotted marjoram, or pot marjoram. Its Latin name is *Origanum marjoram*; its family is Lamiaceae. It is used for seasoning soups, stews, salad dressing, sauces & herbal tea. It is cultivated for its aromatic leaves (fresh or dry). It grows up to 2 feet in height & 1 foot wide. It is native to Cyprus and Turkey

A yellowish colour essential oil is prepared by steam distillation. It has many health benefits in it. It is mentioned in Hadith of Kanzul-ummal & Abu-Nuaim that it is beneficial to take its stem in cold & cough. Its whole plant is used. Please read lesson no 56, page no 175 of part 2 in my book.

• **NAMES:-**

1. In Hadees it is called as Marzanjosh. (المرزنجوش)
2. In Urdu it is called as Marwa, Marzanjosh.
3. In Hindi it is called as Marwa, Sathra.
4. In Sanskrit it is called as Ajanmasurabhi, Marwa.
5. In Latin it is called as *Origanum marjoram*.
6. In Persian it is called as Maranzosh.
7. Its common names are Marjoram, sweet marjoram.
8. In English it is called as Sweet Marjoram, knotted Marjoram.

Please visit my website www.tib-e.nabi-for-you.com for detail Islamic study on it.

It is mentioned in following books of Hadith (reference are also given as Hadith number) Kanzul-ummal & Abu-Nuaim.

• **Plants:-**

It is cold-sensitive perennial herb or under shrub with sweet pine & citrus flavour. It can be grown indoor or in sunlight. It is hermaphrodite [has female & male organ both]; it is pollinated by bees. Marjoram (*Origanum majorana*) is an easy to grow herb well suited for growing in containers as well as the garden. There are generally three varieties that are commonly grown: sweet marjoram, pot marjoram, and wild marjoram (also known as common oregano). All types of marjoram are popular for use in the kitchen as seasoning for numerous dishes. They're also grown for their enticing fragrance.

Although marjoram plants are tender perennials, they are typically treated as annuals as freezing temperatures will cause serious injury or death to the plants. When growing marjoram plants, it's generally best to start the seeds indoors during late winter or early spring. Push seeds just below the soil surface. Seedlings can be transplanted outdoors once all threat of frost has passed. For drying it, pick the shoots just before flowers begin to open. This results in the best flavor, as fully opened blooms produce a bitter taste. Bundle marjoram cuttings and hang them upside down in a dark, dry, well-ventilated area. It needs Light, sandy loam type soils.

Leaves:-



Leaves are smooth, simple, petiolate, ovate to oblong-ovate, 0.5-1.5cm [0.2 to 0.6 inches] long, 0.2 -0.8 cm [0.1 to 0.3 inches] wide with obtuse apex, entire margin, symmetrical but tapering apex & reticulate venation. The texture is extremely smooth due to the presence of numerous hairs. It is gray-green coloured.

• **Stem:-**



It has square branching stems, multiple branching stems; stem has grey hairs along it.

• **Flowers:-**



Flowers are two lipped, pale, borne in small spike like clusters, flowers are small pine, purple or white in colour, small oval. Flowers are attractive to bees. Flowers occur in June to September or in mid-summer.

- **Seeds**



Direct sow Sweet Marjoram seeds uncovered in the spring.

- **Marjoram oil: -**



- **Dry Marjoram: -**



- **Gross benefits:-**

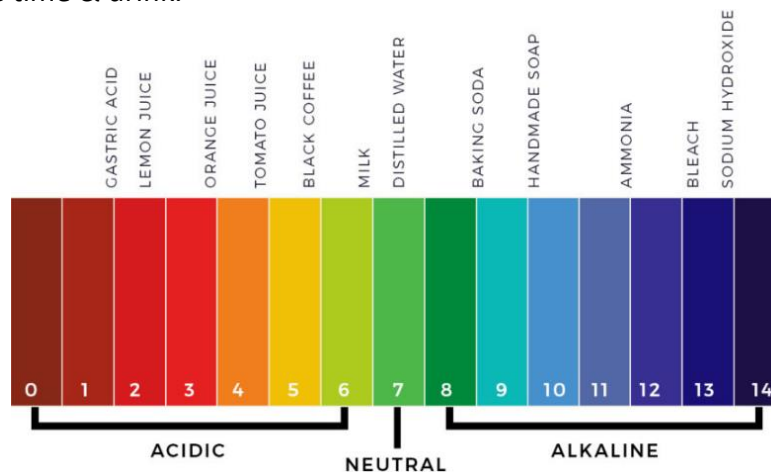
Antioxidant, antimicrobial, anti-inflammatory, anti-cancer, anti-proliferative, anti-platelet, anti-ulcer, cardio-protective, hepato-protective, regulates menstrual cycle, antifungal, Antiviral, nerve-tonic, improves blood circulation, reduces cough, reduces stomach cramps, cures digestive disorders, relief depression, reduces headache, useful in following asthma, nerve pain, runny nose, dizziness, migraine, PCOS; it is diuretic; should not be taken in pregnancy & breast-feeding.

- **pH of marjoram water is: -** pH of it is 4.0-6.5; it is mild acidic because its pH is light less than 7.

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

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

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



- **Calories:-**

100 gm of it gives 272 calories.

- **Glycemic index & Glycemic load of it:** -it has low index & load but yet to study & know exactly.

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

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

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

- **Gross health benefits & indications of marjoram:** -

Coughs & colds, Stomach cramps, Liver problems, Gallstones, Headache, preventing diabetes, Menopause symptoms, Nerve pain, Muscle pain, Sprains, Improving appetite and digestion, Improving sleep, preventing cancer, heart diseases, brain diseases, bone diseases, boost immunity, very helpful in recitative diseases, sinus, throat infection, viral infection, improves digestion, antibacterial, antifungal, insomnia, relieve gas, flatulence, cramps and other digestive complaints, stimulate the appetite, it is expectorant and can help reduce mucus from the lungs, laryngitis, sore throat, thrush, inflamed gums and toothache; induces sweating or perspiration, which is good for colds and flu. Its oil may be applied externally to bruises, swellings or sprains. Marjoram is said to be a stimulant and tonic, which is good if you are feeling tired, run-down or depressed. Marjoram promotes menstruation and stimulates regular blood flow. It can help relieve headaches or earache etc.

- **Clinical pharmacology of marjoram:** -

Water extract, essential oil, and ethyl acetate extract of aerial part of *O. majorana* show significant antioxidant activity. Antioxidant properties were also reported from other extracts of sweet marjoram, including ethanolic, *n*-hexane, and hydro-alcoholic extracta. Phenolic compounds such as hydroxycinnamic acid and flavonoids, ursolic acid, carnosic acid, carnosol, rosmarinic acid, and caffeic acid are responsible for antioxidant activity.

Dried whole plant and its essential oil and water extract of leaves have demonstrated antimicrobial effect and essential oil was more active against lactic acid bacteria and yeasts than water extract. Essential oil showed inhibitory activity against various pathogenic bacteria and fungi, including *Beneckea natriegens*, *Erwinia carotovera*, *Moraxella*, *Aspergillus*, *Staphylococcus aureus*, *Streptococcus pyogenes*, *Bacillus cereus*, *B. subtilis*, *Pseudomonas aeruginosa*, *Salmonella poona*, *Escherichia coli*, and dermatophytes.

Methanol extract of sweet marjoram exhibited antimicrobial activity against *E. Aspergillus niger*, *Fusarium solani*, and *Bacillus subtilis*. The ethanolic ammonia extract reduced the number of viable *Pentatrichomonas hominis* trophozoites. Sabinene hydrate in essential oil of sweet marjoram have been claimed to be responsible for antibacterial effect. Sabinene hydrate and terpineol in essential oil of sweet marjoram suppressed the production of Tumor necrosis factor- α (TNF α), interleukin 1 β (IL-1 β), IL-6, and IL-10 inhibited cyclooxygenase 2 (COX2) and NF κ B gene expression.

Ethanol extract of plant have shown significant cytotoxicity against fibrosarcoma cancer cell line, promoting cell cycle arrest and apoptosis of the metastatic breast cell. There are more benefits mentioned in separate content below.

- **Buying and storing marjoram**

Marjoram can be bought from your local supermarket either fresh or dried. Unlike many herbs, marjoram gets dry really well, better than practically every other herb, in fact. Therefore, if buying dried marjoram, much of the original flavour is retained. In saying this, however, it is always better to use fresh herbs if possible in cooking. When choosing fresh marjoram, try to look for a fresh and healthy-

looking herb, without any discolouration or blemishes. Fresh marjoram should be stored in the refrigerator, wrapped in damp paper towels and placed in a plastic bag. If possible, store your fresh marjoram in the lower part of the fridge, where it will keep for several days.

- **Culinary uses of marjoram**

Marjoram has a delicate and slightly sweet flavour and it goes well with a number of different types of foods. It is traditionally cooked with meat, particularly lamb, goat, beef or chicken and vegetables, pulses or seafood. It is important to note, however, that marjoram does not withstand the cooking process well and its flavour and aroma are destroyed by high temperatures and long cooking times. Therefore, it is almost always added at the end of the cooking process or just before serving.

- 1) Sprinkle chopped marjoram over your favourite pizza.
- 2) Use in minced meat mixtures, such as sausages, meatballs or bolognaise.
- 3) Sprinkle over a fresh salad. Marjoram goes very well with cheese, egg or tomato dishes.
- 4) Try adding marjoram to soups, stews and sauces. Use marjoram in stuffing mixtures.
- 5) Add marjoram to a cheese omelets or quiche. Use in place of oregano for a gentler flavour.
- 6) Use to flavour homemade bread or herby scones. Use in any type of citrus marinade for meat.
- 7) Cook foods that promote bloating and wind, such as cabbage, cauliflower or beans with marjoram to help relieve indigestion. Marjoram is best suited to lighter dishes, such as chicken or fish

- **Modern uses: -**

Marjoram has traditionally been used over the centuries as a treatment for cough & cold, indigestion, as an antiseptic, pain etc; steam inhalation containing marjoram can clear the sinuses and relieve sore throat & laryngitis; drinking marjoram tea in order to keep health in the best.

Marjoram tea ingredients 1/4 tsp marjoram (dried), 2 cup water (boiling), 1 tsp honey; Steps to Make It, boil water and add marjoram leaves. Let steep for 3 minutes or until fragrant, Strain leaves and pour liquid into tea cup. Add honey and serve hot.

Marjoram inhalation, take some water & boil it & after proper boiling put fresh or dried marjoram little & inhale the steam, do it 3 times a day till complete relief.

- **Use of marjoram oil: -**

- 1) Try 1-2 drops of marjoram essential oil with agave, honey, or water for minor bouts of stomach cramping or indigestion.
- 2) You can substitute 1 drop of marjoram essential oil per 1 teaspoon dried/fresh marjoram in your favourite recipes or just dip a toothpick in marjoram oil and swirl it through the liquid part of whatever you're making.
- 3) Use alongside lavender and cedar-wood in a diffuser for a relaxing pre-bedtime scent.
- 4) Infuse a bottle of extra virgin olive oil with your favourite herbs and a few drops of marjoram essential oil to make a fantastic salad dressing, marinade, or bread dip.
- 5) Combine marjoram essential oil with carrier oil such as coconut or Young Living's V6 oil to create a soothing muscle rub, as a part of your post-workout routine.
- 6) Diffuse marjoram oil after a stressful or tense day to promote relaxation and for a calming atmosphere.
- 7) Create an icy compress to promote relaxation by adding 2 drops peppermint, 2 drops ginger, and 1 drop marjoram essential oil to a bowl of icy cold water. Then soak a cloth in the water before wringing out and applying to your forehead and neck.
- 8) Using marjoram essential oil before bed may promote a more restful sleep for those suffering from issues such as insomnia or restlessness at night. Try a drop on your pillow, rubbed onto your feet with carrier oil, or in a diffuser beside your bed.

9) Create a bath for soaking away your stresses with Roman chamomile, lavender, marjoram, and thyme.

10) Add a few drops of marjoram essential oil to your shower, in the same way as you might use eucalyptus, to support a healthy respiratory system.

- **Contents/constituents of marjoram fresh, dried & oil: -**

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.

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

Sodium, potassium, carbohydrate, dietary-fiber, mild sugar, little proteins, vitamin B1, B2, B3, B6, B9, B12, A, D, C, Calcium, Magnesium, copper, manganese, phosphorus, selenium, zinc, Pinene alpha & beta, p-cymene, Camphene, Phellandrene alpha & beta, Terpinene, limonene, terpinolene, Myrcene, B-ocimene, Sabinene, Thujene, carvone, Citronellol, Terpinen, Linalool, Thymol, Terpeneol, Carvacrol, Linalylacetate, piperitol, Anethole, Geraniol, Terpinylacetate, Geranylacetate, Cubebene, Copaene, longipinene, Caryophyllene, Humulene, farnesene, selinene, alloaromadendrene, germacrene D, valencone, muurolene, ursolic acid, caffeic acid, carnosol, sinapic acid, vanillic acid, ferulic acid, syringic acid, hydrobenzoic acid, coumarinic acid, gallic acid, neochlorogenic acid, protocatechuic acid, caftaric acid, rosmarinic acid, chlorogenic acid, cryptochlorogenic acid, coumaric acid, lithospermic acid, methylrosmarinate, hydroquinone, arbutin, vitexin, orientin, thymonin, herperetin, catechin, quercetin, kaempferol, naringenin, eriodictyol, diosmetin, apigenin, trimethoxyflavone, Narigenin-O, Rutin, Luteolin, Eugenol, Sitosterol, Oleanolic acid, Ethylcinnamate, choline, lutein & zeaxanthin, omega 3 & 6 (in its oil)

Active ingredient of marjoram: -alpha and gamma terpinene, p-cymene, 4-terpineol, terpinolene, sabinene, linalool, beta-caryophyllene, borneol, carvacrol, cis and trans sabinene hydrate, linalyl acetate, ocimene, alpha-pinene, geranyl acetate, estragole, eugenol. Flavonoid glycosides, arbutin, tannins, carnosol, caffeic acid, sinapic acid, ferulic acid, coumarinic acid, syringic acid, vanillic acid, ursolic acid, rosmarinic acid, steroids including beta-sitosterol, triterpenoids.

- **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.

- **Dietary fiber: -**

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

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

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

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

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

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

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

Basic clinical pharmacology of dietary fiber: -

It helps in slow down the digestive process thus gives a good control in blood glucose, improves insulin sensitivity, reduces risk of diabetes, maintains weight, helpful in obesity, reduces blood pressure,

reduces cholesterol, reduces inflammation, reduces risk of heart disease, relieves constipation thus helpful in piles, fistula & other rectal disorders & disease, improves bowel movement thus improves bowel health, slows down 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 etc.

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

Its digestion begins in mouth; salivary glands release 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 released in the blood stream & pancreas release insulin to use it as source of energy for the body, & extra is stored is converted into glycogen by liver & stored in liver & little is stored in muscles & tissues. Liver can reconverts glycogen in to sources of energy if body lacks for other source of energy, the undigested carbohydrates reaches the large intestine (colon) where it is partly broken down & digested by intestinal bacterias, the remains is excreted in stools.

Clinical pharmacology of carbohydrates: -

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

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

- **Omega 3: -**

It is also called as n-3 fatty acid, it is polyunsaturated fatty acid, it plays important role in human diet & physiology. It is of 3 type alpha linolenic acid, eicosapentaenoic acid (EPA) & docosahexaenoic acid (DHA).

Main sources of omega 3: -

Walnut, flax seed oil, clary seeds, algal oil, almond, hemp oil, fish, egg, fish oil, grape seed oil etc.

Basic pharmacokinetics of omega 3 (based on human intake in natural food products): -

Same as omega 6.

Basic clinical pharmacology of omega 3: -

It reduces risk of cardio vascular disease, cancer, heart disease, inflammation, symptoms of rheumatoid arthritis, promotes brain, nail, hair, skin, bone, joints health, reliefs depression, improves vision, strengthens the body.

- **Omega 6: -**

It is a polyunsaturated fatty acid; it is also called as w-6 fatty acid or n-6 fatty acid; it is an essential fatty acid (our body needs it but cannot prepare it). The imbalance between omega 3 & 6 may lead to many health problems & heart problems.

Main sources of omega 6: -

It is present in egg, nuts, fish oil, whole grains, vegetables oil, flaxseed oil, grape seed oil, evening primrose oil etc.

Basic pharmacokinetic of omega 6 acid (based on human intake in natural food products): -

It is first hydrolyzed from eaten diet (mostly in triglycerides & phospholipids) by pancreatic enzymes, and then bile is secreted from gall bladder into intestines for further digestion (mostly in ileum). Linoleic acid is the parent compound of omega 6 fatty acid, during digestion & metabolism linoleic acid is converted into Gamma linoleic acid & then into dihomo-gama-linolenic acid then into arachidonic acid then into adrenic acid. Its excretion is not yet known & is under research.

Basic clinical pharmacology of omega 6: -

It is beneficial in asthma, arthritis, vascular disease, thrombosis, atherosclerosis, cancer, stroke; increase health of skin, nails, hair, bones, eyes etc, also heals the wounds. But if taken too much in diet can cause high blood pressure, heart disease, blood clots etc.

- **Vitamin A: -**

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

Main sources of vitamin A: -

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

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

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

Clinical pharmacology of vitamin A: -

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

- **Vitamin 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 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.

- **Calcium: -**

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

Main sources of calcium: -

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

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

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

Basic clinical pharmacology of calcium: -

Calcium acts on bone health, communication between brain & other parts of the body, muscles contraction, blood clotting; it is a co-factor for many enzymes, it relaxes the smooth muscles & blood vessels; it maintains heart rhythm, muscles function; it is more needed in childhood & deficiency of it in childhood may cause convulsions (seizure); Excessive level of it in blood is called as hypercalcemia & may lead to kidney stone formation, heart

attack, stroke, loss of appetite, excessive urination, memory loss etc; its low level in blood is called as hypocalcemia & may lead to cramps in the body, weak bones, weak teeth, numbness, tingling etc.

Contraindication: -

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

• **Iron: -**

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

Main sources of iron: -

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

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

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

The absorption of iron is not known fully; about only 10% of iron taken in food is absorbed; it is absorbed in duodenum & upper jejunum mainly & at the end part of ileum; low pH is needed for its absorption, after absorption it get bind to transferrin (each transferrin can carry 2 atoms of iron); ceruloplasmin (protein) also helps in binding of iron; 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 hemoglobin. Little iron is stored in liver, heart, & kidneys in form of ferritin also little in bone marrow, spleen.

Excretion of iron: -

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

Basic clinical pharmacology of iron: -

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

- **Vitamin D: -**

It is a fat soluble vitamin; it is a group of fat soluble secosteroids responsible for increasing intestinal absorption of calcium, magnesium, phosphate etc.

Main sources of vitamin D: -

It is present in olive oil, fish, liver, egg yolk, milk, salmon oil, orange, cereals, soy milk, legumes etc.

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

It is absorbed in small intestines; it is mainly excreted in stools. All forms of vitamin D are biologically inactive (body cannot use it directly) & get activated in liver & kidney by some enzymes; it is mainly of 2 types, 1) Vitamin D3 (cholecalciferol) 2) Vitamin D2 (ergocalciferol). Both can be ingested from diet.

Vitamin D3 is naturally synthesized from cholesterol by skin on sun exposure (UVB short radiations). It is converted in liver into Calcifediol (25-hydroxycholecalciferol) & kidney converts it into Calcitriol & this is biologically active (usable by the body). Vitamin D2 is converted in liver into (25-hydroxyergocalciferol).

Basic clinical pharmacology of vitamin D: -

It increases absorption in intestines of calcium, magnesium, phosphate & many other minerals; it acts on metabolism of calcium, phosphate thus promotes bone health & growth, promotes remodeling of bones in children; it reduces inflammation, improves cell growth, neuromuscular functions, immune function, prevents osteoporosis (pores in bones), rickets in children. Calcitriol binds with vitamin D receptors (VDR) which are mainly present in the nuclei of target cells. Its deficiency may cause rickets (mainly in children), weak bones, weakness in muscles, fatigue, headache, blood pressure, inflammation in mouth, skin pigmentations, obesity etc.

- **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 olive oil; 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 etc.

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

It is absorbed in small intestine; bile is required for its 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.

- **Zinc: -**

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

Main sources of zinc: -

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

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

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

excess in the body, & production of metalloprotein is reduced when zinc is less in the body to make zinc available for the body.

Basic clinical pharmacology of zinc: -

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

- **Copper: -**

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

Main sources of copper: -

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

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

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

Basic clinical pharmacology of copper: -

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

Deficiency of copper: -

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

- **Selenium: -**

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

Main sources of selenium: -

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

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

It is mainly absorbed in duodenum & proximal jejunum by active transport process; Dietary selenium is in 2 forms organic (selenomethionine) it is 90% absorbed & inorganic (selenite) it is 50% absorbed; after absorption it is sent in liver via portal veins, liver turns it into selenite & then is bound with selenoproteins & sent 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, cardiovascular disease; deficiency of it causes pain in muscles & joints, weaken the hair, nails, white spots on nails are found etc.

- **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 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.

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 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 eases 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 etc.

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

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

Basic clinical pharmacology of vitamin B5: -

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

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

- **Vitamin B6: -**

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

Main sources of vitamin B6: -

It is present in watermelon, quince, chicken, bread, egg, vegetable, soyabean, whole grain cereals, brown rice, fish, legumes, beef, nuts, beans, liver, citrus fruits, starchy vegetables, potato 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; its name is derived from the Latin word *Folium*, which means leaf, leafy vegetables have it in good amount; Folic acid is a synthetic form of vitamin B9.

Main sources of folate: -

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

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

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

Basic clinical pharmacology of folate: -

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

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

- **Vitamin B12: -**

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

Main sources of vitamin B12: -

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

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

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

Basic clinical pharmacology of vitamin B12: -

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

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

- **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.

- **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

- **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.

- **Ethylcinnamate:-**

It is the ester of cinnamic acid ethanol. It is present in cinnamon oil, Marjoram oil. It is clear colourless or pale yellowish coloured. Insoluble water, it is present in guava, strawberries etc. It has fragrance of balsam & honey like. Flavour is strong & sweet. It is used as food spice, used in flavour preparing of following strawberry, raspberry, plum, cherry etc. It is antioxidant, prevent heart disease, stroke, cancer, & is anti-fungal.

- **Oleanolic acid:-**

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

- **Eugenol:-**

It is member of allybenzene class compound. It is colourless or pale yellow aromatic oily liquid extracted from many essential oil like cinnamon, clove oil, nutmeg, basil, bay leaf, marjoram, clove-bud oil, clove leave oil. It has pleasant, spicy, clove like aroma. It is used in perfumes & flavorings; it is antiseptic, anaesthetic, reduces pain & induces sleep.

- **Trimethoxy-flavones:-**

It is a naturally occurring flavone used in treatment of dyspepsia, influenza, malaria, respiratory disease; it is antidote for poisonous stings of some insects, anti-pyretic, anti-fungal, anti-typhoid, anti-hepatotoxic, anti-tumour, anti-cancer; (very limited information is available about it).

- **Diosmetin: -**

It is a naturally occurring flavone; it is also called atrihydroxy-4methoxy-flavone; it is present in Caucasian vetch, marjoram, citrus fruits, lemon peel, orange, grapes; it is a mono-methoxy-flavone; it is antioxidant, anti-cancer, anti-microbial, estrogenic, anti-inflammatory.

- **Eriodictyol: -**

It is a bitter masking flavanone (flavonoid) present in yerba santa mainly; it has taste modifying properties, it is present in yerba santa, tamarind, sacred lotus, common oregano, marjoram, citrus fruits; it is anti-inflammatory, anti-cancer, antioxidant, prevents vascular diseases.

- **Naringenin: -**

It is bitter, colourless flavanone (a type of flavonoid); it is trihydroxy-flavanone; it is lipophilic, it is mainly present in grapes & other fruits & herbs.

Main sources of naringenin: -

It is present in grapes, tomato, cocoa, sour oranges, Greek oregano, beans, thyme, cherries, marjoram, bergamot etc.

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

It is lipophilic (tending to combine with or dissolve in lipids or fats), thus readily absorbed intestinal epithelium by passive diffusion into enterocytes; it reaches the blood circulation by multidrug resistance-associated protein (MRP1) or can be transported by active transport efflux protein carrier P-glycoprotein (P-gP) & with Mrp2 back to the intestine lumen out of the enterocytes, repeating the cycle; liver metabolism is via phase II conjugation by UDP-glucuronosyl transferase (UGT), sulotransferase & catechol-o-methyl-transferase.

Basic clinical pharmacology of naringenin: -

It is anti-inflammatory, antioxidant, it helps in controlling blood pressure, blood sugar, obesity, metabolic syndromes; it is anti-cancer, helpful in curing liver diseases; it is anti-ulcer, reduces gastric secretion by acting on H2 receptor thus it is antacid, estrogen antagonist, anti-inflammatory, antioxidant.

- **Catechin:-**

It is a natural polyphenol; it is a plant secondary metabolite.

Main sources of catechin: -

It is mainly present in tea, cocoa, berries, apples, grapes seeds, kiwi, strawberries, green tea etc.

Basic clinical pharmacology of catechin: -

It is antioxidant, prevents cell damage, anti-inflammatory, anti-cancer, promotes heart & brain health and reduces blood pressure & weight.

- **Hesperetin: -**

It is naturally occurring flavan-glycoside; it is trihydroxy-flavanone; it is mainly present in lemon, sweet lemon, marjoram; it is antioxidant, anticancer, reduces cholesterol, anti allergic, vaso-protective, anti carcinogenic, good for piles, varicose vein.

- **Arbutin: -**

It is a glycoside, glycosylated hydroquinone extracted from the bearberry plant & others.

Main sources of arbutin: -

It is mainly present in blue berries, wheat, peas, marjoram etc.

Basic clinical pharmacology of arbutin: -

It is botanical natural based compound which brighten the skin without side effects, this makes it safe & effective choice for people with sensitive skin & uneven skin tone; it slows down pigment production & slows down the activity of tyrosinase, the process that produces melanin which stimulates by UV-light. It is of a forms alpha & beta; alpha is more stable & effective than beta. Alpha is present mostly in bearberry bush, alpha is clean, water soluble & best for skin care, but it should not be used in excessive; it is made synthetically also but natural form is best.

Our body breaks down arbutin into glucose & hydroquinone slowly & this slow release is less irritation to skin than directly applied synthetic hydroquinone.

- **Hydroquinone: -**

It is known as benzene-1,4-diol or quinol, it is an aromatic organic compound that is a type of phenol, it is derivative of benzene.

Main sources of hydroquinone: -

It is naturally present in raspberries, blue berries, pear, beans, broccoli, coffee, wheat, cereal, marjoram.

Basic clinical pharmacology of hydroquinone: -

It is helpful in lighten the dark patches on skin, hyper-pigmentation, melasma, chloasma, age spots, pregnancy spots, spots due to birth control pills or due to hormonal medication or injury on skin; it also lightens the acne, scars, but there are lot of side effects if used excessively. It is made synthetically also but natural form is best.

- **Lithospermic acid: -**

It is also known as 2-arylbenzofuran flavonoids; it is phenyl-propanoid; it is practically insoluble in water & is moderate acidic compound; It is present in thyme, peppermint, marjoram; it is potential biomarker for consumption of the common thyme & peppermint intake; it is antioxidant, good in diabetic retinopathy.

- **Cafataric acid: -**

It is a non-flavonoid phenolic compound; it is an ester formed from caffeic acid & tartaric acid. It has hyaluronidase inhibitory activity; it is present grapes, thyme, vinegar, cone flower, marjoram, purple cone flower; it is antioxidant, enhances insulin secretion.

- **Protocatechuic acid: -**

It is a dihydroxybenzoic acid (a type of phenolic acid); it is structurally similar to gallic acid, caffeic acid, vanillic acid & syringic acid; it well known antioxidant, anti-inflammatory, anti bacterial, anticancer, anti ulcer, anti-ageing, antiviral, analgesic, protects liver, heart, brain & nerves; it is mainly present in green tea, bran & grains, almond, olive oil, star anise, plums, rosemary, Japanese ginko biloba.

- **Syringic acid: -**

It is a naturally occurring Trihydroxybenzoic acid or dimethoxybenzoic acid; it has a role as a plant metabolite, it is a member of benzoic acid & phenols; it can be derive from gallic acid; it is anti-diabetic,

it is present in wheat, maize, oats, rice, dates, apple, grapes, olive oil, rape, seed oil, thyme, marjoram, vinegar, walnut etc.

- **Terpinene: -**

Terpinene are group of isomeric hydrocarbons & classified as monoterpenes; Alfa terpinene is isolated from cardamom & marjoram oil & from other natural sources, but beta terpinene is made artificially (compounding).

Natural sources of it are cuminum cyminum, melalenca alternifolia, cannabis, apples, tea, cumin, nutmeg, rosemary etc. It has a pleasant aroma & flavour; it is used in manufacturing soaps, perfumes, lotions, insect repellent; it reduces anxiety because it is sedative, it is anticancer, antioxidant.

- **Phellandrene: -**

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

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

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

- **Limonene: -**

It is a cyclic monoterpene & is the major component in the oil of citrus fruit peels; it is soluble in water; it has a pleasant aroma.

Main sources of limonene: -

It is present in orange, orange peel, grapes, lemon, lime, mandarins & marjoram.

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

Limonene is completely absorbed when taken orally; it can be absorbed by inhalation up to 70%; it can be also absorbed by skin; it is distributed throughout the body & fats tissues; it is metabolized in liver & excreted in urine.

Basic clinical pharmacology of limonene: -

it is anti-inflammatory, antioxidant, anti-stress, prevents diseases, it is a natural insect repellent, it is used as an additive & flavouring agent, it is used in shampoo, soaps, perfumes detergent making, also used in laundry, cosmetics, air fresher etc. It is also available in concentrated supplement in capsules & liquid form; it is anti-inflammatory, antioxidant, anti-cancer, heals heart disease, strengthens the heart, reduces stress, anxiety and improves digestion.

- **Terpinolene: -**

It is among isomeric hydrocarbon group; it a monoterpene; it is a volatile oil component, not soluble in water; it is sedative, insect repellent; it is used in making plastics & resins; it is found in all spices; it is a flavouring agent.

It is present in citrus, mentha, juniperus, myristica, parnip oil, pine oil, tea tree oil, orange, marjoram etc. It is antioxidant, anticancer, sedative (when inhaled) reduces anxiety, helpful in insomnia, panic attack, anti-bacterial, anti-fungal; it is used in making of soap, perfumes, lotions, insect repellent.

- **Myrcene: -**

It is monoterpene & is olefinic natural organic hydrocarbon; its aroma is earthy, fruity & clove like; it is pungent, it synergizes activity of terpenes & it has a role as a plant metabolite etc.

It is present in wild thyme leaves, cannabis, hops, lemon grass, mango, myrica, verbena, cardamom, West Indian bay tree, marjoram, houttuynia, basil etc.

It is useful in treating diabetes, diarrhea, dysentery, blood pressure, reduces pain, increases transdermal absorption, improves glucose tolerance, good for osteoarthritis, also used as flavouring agent, perfume making etc; it crosses blood brain barrier & increases the transport of cannabinoids in the brain), it is a significant analgesic. It is under research & its absorption; metabolism is not known. It is anti anxiety, anti depressant, sedative, anti inflammatory, anti epileptic, increase immunity.

- **Terpinen: -**

It is an isomer of terpineol a primary constitute of tea tree oil, also obtained from leaves, branches & bark of melaleuca alternifolia. It is anti-inflammatory, antioxidant, reduces risk of colon cancer, pancreatic cancer, gastric cancer, prostate cancer & enhances the effects of chemotherapeutic agents.

- **Ocimene: -**

It is a monoterpene & among group of isomeric hydrocarbons; it is often found naturally as mixture of various forms (in oil); it has pleasant odour sweet & herbaceous; it is used in perfumes making; it is insoluble in water, but soluble in common organic solvents; it is anti-fungal, anti bacterial, insecticidal.

- **Sabinene: -**

It is a natural thujene bicyclic monoterpene; it is also called as Thujene, sabinene etc; it has woody & spicy smell, it is also used in perfume making & as a flavouring agent in eatables; it is mainly present in black pepper, carrot, seed oil, tea tree oil, nutmeg oil, bay tree, horse wood tree, Norway spruce, marjoram etc; it is strong anti bacterial that also gram positive bacteria, and is anti-fungal, antiseptic, anti helicobacter, anti ulcer, anti inflammatory, antioxidant, inhibits nitric oxide.

- **Thujene: -**

It is referred as alpha-thujene; it is a monoterpene found in many essential oils of plants; it is similar to sabinene; it is present in marjoram oil, boswellia serrata oil, eucalyptus oil, it has a pungent taste, green herbal woody smell, it is yellowish transparent; it is anti inflammatory, anti-arthritis, antimicrobial, insecticide.

- **Terpineol: -**

It is a monoterpene alcohol that is isolated from a variety of sources like pine oil, petit-grain oil, marjoram oil, cajuput oil. Alpha terpineol is most commonly present in trees, though there are 5 isomers of it, Alpha, beta, gamma, delta & terpinen-4-ol; it has pleasant odour & commonly used in perfumes, cosmetics, aromatics, scents etc; It is antioxidant, anticancer, anti-convulsant, anti-hypertensive, anti-nociceptive; it enhances skin penetration, it is insecticidal; it is also present in flowers, of narcissus, & freesia, & in herbs like marjoram, oregano, rosemary, lemon peel oil.

- **Linalylacetate: -**

It is the acetate ester of linalool (derived from linalool) & both often occur in conjunction. It has a pleasant fruity odour; it is found in many flowers & spice, plants & mainly present in bergamot oil, lavender oil, sage oil, citrus oil, etc; It is little toxic to human, fishes etc; it when inhaled promotes relaxation & better mood & commonly used in aromatic therapy, & massage therapy; It is helpful for immune system, G.I. tract; it possesses cleansing properties & anti-inflammatory properties.

- **Piperitol: -**

It is a monoterpene, mainly found in cumin; it is pungent taste & used as a flavouring material; it is among organic compounds known as menthane monoterpenoids. Its main source is myristica fragrant fruit.

- **Anethole: -**

It is an organic compound widely used as a flavouring substance; it is derivative of phenylpropene (aromatic compound); it is slightly soluble in water; it is very sweet, 13 times sweeter than sugar; it has a pungent taste & odour (reminiscent of licorice); it is used in oral hygiene products etc; it is anti-inflammatory, local anesthetic, sedative, estrogenic, anti tumour, anti bacterial, analgesic, anti

convulsant, hypnotic; it should be used in little dose only; it is mainly present in anise, fennel, star anise spices & other 20 plants species including marjoram.

- **Terpinyl acetate: -**

It is found in pine oil, cajuput oil, pine needle oil, cardamom oil etc; it is yellowish liquid & has smell of lemon or lavender; it is used as an aromatic & flavouring substance in pears, plumps, apricot, cherries, citrus fruit flavour. It is anticancer, anti cold & cough, relieves nasal blockages.

- **Geranyl acetate: -**

It is an organic compound among monoterpene; it is mild yellowish liquid with a pleasant floral or fruit roze aroma; it is present in essential oil of ceylon, citronella, palmarosa, lemon grass, petit grain, neroli, coriander, carrot etc. It is used perfumes, soap making; also used as flavouring ingredient; its taste is similar to banana, pear, apple & peach. It is not soluble in water; but dissolves on organic solvents like oils & alcohol. It is anti-fungal, anti inflammatory, anti microbial.

- **Cubebene: -**

It is a pair of organic compound & classified as sesquiterpenes; it was first isolated from piper cubeba berries (cubeb); it is a volatile oil; pale green or bluish-yellow viscous liquid with a warm woody camphoric odour; it is present in 2 forms alpha & beta, both are same just differ in position of a double bond which is endocyclic in alpha & exocyclic in beta; it is present in sweet basil, roman chamomile, pot marjoram, sweet bay.

- **Copaene: -**

It is an oily liquid hydrocarbon found in many essential oils (mainly copaiba tree, copaifera, langsdorfil); it is found in 2 forms alpha & beta; it is tricyclic sesquiterpenes; it is also found in oil of rhizome, piper, boahmeriaefolium, leaves & resin of canarjumparvumleen, croton, julocroton, marjoram, angelica root & seed oil, carrot seed & leaf oil, basil oil, bay leaf oil, cananga leaf oil, cajuput oil, clary sage oil, sweet orange oil, grape fruit oil etc; It is also called as aglaiene; it is colourless, clear, viscous liquid; it has woody spicy honey aroma; it is antimicrobial on gram positive & gram negative bacterias both; anti proliferative, antioxidant, anti-genotoxic, cytotoxic etc.

- **Longipinene: -**

It is mainly a constituent of cascarilla bark oil & helichrysum oil; it inhibits bio-film formation in candida albicans (a common fungal pathogen that causes fungal infection) thus works as anti fungal.

- **Pinene**

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

- **Humulene: -**

It is also known as α -caryophyllene; it is a monocyclic sesquiterpene; it is present in humulus lupulus oil (hops) & salvia officinalis (common sage, culinary sage), lindera strychnifolia, ginseng, ginger, mentha spicata etc; it is often present with Beta-caryophyllene; It has woody aroma; it is anti inflammatory, anti arthritis, anti fibromyalgia etc.

- **Farnesene: -**

The term farnesene refers to a set of six closely related chemical compounds which all are sesquiterpenes; it is found in alpha & beta form, both are similar with little difference but alpha is most common & found in apple coats, perilla oil; it is anti anxiety, anti spasmodic, calming, sedative, muscles relaxant, anti inflammatory, anti fungal, anti bacterial; it is used in cosmetics, perfumes etc.

- **Selinene: -**

It is a group of isomeric chemical compounds amongst sesquiterpenes; it is found in 2 types alpha & beta; It is present in celery seed oil, marjoram oil etc; it is anti inflammatory, antioxidant, anti gout (increase uric acid).

- **Alloaroma-dendrene: -**

It is a sesquiterpene found in variety of plants including C.sativa; it is present in minor quantity in marjoram.

- **Germacrene d: -**

It is a volatile sesquiterpene & amongst essential oils; it is found in many species & is of two prominent molecules Germacrene A & D; D is present mainly in lamium purpureum, clausena ausata, basil, clary sage etc.

- **Valencene: -**

It is a sesquiterpene that is an aroma compound of citrus fruit & citrus-derived odorants; it is mainly obtained from valencia oranges; it is anti inflammatory, anti allergy, beneficial for the skin; it is present in orange, tangerina, mango, grape (fruit).

- **Murolene: -**

It is a sesquiterpene & a carbo-bicyclic compound; it is mainly of two types alpha & gamma, both are similarly; both are neuro-protective, anti nociceptive; it is also present in ptychopetalum olaciodes.

- **Ursolic acid: -**

It is pentacyclic triterpenoid; it is widely present in peels of fruit, herbs like rosemary, thyme, vegetables, basil etc. It is anti inflammatory, anti oxidant, anti apoptotic, anticancer.

- **Caffeic acid: -**

It is 3-4 dihydroxycinnamic acid; it is a type of polyphenol; It is an organic compound that is classified as hydroxycinnamic acid; it is present in all plants; it is a strong antioxidant, anticancer, beneficial in dementia & anti inflammatory, antiviral, boosts athlete performance, reduces blood glucose in diabetes, and reduces aging. It is present coffee, turmeric, thyme, cabbage, apple, mushroom, olive oil etc. Every less is known about it yet.

- **Spathulenol: -**

It is a tricyclic sesquiterpene, it is similar to azulenes (azulene is an organic compound & an isomer of naphthalene hydrocarbon white crystalline solid compound, it has a specially odour); saphthulenol is mainly present in oregano (a flowering plant amongst mint family); it is antioxidant, anti inflammatory, anti proliferative, anti mycobacterial.

- **Carnosic acid: -**

It is a benzenediol diterpene; it is mainly present in rosemary, common sage; it is antioxidant, heals damage by free radicals in brain, useful in stroke, heals the brain injury, protects hippocampal neurons of brain etc.

- **Carnosol: -**

It is phenolic diterpene; it is mainly present in rosemary & mountain sage; it is anticancer, antioxidant, anti inflammatory, anti microbial.

- **Sinapic acid: -**

It is a small natural hydroxycinnamic acid, it is among phenyl-propanoid family; it is also called assinapinic acid; it is mainly present in spices, citrus fruits, berry fruits, vegetables, cereals, seeds, oilseed crops; it is antioxidant, anti inflammatory, anti cancer, anti glycemic, neuro-protective, antibacterial, anti-mutagenic.

- **Vanillic acid: -**

It is a dihydroxybenzoic acid used as a flavouring agent; it is mainly present in root of angelica sinensis (herb from china), acai oil, argan oil, vinegar etc. It is antioxidant, anti inflammatory, anti-pain, neuro-protective.

- **Ferulic acid: -**

It is a hydroxycinnamic acid, an organic phenolic compound; it is antioxidant & used in skin care products, it reduces spots, wrinkles, it is anti-ageing, anti hypertensive, anti diabetic, helpful in cardiovascular diseases, Alzheimer's etc. It is mainly present in bran, oats, rice, eggplant, citrus, apple seeds etc.

- **Hydroxybenzoic acid: -**

It is a monohydrobenzoic acid, a phenolic white crystalline solid compound; it is mainly present in genus vitex, agnus castus, hypercium perforatum ,spongiochloris spongiosa (fresh water green alga), green tea, acai oil, cloudy olive oil, (unfiltered) edible mushroom; it has estrogenic activity, it is used as a preservative; parabens is its esters.

- **Coumarinic acid: -**

It is also known as cis-o-coumaric acid or cis-o-hydroxycinnamic acid; it is a hydroxy derivative of cinnamic acid; it is used in perfumes & pharmaceuticals; it is found in pomegranate mainly; it belongs to class of organic compound; it is excreted in urine mainly.

- **Neochlorogenic acid: -**

It also called as 5-caffeoylquinic acid; it is a natural polyphenolic compound; it is present in dried fruit, peach, sunflower, seed, chicory, blue berry, quince, white cabbage; it is slightly soluble in water; it is antioxidant & anti-inflammatory.

- **Cryptochlorogenic acid: -**

It belongs to class of organic compounds known as Quinic acids & derivatives; it is mainly present in apple, sunflower, potato, coffee, hibiscus sabdariffes; it is a structural isomer of chlorogenic acid; it is anti inflammatory, antioxidant, inhibits Hepatitis B virus DNA replication.

- **Chlorogenic acid: -**

It is the ester of caffeic acid & quinic acid; it is among polyphenol & present mainly in coffee; it has similar action & effect to caffeine, but less potent; it reduces the absorption of carbohydrate, reduces blood glucose, blood pressure & is anti-obesity, improves mood.

It is mainly present in apples, pear, carrot, tomato, sweet potato, coffee, thyme, tea, marjoram etc.

- **Coumaric acid: -**

It is hydroxycinnamic acid belongs to non-flavonoids phenol; it is present in following with caffeic acid kiwi, apple, coffee, grapes, blueberries, cereal grains etc. It is an anti oxidant, anti inflammatory, increases complexion. Every less is known about it yet.

- **Methyrosmarinate: -**

It is a phenylpropanoid organic compound; it is mainly present in rosmarius officinalis; it is antioxidant & antifungal.

- **Vitexin: -**

It is an apigenin flavone glucoside compound; it is also called Apigenin-8-C-glucoside; it is light yellowish colour

Main sources of vitexin: -

Passion flower, hawthorn, bamboo leaves, cucumber, fenugreek, mungs beans, pearl-millet, vitex agnus castus.

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

It has many health benefits like it increases coronary artery blood flow, increase pumping of heart, anti oxidant, controls blood pressure because it is ACE inhibitor, improves low blood pressure, improve exercise capacity. It inhibits thyroid peroxidase thus contributes in goiters.

- **Orientin: -**

It is a flavone a chemical flavonoid like compound; it is present in passion flower, acai palm, sprouts, cucumber, Adonis vernalis, bamboo leave, millets, buck wheat, it is water soluble flavonoid C-glycoside etc.

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

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

Basic clinical pharmacology of orientin: -

It is antioxidant, anti aging, anti viral, anti bacterial, anti inflammatory, cardio protective, neuro protective, anti depressant, radio-protective, anti hypertensive etc.

- **Thymonin: -**

It is a trimethoxyflavone that is flavone substituted by methoxy group; it is also called as majoranin, microflavone-B; it is also present in sweet marjoram, thyme plant; it calms muscles spasm, improves muscles tone, increases exchange of chemical between cells, repairs tissues, maintain flexibility, reduces inflammation, helps in growth of new blood cells.

- **P-cymene: -**

It is a naturally occurring aromatic organic compound; it is insoluble in water; it has a mild pleasant odour; it floats on water; it is a hydrocarbon mono-terpene; it is present in many essential oils (mainly in cumin & thyme oil).

Main sources of p-cymene: -

Cumin oil, thyme oil, basil oil, carrot seed oil, clove bud oil, angelica root & seed oil, grape fruit oil, eucalyptus oil.

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

It is well absorbed through skin; little excreted unchanged & remainder being oxidized to water-soluble metabolism.

Basic clinical pharmacology of p-cymene: -

It is anti inflammatory, reduces pulmonary oedema, it is used for flavouring cakes, beverages, confectionaries, fragrances etc; it is anti bacterial, anti fungal, analgesic, antioxidant, anxiolytic, anticancer, antinociceptive.

- **Camphene: -**

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

- **Carvone: -**

It gives black seeds a special taste & odour; it is a volatile terpenoid. Its absorption, metabolism is not known.

Main sources of carvone: -

Black seed, dill seed, orange peel oil, spearmint, mandarin.

Basic clinical pharmacology of carvone: -

It is a decongestant, diuretic, anti viral, anti tumour, carminative, cardio-protective, stomachic, prevents bronchitis, asthma, cough, laryngitis, sore throat, colicky pain, urinary infection, reduces and relief gastric spasm.

- **Linalool: -**

It refers to 2 enantiomers (opposite or mirror image) of naturally occurring mono-terpene found in flowers & plants of many spices; it has a role plant metabolite, a volatile oil component, an anti

microbial agent, a fragrance agent, it is present in sweet basil, lavender, laurel, citrus fruits, cinnamon, rosewood, birch tree, tea tree oil etc. It is anti anxiety, anti-depressant, sedative, anti inflammatory, anti epileptic, increase immunity. It is under research & its absorption; metabolism is not known.

- **Thymol: -**

It is a natural mono-terpenoid phenol mostly present in thyme plant; it has pleasant aromatic odour, it is anti-hook worm.

Main sources of thymol: -

Thyme oil, eye bright plant (Euphrasia rostkoviana), monarda didyma & origanum compactum.

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

It is readily absorbed in intestines on oral administration; it is essentially excreted in urine within the first 24 hours after absorption.

Basic clinical pharmacology of thymol: -

It relieves headache, diarrhea; it is anti cancer, anti septic, anti inflammatory, antioxidant, anti fungal, anti spasmodic, anti bacterial, prevent free radical, cardio vascular disease, it is analgesic, reduces lipids, treat pain & neurological diseases.

- **Carvacrol: -**

It is a mono-terpenoid phenol; it has a pungent, warm odour of oregano, it is also called as cymophenol. It is present in thyme oil, oregano, pepperwort, wild bergamot. It helps in curing candida infection & yeast infections; it is anti cancer, anti bacterial, antioxidant, anti-inflammatory, reduces blood pressure, improves gut health; heals wounds etc. it is an active principle of oregano oil. Its absorption, metabolism in human is yet not known.

- **Caryophyllene: -**

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

- **Quercetin: -**

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

Main sources of quercetin: -

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

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

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

Basic clinical pharmacology of quercetin: -

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

- **Kaempferol: -**

It is a natural flavonol (a type of flavonoid) it is tetra-hydroxy-flavone.

Main sources of kaempferol: -

Fenugreek seeds, green tea, grapes, tomato, broccoli, spinach, raspberries, peaches, green beans, onion, potato etc.

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

It is ingested as a glycoside, absorbed in small intestines usually by passive diffusion; it is metabolized in various parts of the body. In small intestine it is metabolized to glucuronide & sulfo-conjugate by intestinal enzymes & it is also metabolized by colon micro-flora (bacteria) which can hydrolyze the

glycosides to aglycones or form simple phenolic compounds. It is mainly metabolized in liver to glucurono-conjugated & sulfo-conjugated form. It is mainly excreted in urine.

Basic clinical pharmacology of kaempferol: -

It is anti oxidant, anti inflammatory, anti microbial, anti cancer, cardio protective, neuro microbial, anti diabetes, estrogenic, analgesic, anxiolytic, anti allergic, anti viral etc.

- **Apigenin: -**

It is a natural flavonoid compound found in many fruits & vegetables serves multiple physiological functions.

Main sources of apigenin: -

It is present in onion, oranges, wheat, tea, grapes, parsley, thyme.

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

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

Basic clinical pharmacology of apigenin: -

It calms the nerves, provides antioxidant effects, prevents & helps the body to fight cancer; it is anti-obesity; neuro-protective, help mood & brain function; reduces cortisol, blood sugar; improves bone, heart & skin health; promotes sleep. It is also anti bacterial, anti viral; reduces blood pressure.

- **Rutin: -**

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

Main sources of rutin: -

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

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

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

Basic clinical pharmacology of rutin: -

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

- **Luteolin: -**

It is a tetra-hydroxy flavone (flavonoids are polyphenolic compounds); a naturally occurring flavonoid

Main sources of luteolin: -

Celery seeds, thyme, green pepper, fenugreek seeds, broccoli, carrot, orange, basil etc.

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

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

Basic clinical pharmacology of luteolin: -

It is famous for activities like anti oxidant, anti inflammatory, apoptosis (inducing & chemo-preventive activities), reduces free radicals, oxidative stress, reduces tumour cell growth & suppresses metastasis & cancer growth.

- **Sitosterol: -**

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

Main sources of sitosterol: -

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

- **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): -

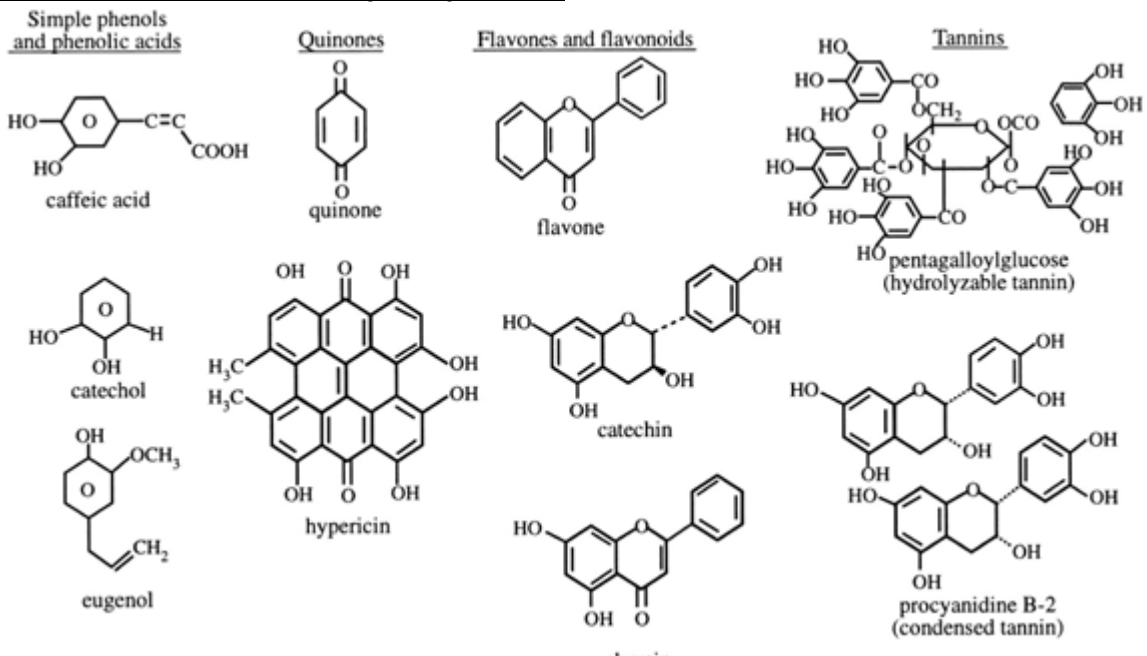
They are absorbed with the help of bile by mucosa of small intestine via passive diffusion & send to the liver via lymphatic system & in liver it is incorporated into low density & high density lipo proteins & transported to target tissues (retina etc) by specific lutein binding protein mediates the 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.

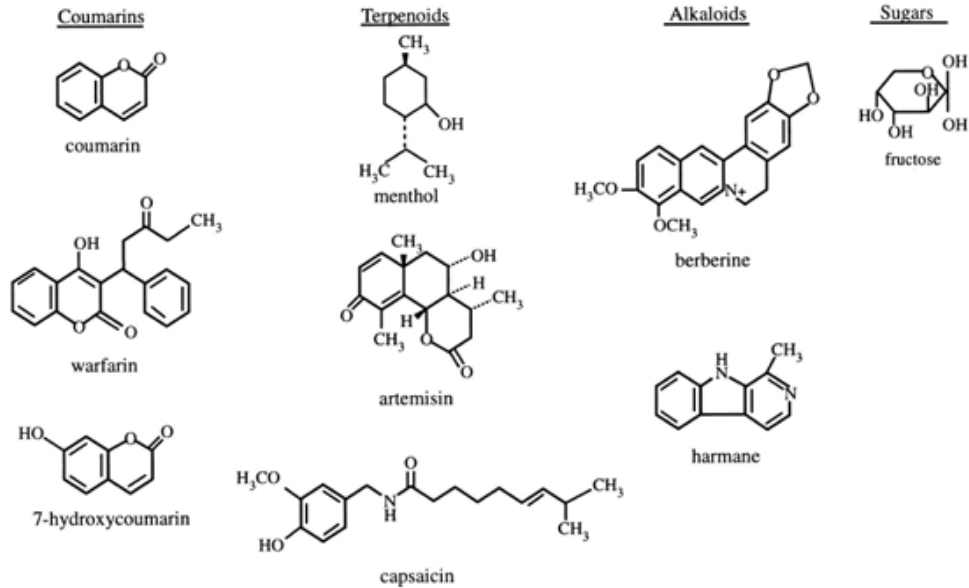
Basic clinical pharmacology of both: -

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, respiratory infections, reduce high blood pressure, reduce soreness of muscles after exercise, reduce eye strain, controls diabetes, prevent heart diseases etc.

- **Main chemical structures of Marjoram: -**





Dried Marjoram

(Spices Marjoram Dried)

Database: Standard Release

Nutrition Facts

1 Tsp (1g)

Calories

% Daily Value *

Total Fat 0g	Sugars
Saturated Fat 0g	Fiber
Trans Fat 0g	
Cholesterol 0mg	Saturated Fats
Sodium 0.5mg	Net-Carbs
Total Carbohydrate 0.4g	Trans Fatty Acids
Dietary Fiber 0.2g	1%
Total Sugars 0g	0%
	~ No added sugar data collected
Protein 0.1g	0%
Vitamin D 0mcg	0%
Iron 0.5mg	3%
Calcium 11.9mg	1%
Potassium 9.1mg	0%
Phosphorus 1.8mg	0%

Weight	1g	
Calcium	11.9mg	1%
Iron, Fe	0.5mg	3%
Potassium, K	9.1mg	0%
Magnesium	2.1mg	0%
Phosphorus, P	1.8mg	0%
Sodium	0.5mg	0%
Zinc, Zn	0mg	0%
Copper, Cu	0mg	1%
Manganese	0mg	1%
Selenium, Se	0µg	0%
Fluoride, F	~µg	~%
Molybdenum	~µg	
Iodine, I	~µg	
Chlorine	~mg	
Chromium	~µg	

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

Weight	1g
Vitamin A, RAE	2.4µg 0% mega 3s 19mg

Vitamin C	0.3mg	0%	Omega 6s	7mg
Thiamin (B1)	0mg	0%	Omega 3 to Omega 6 Ratio	2.71
Riboflavin (B2)	0mg	0%	Omega 6 to Omega 3 Ratio	0.37
Niacin (B3)	0mg	0%	Stigmasterol	~mg
Pantothenic acid (B5)	~mg	~%	Campesterol	~mg
Vitamin B-6	0mg	0%	Beta-sitosterol	~mg
Folic acid	0µg	0%		
Food Folate	1.6µg	0%		
Folate DFE	1.6µg	0%		
Choline	0.3mg	0%		
Vitamin B-12	0µg	0%		
Retinol	0µg			
Carotene, beta	28.8µg	0%		
Carotene, alpha	0µg	0%		
Cryptoxanthin, beta	0.4µg	0%		
Vitamin A, IU	48.4IU	2%		
Lycopene	0µg			
Lutein + Zeaxanthin	11.4µg			
Vitamin E (alpha-tocopherol)	0mg	0%		
Vitamin D	0µg	0%		
Vitamin D2 (ergocalciferol)	~µg			
Vitamin D3 (cholecalciferol)	~µg			
Vitamin D (IU)	0IU	0%		
Vitamin K (phylloquinone)	3.7µg	3%		
Vitamin K1 Dihydrophyloquinone	3.7µg			
Menaquinone-4	~µg			
Biotin	~µg			
Phytosterols	0.36mg			

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- **Research: -**

SCIENCE & HADEES REGARDING MARZANJOSH (المرزنجوش): -

Asthma: - Early research shows that taking 2 drops of marjoram oil daily along with asthma medication for 3 months might improve lung function in people with asthma better than taking asthma medication alone. Its oil is also used for coughs, gall bladder complaints, stomach cramps and digestive, depression, dizziness, migraines, nervous headaches, nerve pain, paralysis, coughs, runny nose; and as a “water pill.

Tea made from the leaves or flowers is used for runny nose and colds in infants and toddlers, also useful in dry irritating coughs, swollen nose and throat, and ear pain. Marjoram tea is also used for various digestion problems including poor appetite, liver disease, gallstones, intestinal gas, and stomach cramps. Some women use marjoram tea for relieving symptoms of menopause, treating mood swings related to menstrual periods, starting menstruation, and promoting the flow of breast milk.

Other uses include treating diabetes, sleep problems, muscle spasms, headaches, sprains, bruises and back pain. It is also used as a “nerve tonic” and a “heart tonic,” and to promote better blood circulation.

- **CONCLUSION OF RESEARCH: -**

It has very powerful healing, curative, preventive constituents; it has the maximum constituents & not very costly also; helpful in all diseases. Sweet marjoram is a medicinal plant with various proven pharmacological properties, including antioxidant, antibacterial, hepatoprotective, cardio-protective, antiulcer, anticoagulant, anti-inflammatory, anti-proliferative, and antifungal activities. The flowering stems are the medicinal parts. Their constituents include 1% to 2% of an essential oil with a containing terpinenes and terpinols, plus tannins, bitter compounds, carotenes, and vitamin C. These substances give sweet marjoram stomachic, carminative, antispasmodic, and weak sedative properties.