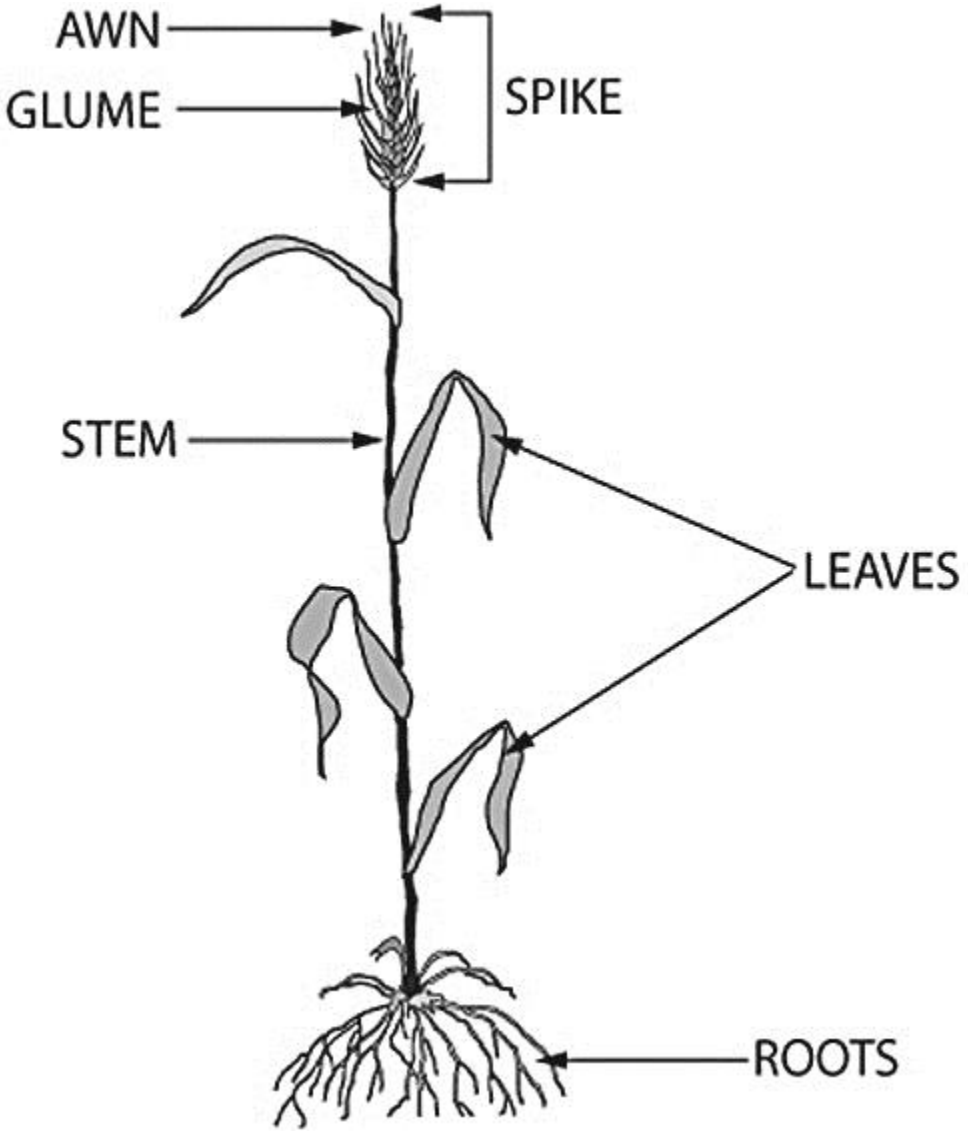
Lesson no. 31 Barley.



Barley is among the cereal grain eaten worldwide as the source of food to survive life; it is cheap easily available; it has lot of health benefits; eaten on earth since long back; eaten in various forms like chapatti, bread, soup, cooked broth, its vinegar, its water, roasted flour used in making sweets, used in cooked dishes, its flour diluted in water & eaten (sattu) etc; it suits to all age except glutamine allergy patient & barley intolerance patients. It is mentioned in many Hadith by Muhammad (s.a.w) along with its health benefits; it is mentioned in Hadith that Talbinah (a sweet dish made by barely flour) cleans the gut from unwanted elements like water cleans the dirt present on face; in other Hadith it said that barley is best for anorexia, it removes grief from heart, removes weakness & much more is mentioned as it; for detail Islamic study on barley please read my English book Tibb e Nabawi lesson no. 51 page 155 onward or visit my website www.tib-e-nabi-for-you.com or direct link to lesson barley on my website http://www.tib-e-nabi-for-you.com/jaw.html

- **NAMES: -**

1. In Hadees, Persian & Arabic it is called as Sh'aeer (الشعیر).
2. In English it is called as Barley.
3. In Urdu & Hindi it is called as Jaw.
4. In Sanskrit it is called as Bawa.
5. In Latin it's called as Hordeum vulgare.

6. It belongs to Poaceae family.
7. Sattu in Hadees & Arabic is called as Saweeq. (Sattu is roasted flour of Barley the details are given further in this lesson.) It is a member of grass family & cereal grain. It is a self-pollinated, diploid species with 14 chromosomes.

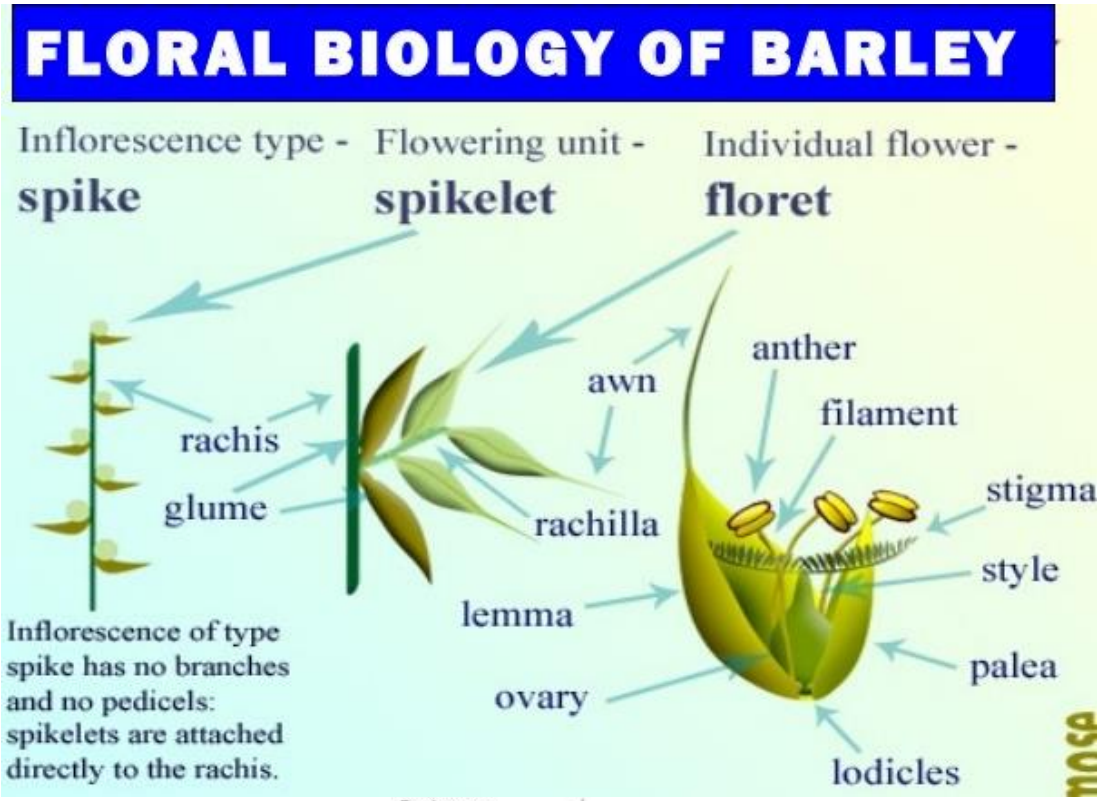
It is mentioned in following books of Hadith (names of book of Hadith & reference are also given) Bukhari; Ibn-Majah; Muslim; Tirmizi; Abu-Dawud.

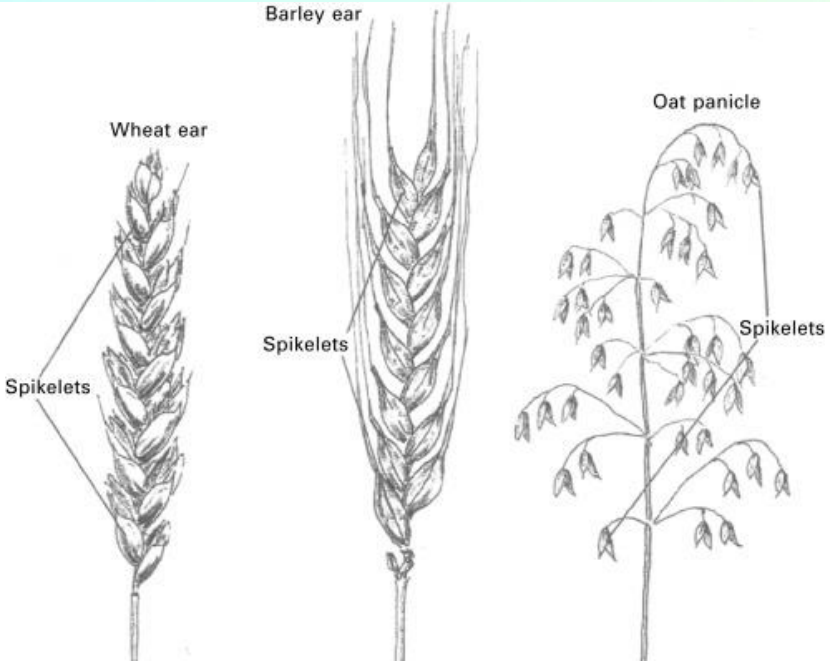
- ***Basic encyclopedia of barley: -***

Barley (*Hordeum vulgare*), belongs to Poaceae family; it is a member of the grass family; it is a major cereal grain grown in temperate climates globally. It was one of the first cultivated grains, particularly in Eurasia as early as 10,000 years ago. Barley has been used as animal fodder, as a source of fermentable material for beer and certain distilled beverages, and as a component of various health foods. It is used in soups and stews, and in barley bread of various cultures. Barley grains are commonly made into malt in a traditional and ancient method of preparation. In 2017, barley was ranked fourth among grains in quantity produced (149 million tonnes) behind maize, rice and wheat. It is a self-pollinating, diploid species with 14 chromosomes. Wild barley (*H. spontaneum*) is the ancestor of domestic barley (*H. vulgare*). Over the course of domestication, barley grain morphology changed substantially, moving from an elongated shape to a more rounded spherical one. Additionally, wild barley has distinctive genes, alleles, and regulators with potential for resistance to abiotic or biotic stresses to cultivated barley and adaptation to climatic changes. Wild barley has a brittle spike; upon maturity, the spikelets separate, facilitating seed dispersal. Domesticated barley has nonshattering spikes, making it much easier to harvest the mature ears. The nonshattering condition is caused by a mutation in one of two tightly linked genes known as Bt_1 and Bt_2; many cultivars possess both mutations. The nonshattering condition is recessive, so varieties of barley that exhibit this condition are homozygous for the mutant allele. Domestication in barley is followed by the change of key phenotypic traits at the genetic level. Little is known about the genetic variation among domesticated and wild genes in the chromosomal regions.
Traditional classifications of barley, these morphological differences have led to different forms of barley being classified as different species. Under these classifications, two-row barley with shattering spikes (wild barley) is classified as *Hordeum spontaneum* K. Koch. Two-row barley with nonshattering spikes is classified as *H. distichum* L., six-row barley with nonshattering spikes as *H. vulgare* L. (or *H. hexastichum* L.), and six-row with shattering spikes as *H. agriocrithon* Åberg.
Because these differences were driven by single-gene mutations, coupled with cytological and molecular evidence, most recent classifications treat these forms as a single species, *H. vulgare* L.
Two-row barley has low protein content than six-row barley, thus more fermentable sugar content. High-protein barley is best suited for animal feed. Malting barley is usually lower protein ("low grain nitrogen", usually produced without a late fertilizer application) which shows more uniform germination, needs shorter steeping, and has less protein in the extract that can make beer cloudy. Two-row barley is traditionally used in English ale-style beers, with two-row malted summer barley being preferred for traditional German beers. Amylase-rich six-row barley is common in some American lager-style beers, especially when adjuncts such as corn and rice are used.
Hulless or "naked" barley (*Hordeum vulgare* L. var. *nudum* Hook. f.) is a form of domesticated barley with an easier-to-remove hull. Naked barley is an ancient food crop, but a new industry has developed around uses of selected hulless barley to increase the digestible energy of the grain, especially for swine and poultry. Hulless barley has been investigated for several potential new applications as whole grain, and for its value-added products. These include bran and flour for multiple food applications.

- ***Barley crop: -***


HOR 3150 - 1
HOR 3155 - 1
HOR 4157 - 1
HOR 11544 - 1
HOR 4119 - 3
HOR 11631 - 1
HOR 11867 - 1
HOR 11036 - 1


FLORAL BIOLOGY OF BARLEY
Inflorescence type - spike
Flowering unit - spikelet
Individual flower - floret
rachis
glume
awn
rachilla
lemma
ovary
anther
filament
stigma
style
palea
lodicles
Inflorescence of type spike has no branches and no pedicels: spikelets are attached directly to the rachis.


Barley ear
Wheat ear
Oat panicle
Spikelets
Spikelets
Spikelets

Barley is a widely adaptable crop. It is currently popular in temperate areas where it is grown as a summer crop and tropical areas where it is sown as a winter crop. Its germination time is one to three days. Barley grows under cool conditions, but is not particularly winter hardy.

Barley is more tolerant of soil salinity than wheat, which might explain the increase of barley cultivation in Mesopotamia from the second millennium BCE onwards. Barley is not as cold tolerant as the winter wheats (*Triticum aestivum*), fall rye (*Secale cereale*) or winter triticale (× *Triticosecale* Wittm. ex A. Camus.), but may be sown as a winter crop in warmer areas of Australia and Great Britain. Barley has a short growing season and is also relatively drought tolerant. It crop is often infected with fungus & bacterias (barley mild mosaic by movirus as well as bacterial blight).

Hordeumvulgare is an annual grass featuring erect stems with few, alternate leaves. Barley comes in two varieties, distinguished by the number of rows of flowers on its flower spike. Six-row barley has its spike notched on opposite sides, with three spikelets at each notch, each containing a small individual flower, or floret, that develops a kernel. Two-row barley has central florets that produce kernels and lateral florets that are normally sterile. Whereas six-row barley has higher protein content and is more suited for animal feed, two-row barley has higher sugar content and is thus more commonly used for malt production.

Barley is adaptable to a greater range of climate than any other cereal, with varieties suited to temperate, subarctic, or subtropical areas. Although it does best in growing seasons of at least 90 days, it is able to grow and ripen in a shorter time than any other cereal. Cultivation is possible even in very short seasons such as those of the Himalayan slopes, although the yield there is smaller than in less harsh areas. Barley, with greater resistance to dry heat than other small grains, thrives in the near-desert areas of North Africa, where it is mainly sown in the autumn. Spring-sown crops are especially successful in the cooler, moist areas of Western Europe and North America.

Barley has a nutlike flavour and is high in carbohydrates, with moderate quantities of protein, calcium, and phosphorus and small amounts of the B vitamins. Because it contains little gluten, an elastic protein substance; it is a tall grass with a hairy stem which stands erect and produces spikelets at the head. The stem is made up of nodes and internodes. The internodes are solid, whereas the internodes are hollow. The stem supports the inflorescence, or spike, where the grain is produced. Barley seeds heads are cylindrical spikes composed of rachis each with 3 spikelets. Each spike produces 20–60 grains. Barley plant is freely tillering and typically possesses 1–6 stems. The tillers do not produce seed heads. Barley is an annual plant which is harvested each year and it can range in height from 80 to 100 cm.

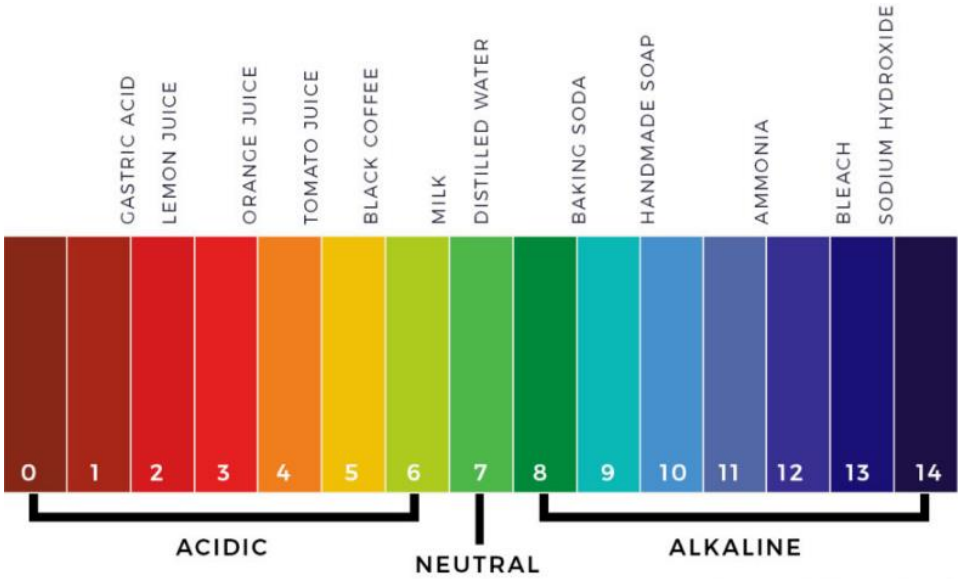
- ***pH of it is: -*** 5.21; it is acidic because its pH is below 7.

pH is a measure of hydrogen ion concentration, a measure of the acidity or alkalinity of a solution. The pH scale usually ranges from 0 to 14. Aqueous solutions at 25°C with a pH less than 7 are acidic, while

those with a pH greater than 7 are basic or alkaline & 7 is neutral; only aqueous solutions have pH levels, vegetable oil has no pH value. Likewise, other oils such as animal and petrochemical oils also have no pH value. Fatty acids are organic molecules often found in foods, including vegetable oils.

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

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



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

In a 100-g serving, cooked barley provides 123 Calories and is a good source (10% or more of the Daily Value, DV) of essential nutrients, including, dietary fiber, the B vitamin, niacin (14% DV), and dietary minerals including iron (10% DV) and manganese (12% DV).

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

Glycemic load of raw barley is 5.2 from 30 grams & glycemic load is 25 only so it is low glycemic index & load.

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

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

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

- ***Gross health benefits of it: -***

It is a good source of nutrition; best in weakness & recovery period; relieves constipation as it has fibers in it; reduces hunger thus is helpful in obesity or weight controlling; high fiber content of it is helpful in gallstones, reduces cholesterol, diabetes, prevents heart diseases; prevents colon diseases & cancers, it is antioxidant, nourishes skin, as it is rich in selenium it is anti-inflammatory; helpful in kidney stones, it broth does emulsion of stomach & is very helpful in peptic ulcers; prevents lot of cancer due to its antioxidant properties & there are lot of more benefits of it. It promotes bone, skin, hair, nails health due to rich in vitamins.

- ***Clinical pharmacology of it: -***

Early research suggests that eating food containing germinated barley daily for 4-24 weeks appears to reduce the symptoms of a type of inflammatory bowel disease called ulcerative colitis; fiber in barley might lower cholesterol and blood pressure in people with high cholesterol. Barley may also reduce blood sugar and insulin levels. Barley seems to slow stomach emptying. This could help keep blood sugar stable and create a sensation of being full, which might help to control appetite; Barley is LIKELY SAFE when taken by mouth during pregnancy in amounts commonly found in foods; Research shows that taking barley reduces total cholesterol and low-density lipoprotein (LDL) (Bad) cholesterol. The benefit might depend on the amount taken. Taking 0.4, 3, or 6 grams of soluble fiber from barley daily reduces total cholesterol by 14%, 17%, and 20% respectively. LDL is lowered by 17% to 24%. Barley also seems to lower triglycerides by 6% to 16% and increase "good" high density lipoprotein (HDL) cholesterol by 9% to 18%. Barley orally also seems to reduce blood pressure in people with high cholesterol. The Food and Drug Administration (FDA) now allows a health claim for food products containing barley. A food product containing 0.75 grams of soluble fiber from barley per serving can claim that, when used as part of a diet that is low in saturated fat and cholesterol, the product may reduce the risk of heart disease; some evidence suggests that eating dietary fiber, including barley, is linked with a reduced risk of stomach cancer; barley is nutrient rich and makes a satisfactory meal. It is packed with fiber and essential minerals such as: selenium, copper, tryptophan, and manganese**.** It gives energy and keeps us feel satisfied for a good part of the day. The manganese in barley helps you to feel happy and energetic; it also calms your nervous system. (As it is mentioned in Hadith that if removes grief from heart &removes weakness means gives feeling of satisfaction & it also expel out toxin& waste from stomach.

Barley helps to reduce weight, partially because of several kinds of essential amino acids, and partially because of its fiber content. Barley modulates your blood sugar levels, thus avoiding the sugar peaks and drops usually associated with the fat storage process. Barley, compared to other grains, is low in calories and at the same time it makes a satisfactory meal, helping you feel full longer, so you don't need to eat as frequently. A five week long study compared different grain combinations; it showed that adults who increased their intake of barley experienced a reduction in blood pressure.

Anti-carcinogenic effects: Lunasin, a novel, cancer-preventive peptide found in barley, internalizes into mammalian cells within minutes of exogenous application and localizes in the nucleus after 18 hours. It inhibits acetylation of core histones in mammalian cells. Lunasin does not affect the growth rate of normal and established cancer cells, but is selective for cells being transformed or newly transformed by binding to deacetylated core histones exposed by the transformation event, disrupting the dynamics of histone acetylation-deacetylation and leading to cell death.

- ***Modern uses of it: -***

For general health: -

Eat barley broth twice or thrice a week; add smashed chicken or mutton; add few seeds of fenugreek & black caraway also add little extra olive oil & honey etc.

For recovery from diseases or during diseases: -

Prepare Talbinah from barely flour & eat many times a day possible freshly prepared each time till complete recovery.

Method of preparing Talbinah: -

1. Take 2 to 3 spoon of roasted barley flour (sattu).
2. Add it in 1 glass milk & mix vigorously in mixer or manually.
3. Than boil the mixture properly on a low flame for 10 to 15 minutes till the mixture gets thick & fumes of jaw & milk comes.
4. Than let it cool a little and add 3 to 5 teaspoon of honey in it.
5. Then use it in Luke warm condition, again & again.
6. Give Talbinah to ill patient, old, pregnant etc.
7. Always prepare fresh & serve.

For kidney stones: -

Boil water with barley grain with husk & drink this water empty stomach & many times of the day till complete relief.

For maintains of health: -

Try to add barley is your daily eatables as possible example in chapatti, soup etc.

- ***Contents/constituents of it: -***

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

A good quality of barley contains little amount of amino acids mentioned in table below: -

The above ingredients are based on scientific study, means these has been identified, known & learnt by modern science, it does not means that it contains only these ingredients, there may be many more ingredients which are yet to be discovered, learnt & known by modern science. The details given below are based on natural ingredients found in barley and not synthetically prepared.

Barley contains an assortment of phytochemicals (non-nutrient components) in varying concentrations usually determined by genotypic or environmental factors, or the interaction of both factors. Phytochemicals in barley may exist in free, conjugated, or bound forms and are categorized into several major classes, including phenolic acids, flavonoids, lignans, tocols, phytosterols, and folate etc.

- ***Active components of it: -***

Dietary fiber mainly β-glucan and phenolic compounds are the active components of it.

Phenolic acids, the dominant phenolic group of phytochemicals in barley are primarily located in the outer layers of the kernel. They are subdivided into two groups: benzoic acid and cinnamic acid and their derivatives. Phenolic acids have been linked to chronic disease prevention partly due to the presence of unsaturated carboxylic group thus have natural antioxidants with antiradical and anti-proliferative potentials properties. In barley, phenolic acids are found at highest concentrations in the bound form, followed by conjugated and free forms, respectively such as lignin, cellulose, arabinoxylans, polysaccharides, and hemicelluloses, ferulic acid, vanillic acid, syringic acid, coumaric acid and *p*-coumaric acid, also bicinnamic acid, 4-hydroxy-3-methoxycinnamic acid, 7-methoxy-2,3-dihydrobenzofuran-3-carboxylic acid.

Flavanols and anthocyanins are located in the pericarp of barley grains. Flavanols, anthocyanins, and proanthocyanidins& mostly prevent as glycoside derivatives, including cyanidin-3-glucoside, penidin-3-glucoside, and delphinidin-3-glucoside, proanthocyanidin , Anthocyanins, cyanidin, cyanidin 3-glucoside, delphinidin, pelargonidin, pelargonidin glycosides, and petunidin 3-glucoside, myricetin, quercetin, kaempferol, lignan, pinoresinol, medioresinol, syringaresinol, lariciresinol, cyclolariciresinol, secoisolariciresinol, secoisolariciresinol-sesquilignan, matairesinol, oxomatairesinol, and 7-hydroxymatairesinol as major lignans and todolactol, α-conidengrin acid, nortrachelogenin, and lariciresinol-sesquillgnan as minor lignans.

Tocopherols and tocotrienols (Barley is one of the best sources of tocols among cereals due to a high concentration and favorable distribution of all eight biologically active vitamers).

Barley is considered a good source of phytosterol although barley's phytosterol level is moderate compared with other major grains. Barley grains generally contain phytosterols in both free and bound forms, esterified to fatty acids, phenolic acids, steryl glucosides, or acylated steryl glycosides. The level of esterification varies among varieties and around different parts of barley grain; beta-sitosterol is the most abundant sterol form in barley, contributing about 53–61% of total sterols, followed by campesterol. Other reported forms of sterol in barley include brassicasterol, stigmasterol, δ5-avenasterol, stigmastenol, stigmastadienol, and δ7-avenasterol, sistostanol and campestanol.

Barley

Nutrition Facts 100 grams of barely

Calories 354	
% Daily Value*	
Total Fat 2.3 g	3%
Saturated fat 0.5 g	2%
Polyunsaturated fat 1.1 g	

Monounsaturated fat 0.3 g	
Cholesterol 0 mg	0%
Sodium 12 mg	0%
Potassium 452 mg	12%
Total Carbohydrate 73 g	24%
Dietary fiber 17 g	68%
Sugar 0.8 g	
Protein 12 g	24%

Vitamin A	0%	Vitamin C	0%
Calcium	3%	Iron	19%
Vitamin D	0%	Vitamin B-6	15%
Cobalamin	0%	Magnesium	33%

Amino acid in barley	#1
Weight (g)	157
Tryptophan(mg) (% RDI)	60 (21%)
Threonine(mg) (% RDI)	121 (12%)
Isoleucine(mg) (% RDI)	130 (9%)
Leucine(mg) (% RDI)	242 (9%)
Lysine(mg) (% RDI)	132 (6%)
Methionine(mg) (% RDI)	68 (9%)
Cystine(mg) (% RDI)	79 (27%)
Phenylalanine(mg) (% RDI)	199 (23%)
Tyrosine(mg) (% RDI)	102 (12%)
Valine(mg) (% RDI)	174 (10%)
Histidine(mg) (% RDI)	80 (11%)
Arginine(mg)	177
Alanine(mg)	138
Aspartic acid(mg)	221
Betaine(mg)	~
Glutamic acid(mg)	928
Glycine(mg)	129
Proline(mg)	422
Serine(mg)	149

Each content& constituent explained separately: -

- ***Beta glucan: -***

Beta glucan is one form of soluble dietary fiber that's strongly linked to improving cholesterol levels and boosting heart health. Like many fibers; it is present in whole grains, oats, bran, wheat, and barley. Baker's yeast and some types of fungi, such as maitake and reishi mushrooms; it is helpful in high cholesterol, diabetes, cancer, HIV/AIDS, high blood pressure, and canker sores.

- ***Benzoic acid: -***

Benzoic acid occurs naturally in many plants and serves as an intermediate in the biosynthesis of many secondary metabolites. It naturally occurs in berries and other fruits such as cranberries, prunes, plums, cloudberries. Additionally, cinnamon and cloudberries contain high amounts of benzoic acid.

- ***Lignin: -***

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

- ***Cellulose: -***

Cellulose is the main substance found in plant cell walls and helps the plant to remain stiff and strong. Humans cannot digest cellulose, but it is important in the diet as a source of fiber. Cellulose is a long chain of linked sugar molecules that gives wood its remarkable strength. It is helpful in constipation.

- ***Hemicellulose: -***

It is also known as polyose; it is heteropolymer (matrix polysaccharides) non digestible dietary fiber present along with cellulose in almost all terrestrial (grow & live on soil) plant cell walls.

Basic clinical pharmacology of hemicellulose: -

As it is indigestible fiber it reliefs constipation, slow down starch hydrolysis, reduce candida, improves digestion, improves overall health.

- ***Arabioxylan: -***

Arabinoxylan is a type of cellulose obtained from the outer shell of wheat, rye, rice, and other cereal grains. A major component of the dietary fiber in grains, arabinoxylan is said to offer a variety of health benefits, including improved digestive health and the control of diabetes.

- ***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. It is also known as 4-Hydroxy-3-methoxycinnamic acid.

- ***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.

- ***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.

- ***p-coumaric acid:***-

***p*-Coumaric acid** is a hydroxycinnamic acid, an organic compound that is a hydroxy derivative of cinnamic acid. There are three isomers of coumaric acid—*o*-coumaric acid, *m*-coumaric acid, and *p*-coumaric acid—that differ

by the position of the hydroxy substitution of the phenyl group. *p*-Coumaric acid is the most abundant isomer of the three in nature. *p*-Coumaric acid exists in two forms *trans*-*p*-coumaric acid and *cis*-*p*-coumaric acid. It is present in dates, peanut, garlic, tomato, basil, beans, honey, vinegars, barley grains, bread, flex seeds. It is a strong anti-inflammatory, best for arthritis, antioxidant, liver & kidney protective.

- ***Anthocyanin: -***

It is a type of flavonoid & is the pigments that give red, purple & blue plants their rich colouring.

Main sources of anthocyanin: -

Black soybean, pomegranate, black berries, cherries, grape, plums etc.

Basic pharmacokinetics of anthocyanin: -

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

Basic clinical pharmacology of anthocyanin: -

It is a strong anti-oxidant, anti-cancer, anti-inflammatory, removes free radicals from the body, prevents heart diseases, blood pressure, infections, urinary infections, cough & cold.

- ***Proanthocyanidin: -***

Proanthocyanidins are chemical compounds. They give the fruit or flowers of many plants their red, blue, or purple colors. They were first studied for their importance as plant pigments. But these compounds may help prevent cancer. Proanthocyanidins are in a group of compounds called polyphenols.

- ***Glycosides: -***

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

Main sources of glycosides: -

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

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

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

Basic clinical pharmacology of glycosides: -

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

- ***Cyanidin: -***

It is a natural organic compound & type of anthocyanin; it is a pigment found in grapes, black berry, cherry, raspberry etc. it is anti-inflammatory, anti-oxidant, anti-toxic, anti-cancer, reduces free radical etc. Every less is known about it yet.

- ***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, ginko 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.

- ***Myricetin: -***

It is among polyphenolic flavonoid. It is anticancer, anti-oxidant, anti-bacterial, anti-inflammatory; reduces weight, cholesterol, L.D.L & triglycerides.

Main sources of myricetin: -

Nuts, berries, grapes, tea, walnut, onion, herbs etc.

- ***Lignans: -***

It is among polyphenols, it is rich in omega 3 fatty acid (alpha linolenic acid). It has estrogenic activity in the process digestion, bacterias convert lignans into estrogenic like substance.

Main sources of lignans: -

It is present in cucumber, flax seeds, sesame seeds, cereals, soybean, broccoli, cabbage, apricot, strawberries.

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

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

Basic clinical pharmacology of lignans: -

It increases digestion, reduces high blood pressure, cholesterol, blood glucose; it is anti-cancer, anti-inflammatory, anti-oxidant.

- ***Tocopherol: -***

Tocopherol is among class of organic compound; fat-soluble compound with vitamin E activity is best known for its antioxidant activity. It is synthesized only in photosynthetic organisms and acts as a protective component. It is antioxidants with the power to reduce inflammation, potentially promoting anti-cancer, anti-aging, and other benefits.

- ***Stigmasterol: -***

Stigmasterol is a 3beta-sterol that consists of 3beta-hydroxystigmastane having double bonds at the 5,6- and 22,23-positions. It has a role as a vitamin and a plant metabolite. It is a 3beta-sterol, a stigmastane sterol, a 3beta-hydroxy-Delta (5)-steroid and a member of phytosterols. It derives from a hydride of a stigmastane. It is among unsaturated phytosterol; it maintains the structure & physiology of cell membrane; it reduces LDL & cholesterol, reduces risk of heart diseases, it prevents atherosclerosis.

Main sources of stigmasterol: -

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

- ***Campesterol: -***

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

Main sources of campesterol: -

Soybean oil, vegetable oil, banana, cucumber, grapes seed oil, onion, potato, lemon grass etc

- ***Benzofurans: -***

Benzofuran (coumarone), a heterocyclic compound consisting of fused benzene and furan rings, has been identified as a privileged structure in medicinal chemistry. Benzofuran derivatives have shown biological activities ranging from antifungal and antimicrobial to antagonists for the H3 receptor and angiotensin II. A diversity of synthetic routes can be applied to the synthesis of benzofurans.

- ***Cyanidin 3-glucoside: -***

Cyanidin 3-glucoside is an anthocyanin cation that is a cyanidin cation linked to a beta-D-glucosyl moiety at position 3. It has a role as a metabolite. It is an anthocyanin cation, a beta-D-glucoside and a monosaccharide derivative. It derives from a cyanidin cation. It is a conjugate acid of a cyanidin 3-O-beta-D-glucoside betaine. It is found in American cranberry & in many plants and fruits, e. g. cherries, olives and grape. It is gastro protective, anti-inflammatory, anti-thrombotic chemo-preventive and as an epigenetic factor, exerting protection against Helicobacter pylori infection, age-related diseases, type 2 diabetes, cardiovascular disease, metabolic syndrome and oral cancer.

- ***Peonidin 3-glucoside: -***

Peonidin 3-glucoside is an anthocyanin cation that is the 3-O-beta-D-glucoside of peonidin (methylcyanidin). It has a role as an antioxidant and a plant metabolite. It is an anthocyanin cation, a beta-D-glucoside and a monosaccharide derivative. It derives from a peonidin. It is a conjugate acid of a peonidin 3-O-beta-D-glucoside betaine.

- ***Delphinidin 3-glucoside: -***

Delphinidin 3-glucoside is an anthocyanin cation consisting of delphinidin having a beta-D-glucosyl residue attached at the 3-hydroxy position. It has a role as a plant metabolite. It is a beta-D-glucoside and an anthocyanin cation. It derives from a delphinidin. It is a conjugate acid of a delphinidin 3-O-beta-D-glucoside betaine. It is found in adzuki bean. Delphinidin 3-glucoside is isolated from grapes and many other plant species.

- ***Petunidin 3-glucoside: -***

Petunidin 3-glucoside is an anthocyanin cation that is petunidin substituted at position 3 by a beta-D-glucosyl residue; it has a role as a metabolite and an antioxidant. It is an anthocyanin cation, a beta-D-glucoside and aromatic ether. It derives from a petunidin.

- ***Pinoresinol: -***

It is also called (+)-pinoresinol is an enantiomer of pinoresinol having (+)-1S,3aR,4S,6aR-configuration. It has a role as a hypoglycemic agent, a plant metabolite and a phytoestrogen. Pinoresinol inhibits the enzyme α-glucosidase *in vitro* and may therefore act as a hypoglycemic agent. A study involving extra virgin olive oil showed that pinoresinol possess *in vitro* chemoprevention properties. Increased apoptosis and cellular arrest at the G2/M stage in p53-proficient cells occurred.

- ***Medioresinol: -***

It is also called as (-)-medioresinol; it is a member of the class of compounds known as furanoid lignans. Furanoid lignans are lignans with a structure that contains either tetrahydrofuran ring, a furan ring, or a furofuan ring system, that arises from the joining of the two phenylpropanoid units. Medioresinol is practically insoluble (in water) and a very weakly acidic compound (based on its pKa). Medioresinol can be found in a number of food items such as garden tomato (variety), common buckwheat, radish (variety), and black elderberry, which makes medioresinol a potential biomarker for the consumption of these food products.

- ***Syringaresinol: -***

It is also called as (+)-syringaresinol; it is a member of the class of compounds known as furanoid lignans. Furanoid lignans are lignans with a structure that contains either a tetrahydrofuran ring, a furan ring, or a furofuan ring system, that arises from the joining of the two phenylpropanoid units (+)-syringaresinol is practically insoluble (in water) and a very weakly acidic compound (based on its pKa). (+)-syringaresinol can be found in a number of food items such as radish (variety), grape wine, oat, and ginkgo nuts, which makes (+)-syringaresinol a potential biomarker for the consumption of these food products.

- ***Lariciresinol: -***

It is also called as (+)-lariciresinol is a lignan that is tetrahydrofuran substituted at positions 2, 3 and 4 by 4-hydroxy-3-methoxyphenyl, hydroxymethyl and 4-hydroxy-3-methoxybenzyl groups respectively (the 2S,3R,4R-diastereomer). It has a role as an antifungal agent and a plant metabolite. It is a member of oxolanes, a member of phenols, a lignan, a primary alcohol and aromatic ether. It is an enantiomer of a (-)-lariciresinol.

- ***Lariciresinol-sesquilignan: -***

Lariciresinol-sesquilignan is a member of the class of compounds known as 7,9'-epoxylignans. 7,9'-epoxylignans are lignans that contain the 7,9'-epoxylignan skeleton, which consists of a tetrahydrofuran that carries a phenyl group, a methyl group, and a benzyl group at the 2-, 3-, 4-position, respectively. Lariciresinol-sesquilignan is practically insoluble (in water) and a very weakly acidic compound (based on its pKa). Lariciresinol-sesquilignan can be found in sesame, which makes lariciresinol-sesquilignan a potential biomarker for the consumption of this food product.

- ***Cycloariciresinol: -***

Cyclolariciresinol is a member of the class of compounds known as 9,9p-dihydroxyaryltetralin lignans. 9,9p-dihydroxyaryltetralin lignans are lignans with a structure based on the 1-phenyltetralin skeleton carrying a hydroxyl group at the 9- and the 9'- position. Cyclolariciresinol is practically insoluble (in water) and a very weakly acidic compound (based on its pKa). Cyclolariciresinol can be found in sesame, which makes cyclolariciresinol a potential biomarker for the consumption of this food product.

- ***Secoisolariciresinol: -***

Secoisolariciresinol is a lignan, a type of phenylpropanoid. It is present in the water extract of silver fir wood, where its content is more than 5%. It is also present in nettle brew. Its content in flaxseed (Linum usitatıssimum) was found to be 0.3%, which is the highest known content in food. In the intestine the gut microflora can form secoisolariciresinol from the secoisolariciresinol diglucoside and it can then be further transformed into the enterolignan enterodiol.

- ***Secoisolariciresinol-sesquilignan: -***

Secoisolariciresinol-sesquilignan is a member of the class of compounds known as dibenzylbutanediol lignans. Dibenzylbutanediol lignans are lignan compounds containing a 2,3-dibenzylbutane-1,4-diol moiety. Secoisolariciresinol-sesquilignan is practically insoluble (in water) and a very weakly acidic compound (based on its pKa). Secoisolariciresinol-sesquilignan can be found in sesame, which makes secoisolariciresinol-sesquilignan a potential biomarker for the consumption of this food product.

- ***Matairesinol: -***

It is also called as (-)-matairesinol; it is a lignan that is gamma-butyrolactone in which the 3 and 4 positions are substituted by 4-hydroxy-3-methoxybenzyl groups (the 3R,4R-diastereomer). It has a role as a phytoestrogen, a plant metabolite, an angiogenesis inhibitor and an anti-asthmatic agent. It is a polyphenol, a lignan and a gamma-lactone.

- ***7-oxomatairesinol: -***

7-oxomatairesinol is a member of the class of compounds known as dibenzylbutyrolactone lignans. Dibenzylbutyrolactone lignans are lignan compounds containing a 3,4-dibenzyloxolan-2-one moiety. 7-oxomatairesinol is practically insoluble (in water) and a very weakly acidic compound (based on its pKa). 7-oxomatairesinol can be found in sesame, which makes 7-oxomatairesinol a potential biomarker for the consumption of this food product.

- ***7-Hydroxymatairesinol: -***

7-Hydroxymatairesinol (7-HMR) is a plant lignan abundant in various concentrations in plant foods; it is anticancer & antioxidant.

- ***Nortrachelogenin: -***

Nortrachelogenin [(−)-Wikstromol], a bioactive α-hydroxylated lactone, is a pharmacologically active lignan used to study its antitumor activities versus breast and lung cancer cells. Nortrachelogenin may be used as a reference compound during the isolation and identification of α-hydroxylated lactone type lignans.

- ***Tocotrienols: -***

Tocotrienols are members of the vitamin E family, are natural compounds found in a number of vegetable oils, wheat germ, barley, and certain types of nuts and grains. Like tocopherols, tocotrienols are also of four types viz. alpha, beta, gamma and delta. Unlike tocopherols, tocotrienols are unsaturated and possess an isoprenoid

side chain. Tocopherols are lipophilic in nature and are found in association with lipoproteins, fat deposits and cellular membranes and protect the polyunsaturated fatty acids from peroxidation reactions. The unsaturated chain of tocotrienol allows an efficient penetration into tissues that have saturated fatty layers such as the brain and liver. Recent mechanistic studies indicate that other forms of vitamin E, such as γ-tocopherol, δ-tocopherol, and γ-tocotrienol, have unique antioxidant and anti-inflammatory properties that are superior to those of α-tocopherol against chronic diseases.

- ***Brassicasterol: -***

Brassicasterol is a 3beta-sterol that is (22E)-ergosta-5,22-diene substituted by a hydroxy group at position 3beta. It is a phytosterol found in marine algae, fish, and rapeseed oil. It has a role as an EC 1.3.1.72 (Delta(24)-sterol reductase) inhibitor, a biomarker, a human metabolite, a plant metabolite, an animal metabolite, an algal metabolite and a sterol biosynthesis inhibitor. It is an ergostanoid, a 3beta-sterol and a member of phytosterols.

- ***Avenasterol: -***

Avenasterol is a phytosterol. Phytosterols, or plant sterols, are compounds that occur naturally and bear close structural resemblance to cholesterol, but have different side-chain configurations. Phytosterols are relevant in pharmaceuticals (production of therapeutic steroids), nutrition (anti-cholesterol additives in functional foods, anti-cancer properties) and cosmetics.

- ***Stigmastadienol: -***

Stigmastadienol belongs to stigmastanes and derivatives class of compounds. Those are sterol lipids with a structure based on the stigmastane skeleton, which consists of a cholestane moiety bearing an ethyl group at the carbon atom C24. Delta-5,24-stigmastadienol is practically insoluble (in water) and an extremely weak acidic compound (based on its pKa). Delta-5,24-stigmastadienol can be found in common walnut, which makes delta-5,24-stigmastadienol a potential biomarker for the consumption of this food product.

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

When we eat high-protein foods, body breaks down protein into amino acids and peptides through digestive enzymes, such as pepsin & pancreas produces trypsin, chymotrypsin and other that aid in protein digestion.
Pepsin is the primary enzyme responsible for digesting protein; it acts on the protein molecules & breaks the bonds – called peptide bonds – that hold the protein molecules together. Next, these smaller chains of amino acids move in the stomach & then in small intestine where they're further broken down by enzymes released by the pancreas. Small intestine contains finger-like extensions called micro-villi. These structures enhance its ability to absorb dietary nutrients. Now the semi digested material pass through brush border and baso-lateral membranes of small intestine & di-tripeptides are absorbed by passive transport (facilitated or simple diffusion) or active transport (Na+ or H+ co-transporters) pathways. Di and tripeptides are more efficiently absorbed than free amino acids which in turns are better absorbed than oligopeptides. They're released into the bloodstream and used for various biochemical reactions.
Each amino acid has a different role in the human body. Upon absorption, some amino acids are incorporated into a new protein. Some fuel your muscles and support tissue repair. Others are used as a source of energy.
Tryptophan and tyrosine, for example, promote brain health. These amino acids support the production of neurotransmitters, leading to increased alertness and optimum nerve responses. Tryptophan also assists with serotonin production, lifting your mood and keeping depression at bay.
Phenylalanine serves as a precursor to melatonin, epinephrine, dopamine and other chemicals that regulate your mood and bodily functions. Methionine helps your body absorb selenium and zinc, two minerals that promote overall health. Some amino acids, such as isoleucine, play a vital role in hemoglobin production and glucose metabolism.

- ***Tryptophan: -***

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

Main sources of tryptophan: -

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

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

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

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

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

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

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

Basic clinical pharmacology of tryptophan: -

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

- ***Threonine: -***

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

Main sources of threonine: -

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

Basic clinical pharmacology of threonine: -

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

- ***Isoleucine: -***

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

Main sources of isoleucine: -

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

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

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

Basic clinical pharmacology of isoleucine: -

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

- ***Leucine: -***

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

Main sources of leucine: -

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

Basic clinical pharmacology of leucine: -

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

- ***Lysine: -***

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

Main sources of lysine: -

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

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

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

Basic clinical pharmacology of lysine: -

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

- ***Methionine: -***

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

Main sources of methionine: -

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

- ***Cystine: -***

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

Main sources of cystine: -

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

- ***Phenylalanine: -***

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

Main sources of phenylalanine: -

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

- ***Tyrosine: -***

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

Main sources of tyrosine: -

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

Dopamine: -

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

Nor-adrenaline & adrenaline: -

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

Thyroxin: -

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

Melanin: -

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

- ***Valine: -***

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

Main sources of valine: -

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

- ***Histidine: -***

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

Main sources of histidine: -

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

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

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

Basic clinical pharmacology of histidine: -

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

- ***Arginine: -***

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

Main sources of arginine: -

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

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

It is absorbed in jejunum mainly from oral diet.

Basic clinical pharmacology of arginine: -

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

- ***Alanine: -***

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

Main sources of alanine: -

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

- ***Aspartic acid: -***

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

Main sources of aspartic acid: -

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

- ***Glutamic acid: -***

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

Main sources of glutamic acid: -

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

- ***Glycine: -***

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

Main sources of glycine: -

Meat, fish, milk, legumes etc.

- ***Proline: -***

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

Main sources of proline: -

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

- ***Serine:-***

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

Main sources of serine: -

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

- ***Asparagine: -***

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

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

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

- ***Vitamin A: -***

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

Main sources of vitamin A: -

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

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

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

Clinical pharmacology of vitamin A: -

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

- ***Vitamin C: -***

It is also called as Ascorbic acid; it is an essential water soluble vitamin, it is 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, strawberry, spinach, green & red chillies, cabbage, leafy vegetables, tomato, cereals 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 etc. 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 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, pomegranate 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 biological 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 synthesis 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 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.

- ***Calcium: -***

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

Main sources of calcium: -

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

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

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

Basic clinical pharmacology of calcium: -

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

Contraindication: -

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

- ***Iron: -***

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

Main sources of iron: -

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

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

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

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

Storage of iron: -

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

Excretion of iron: -

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

Basic clinical pharmacology of iron: -

It is an important component of Haemoglobin (heamoglobin bind oxygen in lungs & supply it to whole body); iron is beneficial for nails, hair, skin etc; it acts on blood production, its deficiency causes Anaemia (low haemoglobin level in blood) (this causes reduced in oxygen carrying capacity & supply of it); most of the iron is present in haemoglobin, it consist 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 act on protein synthesis, muscles & nerve function, blood glucose, control blood pressure, it is required for energy production, bone development, synthesis of DNA & RNA. It also plays a role in active transport of calcium & potassium ions, muscles contraction, normal heart rhythm etc.

- ***Carbohydrate: -***

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

Main sources of carbohydrates: -

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

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

Its digestion begins in mouth; salivary glands releases saliva & salivary amylase (enzyme) which begins the process of breaking down the polysaccharides (carbohydrates) while chewing the food; now the chewed food bolus is passed in stomach through food pipe (esophagus); gastric juice like HCL, rennin etc & eaten material are churned to form chyme in the stomach; the chyme now is passed little by little down into duodenum, pancreatic amylase are released which break the polysaccharides down into disaccharide (chain of only sugars linked together); now the chyme passes to small intestine, in it enzymes called lactase, sucrase, maltase etc breakdown disaccharides into monosaccharide (single sugar) & absorbed in upper & lower intestines, through villi present in small intestine & send into liver through venous blood present into portal veins, as per bodies need it is releases in the blood stream & pancreas release insulin to use it as source of energy for the body, & extra is stored is converted into glycogen by liver & stored in liver & little is stored in muscles & tissues. Liver can reconverts glycogen in to sources of energy if body lacks for other source of energy, the undigested carbohydrates reaches the large intestine (colon) where it is partly broken down & digested by intestinal bacterias, the remains is excreted in stools.

Clinical pharmacology of carbohydrates: -

Carbohydrates are main sources of body energy, it helps brain, kidney, heart, muscles, central nervous system to function, it also regulates blood glucose, it acts on uses of protein as energy, breakdown of fatty acids & prevent ketosis. So it is an instant energy provider for the body & best for pre & post workout. 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.

- ***Potassium: -***

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

Main sources of potassium: -

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

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

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

Basic clinical pharmacology of potassium: -

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

Its normal amount in body keeps blood pressure normal; water balance in body normal; prevents heart disease, stroke, osteoporosis, kidney stone etc.

- ***Sodium: -***

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

Main sources of sodium: -

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

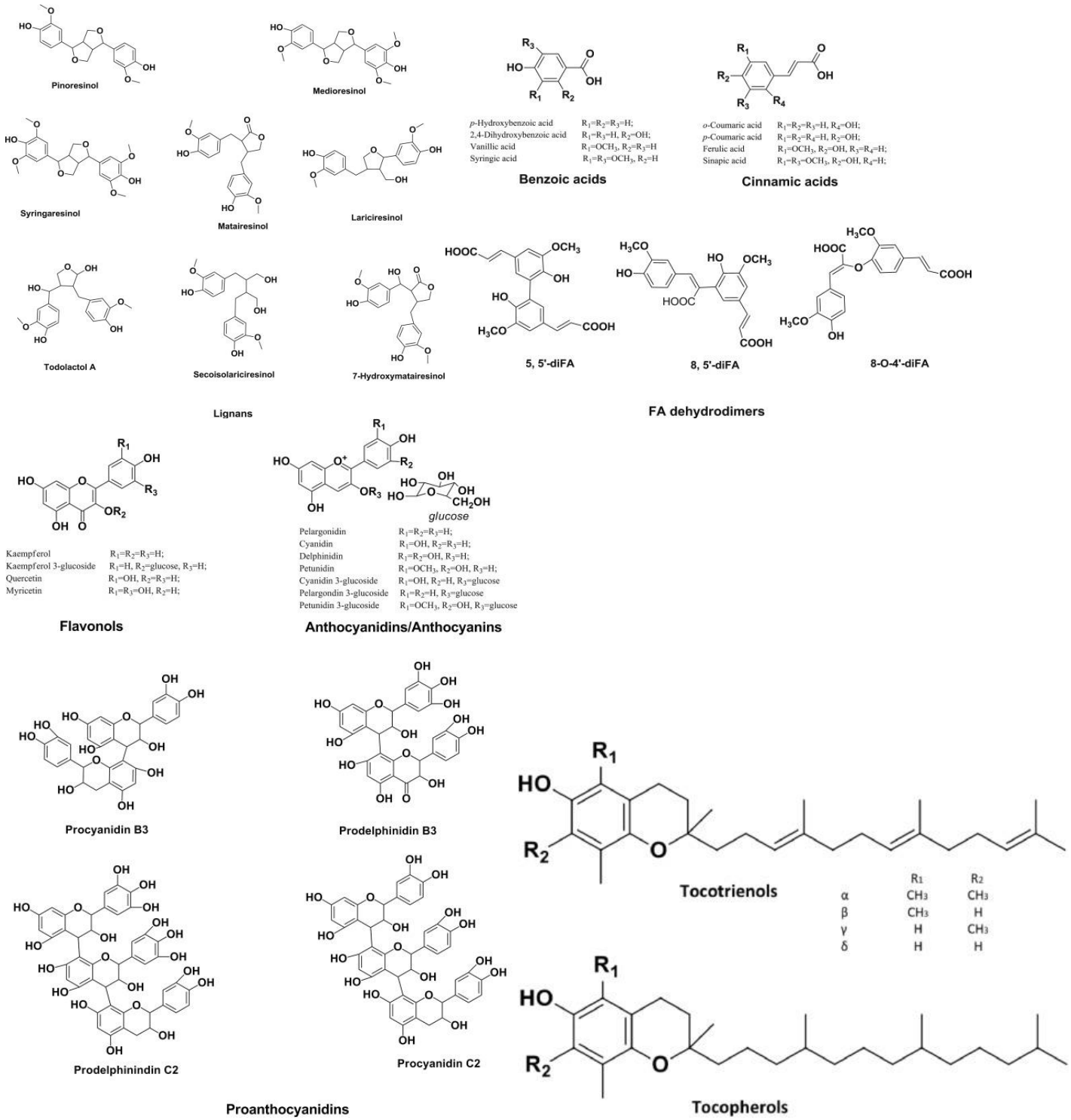
Basic pharmacokinetic of sodium (based on human intake in natural food products): -

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

Basic clinical pharmacology of sodium: -

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

- ***Main chemical structures of barley: -***



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- ***Research: -***

SCIENCE & HADEES REGARDING BARLEY: -

In Hadees it is mentioned that it cleans the digestive system, strengthens the Qalb (heart) & etc: -

Scientists have found the following items during the chemical synthesis of barley- albuminoids, starch, fat, fiber, ash and water. Chemical composition shows that it contains the fat in the form of Leucosine Gluten Albumen, the compound of Nitrogen as palmatic Acid, Salisylic Acid, and Phosphoric Acid. Besides, it contains Hypoxanthens. It contains 4 per cent Proteins, the enzymes for digestion of carbohydrates and vitamins. Some scientists also indicate the presence of Arsenic in the barley grain.

Mechanism of Action according to Pharmacology: -

Gastrointestinal effects: Germinated Barley Foodstuff (GBF) is derived from the aleurone and scutellum fractions of germinated barley. GBF appears to induce proliferation of intestinal epithelial cells and facilitate defecation through bacterial production of short chain fatty acids, especially butyrate. GBF is believed to facilitate epithelial repair and suppress epithelial NFkB-DNA binding activity through butyrate (by the micro flora bifid bacterium and eubacterium). GBF has been associated with increased growth of these micro floras in the intestinal tract & varying amounts of total tocopherols and tocotrienols (49.9-67.6mg/kg) and vitamin E content (vitamin E equivalent; 15.7-20.1mg/kg). Barley products composed of different amylose-amylopectin ratios (7-44% amylose) have been reported to lower metabolic responses

Anti-carcinogenic effects: Lunasin, a novel, cancer-preventive peptide found in barley, internalizes into mammalian cells within minutes of exogenous application and localizes in the nucleus after 18 hours. It inhibits acetylation of core histones in mammalian cells. Lunasin does not affect the growth rate of normal and established cancer cells, but is selective for cells being transformed or newly transformed by binding to deacetylated core histones exposed by the transformation event, disrupting the dynamics of histone acetylation-deacetylation and leading to cell death.

Barley as a Antihypertensive: - Barley has predominantly insoluble fiber and soluble fiber in a whole-grain, it is a diet helpful for blood pressure & lowers cholesterol. Two barley products, barley oil and brewer's spent grains (BSG), neither of which contains soluble fiber, have been investigated for their potential positive impact on lipid metabolism. Brewer's spent grains (BSG) is a by-product of the brewing industry and typically contains 98% insoluble dietary fiber and is high in protein (20-30%) and lipid (6-10%) and contains three times more tocotrienols than the whole grain. The combined animal and human studies on barley oil and brewer's spent grains suggest that some components, possibly the tocotrienols which are an antioxidant, have the ability to affect lipid controlling enzymes and lower the cholesterol. Plasma lipid-lowering effects of barley have been attributed to rich amounts of beta-glucan, a water-soluble fiber. The beta-glucan component of barley has slow gastric emptying time, prolong the feeling of fullness, and stabilize blood sugars. Other contributory factors may be d-alpha-tocotrienol. In chicks, high protein barley flour (HPBF)-based diets increase body weight (18%), suppress HMG-CoA reductase (-36%), impair fatty acid synthetase (-40%), and decrease serum triglyceride (-9%) and cholesterol levels (-23%).

Glycemic/insulinemic effects: Barley contains more fermentable carbohydrate than other cereals such as rice. Fermentation of undigested carbohydrate produces short chain fatty acids, some which may reduce hepatic glucose production and affect postprandial glycemia. Because of viscous properties of beta-glucans, boiled flours appear to produce higher glucose and insulin responses when compared with milled kernels. According to a controlled study in 18 lean, healthy men ingesting barley beta-glucan given with high- carbohydrate food and high-carbohydrate drinks, beta-glucan significantly decreased glycemic and insulinemic responses on the food ($p<0.05$) but not on the drink ($p>0.05$) treatments, compared to controls. In another study comparing crackers and cookies made of whole wheat or barley, the barley crackers and cookies had glycemic indices of 49 and 34, respectively, whereas whole wheat crackers and cookies had 78 and 81, respectively.

- ***Conclusion: -***

Barley is the oldest and the richest functional food among global cereals. Its grains are rich in *β*-glucan; polyphenols (phenolic acids, flavonoids, and anthocyanins), polysaccharide (arabinoxylan), phytosterols (*β*-sitosterol, campesterol), tocols (*β*-tocotrienol, *α*-tocotrienol, *β*-tocopherol, *α*-tocopherol), resistant starch, alkaloid, GABA, folates, linoleic acid, phytate, and so on. This review paper summarizes the obvious efficacy of barley grains that includes antidiabetes, antiobesity, anticancer, antioxidants, anti-inflammation, immunomodulation, cardioprotection, gastroprotection, and hepatoprotection properties, and also, barley grains can lower blood pressure; prevent cardiovascular diseases; optimize cholesterol; improve bowel health and metabolic syndrome; prevent heart disease; reduce chronic kidney disease; decrease stroke; alleviate allergic rhinitis and atopic dermatitis; and accelerate wound healing activities.

Barley grains, grass, straw, husk, bran, and fine powder are rich in 30 ingredients and food structure to defeat chronic diseases during human migration, especially molecular mechanisms of six functional ingredients barley grass (GABA, flavonoids, SOD, K-Ca, vitamins, and tryptophan) and grains (*β*-glucans, polyphenols, arabinoxylan, phytosterols, tocols, and resistant starch) involve to combat more than 20 chronic diseases. These results suggest that barley plays an important role in a healthy diet and in the promotion of early human intelligence. In particular, the healthy effects of functional components of barley grains and grass are the result of long-term continuous evolution of early hominids (fruits/vegetables and leaves rich in polyphenols, K-Ca, and vitamins), Neanderthals (mushrooms and nuts rich in polysaccharides, phytosterols, and linoleic acids), and *Homo sapiens* (grasses and seeds rich in GABA, enzymes, and resistant starch), which associate with modern humans originating in the progenitor of African *Homo sapiens* with cognitive hominin, especially after interbreeding between *Homo sapiens* and Neanderthals that took place in the Middle East. The migration route from Africa to Asia and then to Eurasia is basically consistent with the origin and spread of barley and its domestication path, which indirectly supports that barley against stress (drought, cold, and salt) enriched with functional ingredients prevented chronic disease from ancient humans to modern people. Fertile Crescent is the concentrated area of wild barley and the distribution area of ancient Babylonian civilization and ancient Egyptian civilization, among which Jerusalem is the holy place of Judaism, Christianity, and Islam. These results indirectly support this great contribution of barley for promoting world civilization.

The polyphenols in fruits/leaves and polysaccharide in mushrooms/nuts as well as GABA in grass/seeds for prevention of chronic disease are associated with depending functional ingredients for diet from Pliocene hominids in Africa to modern humans. Ethiopia and Morocco in Africa are top choices for cradle of modern humans *Homo sapiens* and Miocene *hominoids* as well as are the centers of origin for functional barley. Food shortages and survival struggles caused by climate change were the causes of early human evolution associated with GABA in the barley grass increased sharply under environmental extremes from Africa to Asia and later to Eurasia, especially GABA in crop diets suiting environmental extremes improved intelligence. These results support findings that barley and its grass may be the best functional food crop, especially barley prevents over 20 human chronic diseases based on six functional ingredients of barley grass and grains due to three aspects of the scientific basis, i.e., the similar origin and evolution center of barley and human, the promotion of human intelligence in the early stage, and the sum of staple foods for early hominids and Neanderthals as well as *Homo sapiens*.

We put forward the strategy of increasing the functional ingredients of barley grain and its grass powder that is as follows: (1) exploration of excellent germplasm with high functional ingredients in barley; (2) breeding excellent cultivars with high functional ingredients in barley; (3) optimization of ecological conditions for high functional ingredients of barley. In addition, the functional ingredients of different parts of barley grain and the functional ingredients of different grass cutting stages are different.

Although therapeutic mechanisms of functional ingredients in barley grains and grass powder for prevention of human chronic diseases seem a very complicated task, and functional food for therapeutic interventions opens up new ways, it is necessary to find further scientific evidence that demonstrates the health effects of functional ingredients of barley and their extracts from barley on the treatment of chronic diseases. Barley is one of the most exciting potential natural sources for the development of functional foods and new drugs with improved efficiency and safety. Although we have found some relationship of origin and migration between human and barley, especially preventive role of barley for chronic diseases of human beings, it is necessary to conduct more systemic studies to unravel coevolutionary interconnection mechanism between chronic diseases prevention and human diet for barley functional foods. Unfortunately, so far there, is no evidence provided of barley evolving as part of evolutionary consumption. Barley plays an important role in promoting the development of functional food and has a potential underlying molecular mechanism and formation as well as action mechanism, which is worthy of further study. This review can be used as a starting point for novel nutraceuticals and functional foods and drugs for barley to improve the prognosis of chronic diseases.