DIETARY SUPPLEMENTS
COMPOSITION OF FOOD SUPPLEMENTS

Dietary Supplements - vitamin, mineral or vitamin and herbal supplements alone and / or combined in the form of tablets, powders for oral administration together with food or added to food within physiological norms for further comparison with the conventional power consumption of these substances;

Dietary supplements also include or contain different substances or mixtures of substances, including proteins, carbohydrates, amino acids, edible oils and extracts of plant and animal materials, which are deemed necessary or useful for nutrition and general health.

Dietary supplements depending on the effect divided **into *three* groups:**

1. **PARAPHARMACEUTICALS**
2. **NUTRACEUTICAL**
3. **PROBIOTICS**

Nutraceutical can be defined as A food or part of food or nutrient, that provides health benefits, including the prevention and treatment of a disease. Nutraceuticals - dietary supplements used to correct the chemical composition of human food (additional nutrient sources):protein, amino acids, fats, carbohydrates, vitamins, minerals, dietary fiber). **The goal** of using nutraceuticals is improvement human nutritional status, health improvement and prevention of a number of diseases.
Nutraceuticals are divided into dosage forms according to their direction of exposure, intended to:

- prevent chronic diseases
- improve health
- delay the aging process
- increase life expectancy
- maintain the structure or function of the body.

Nutraceuticals, main ingridients:

- Vitamins
- Vitamin-like substances
- Amino acids or peptide complexes
- Food fibers
- Trace elements
- Macronutrients
- PUFA (polyunsaturated fatty acids)

Parapharmaceuticals - dietary food supplements that are recommended to improve the health and prevention of disease, and not for the treatment.

Depending on the origin of the major components of the DS is divided into

- plant extracts, whole plant parts (herbal drugs)

- bee products,
- seafood,
- animal extracts,
- mineral components,
- fermentation products,
- products of biotechnology,
- synthetic analogues of natural nutrients
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Classification of Dietary supplements (DS) based on biological ac**tion**

1. Dietary supplements that affect on the central nervous system
2. DS that affect on tissue metabolism
3. DS- sources of minerals
4. DS- support immune system function
5. DS - sources of antioxidant action of substances and substances that affect the energy metabolism
6. DS that affect the function of the cardiovascular system
7. DS that support function of the respiratory system
8. DS that support digestion organ function
9. DS for control body weight
10. DS supporting function of the genitourinary system
11. DS that support function of the muscular-skeletal system
12. Ds that affect on humoral factors of metabolism regulation
13. DS that affect lactation
14. DS that influence the process of detoxification and promotes the excretion of foreign and toxic substances
15. Supplements of various groups

Top Ten U.S. Herbal Supplements (best saller)

- 1.) Soy (Glycine max)
- 2.) Cranberry (Vaccinium macrocarpon)
- 3.) Garlic (Allium sativum)
- 4.) Ginkgo (Ginkgo biloba)
- 5.) Saw Palmetto (Serenoa repens)
- 6.) Echinacea (Echinacea purpurea)
- 8.) Milk Thistle (Silybum marianum)
- 7.) Black Cohosh (Cimicifuga racemosa)
- 9.) Ginseng (Panax ginseng) 3 species sold in the U.S.
- 10.) St. Johns Wort (Hypericum perforatum)

Dietary supplements Probiotics

Eubiotics is a dietary supplement in the form of living microorganisms and (or) substrates and (or) products of their metabolism, which when introduced into the human body have a normalizing effect on the composition and biological activity of the microflora and motility of the digestive tract.

Probiotics are living organisms that are used in adequate quantities to restore microbiocenoses.

Prebiotics are carbohydrates that are not broken down in the upper gastrointestinal tract, as well as other foods that serve as a source of nutrition (substance) for the normal gut microbiota.

Synbiotics - therapeutic and prophylactic agents that contain jointly probiotics and prebiotics, ie bifidobacteria and lactobacilli together with the substrate for their reproduction

Comparative analysis of drugs and dietary supplements

The comparison criterion	*The drug*	*Food Supplement (Dietary Supplement)*
Purpose of the application	Prevention, treatment and diagnosis of diseases	Health promotion, disease risk reduction, diet therapy, health food
Indications to application	Nosological form of the disease	Optimization of metabolism and functional state of individual organs and systems
Composition	Mono-and multicomponent mixtures of medicines and excipients	Individual nutrients, plant raw materials or multicomponent mixtures
Dosage	Depends on the pharmacological properties of the substance, the age and condition of the patient	Acceptable daily intake dose approved by chief state sanitary doctor (in Ukraine)
Mode of application	Oral, sublingual, parenteral, etc.	Only orally with food
Product form	Various medicinal forms	Granules, tablets, powders, liquids for internal use in conjunction with food
Effectiveness	Determined on the basis of pharmacological studies	Determined on the basis of information about action of the ingredients or permission for application of a particular supplement
Safety	Determined by carrying out of the complex of toxicological and medical-biologic researches	Approved label; dependence "dose-response" has not been experimentally established
Side effects	Specifically listed	Of a general nature
Bioavailability	Clinical studies	Not established
Quality control	According to normative documents	Sanitary-Epidemiological Conclusion (in Ukraine)
Registration authority (in Ukraine)	State Pharmacological Center of the Health Ministry of Ukraine	State Sanitary and Epidemiological Service of Ukraine

In the composition of dietary supplements includes biologically active substances, components and food components that are their source and no harmful effects on human health when used in the manufacturing process of dietary supplements.

1. Proteins, protein derivatives (animal, vegetal or other origin), protein isolates, protein concentrates, protein hydrolysates , amino acids and their derivatives.

2. Fats , fat-like substances , and its derivatives.

- Vegetable oils - sources of essential polyunsaturated fatty acids, phytosterols, phospholipids , fat-soluble- vitamins.
- Fish fat and fat of marine animals - sources of polyunsaturated fatty acids, phospholipids, fat-soluble vitamins.
- Sterols isolated from food raw materials,
- Medium- chain triglycerides,
- Phospholipids and their precursors, including lecithin, cephalin, choline, ethanolamine,

3. Carbohydrates and their products.

- Dietary fiber (cellulose, hemicellulose, pectin, lignin, gums, etc.).
- Polyglycoseamin (chitosan, chondroitin sulfate, glucosamine glycans, glucosamine),
- Starch and its products of hydrolysis.
- Inulin and other polyfructozans,
- Glucose, fructose, lactose, lactulose, ribose, xylose, arabinose.

4. Vitamins, such as vitamins and coenzymes, substances: vitamin C (ascorbic acid, its salts and esters), B_1 (thiamine) , B_2 (riboflavin, flavin mononucleotide) , B_6 (pyridoxine, pyridoxal, pyridoxamine and phosphates), PP (nicotinamide , nicotinic acid, and salts thereof), folic acid, vitamin B12 (cyanocobalamin, methylcobalamin), pantothenic acid and its salts, biotin, vitamin A (retinol and its esters), carotenoids (β- carotene , lycopene , lutein , etc.), vitamin E (tocopherols, tocotrienols and their esters), vitamin D and its active forms of vitamin K, para-aminobenzoic acid, lipoic acid, orotic acid, inositol, metilmetioninsulfonil , carnitine, pangamic acid.

5. Minerals (macro-and trace elements): calcium, phosphorus, magnesium, potassium, sodium, iron, iodine, zinc, boron, chromium, copper, sulfur, manganese, molybdenum, selenium, silicon, vanadium, fluoride, germanium, cobalt.

6. Minor components of food.

- The enzymes of vegetable origin or produced by biotechnological methods on the basis of microbial synthesis.
- Polyphenol compounds including with strong antioxidant effect: bioflavonoids, anthocyanidins, catechins.

Natural metabolites : succinic acid , α- keto acids , ubiquinone , citric acid, fumaric acid, tartaric acid, ornithine, citrulline, creatine, betaine, glutathione, taurine, malic acid, indoles, isothiocyanates, octacosanol, chlorophyll, terpenoids,

iridoids, resveratrol, stevioside.
7. Probiotics (in monocultures and associations) and prebiotics.
- Bifidobacteria species including infantis, bifidum, longum, breve; Lactobacillus, species including acidophilus, fermentii, casei, plantarum, bulgaricus etal .; Lactococcus; Streptococcus thermophilus; Propionibactrium.
- oligo - and polysaccharides of various classes (fructooligosaccharides, galacto- naturally occurring microbial synthesis , etc.).
- biologically active substances - immune proteins, and enzymes, glycopeptids, lysozyme, lactoferrin, lactoperoxidase, bacteriocins of lactic acid microorganisms, except for preparations of human tissues and body fluids.

8. Plants (food and medicinal), products of sea, rivers, lakes, reptiles, arthropods, mineraloorganic or natural mineral substance (dry, powdered, pelletized, encapsulated form, in the form of aqueous, alcoholic , fat dry and liquid extracts, tinctures, syrups, concentrates, balsams): mummy, spirulina, chlorella, and inactivated yeast hydrolysates, zeolites.
9. Bee products: royal jelly, propolis , wax, pollen, bee bread.

Information about some of the minor components of food that are used in the composition of dietary supplements are presented **in Table** about some of the raw materials of animal and vegetable origin - **Table**.

Table

Components of food supplements

Component	Chemical nature	Physiological effect
Lecitin	Phospholipid, choline ester and diglitceridphosporic acids	Antioxidant. It is necessary for the normal functioning of the nervous system and liver
Chitosan	Amonopolysaccharide, derivatives of glucose-amine	Binds the fat in the digestive tract, improves peristalsis, has antimicrobial, hemostatic and regenerating activity
Chondroitine sulphate	Glycoseamonoglycan, derivatives of glucose-amine	Specific components of the cartilage, stimulates the synthesis of hyaluronic acid, has analgesic, anti-inflammatory and chondroprotective activity
Glucoseamine	Aminimonosaccharide	Component of metabolism of cartilage and synovial fluid; chondroprotector
Succinic acid	Dibasic saturated carboxylic acid	Involved in the processes of cellular respiration; has adaptogenic activity, increases appetite and physical performance, accelerates the oxidation of ethanol
Betain	Trimethyl derivative of glycine	Donor of methyl groups in the processes of intermediary metabolism; hepatoprotector
Taurin	Sulphoacid	Emulsifier bile, possesses anticonvulsant, hepatoprotective, cardiotonic and hypotensive activity
3-hydroxymethyl-indole (indole-3-carbinol)	Indole derivative	Used in the prevention and treatment of estrogen-dependent tumors and papillomatosis

Chlorophylls	Magnesium-containing porphyrin derivatives	Have regenerating activity, stimulate hematopoiesis
Resveratrol	Phenol	Prevents and slows the development of malignant tumors of the skin and gastrointestinal tract, has anti-inflammatory, hypoglycemic, lipid-lowering, antiviral activity
Ornitin	Aminoacid	Possesses hepatoprotective and detoxifying activity

Drugs of herbal and animal origin which is a component of food supplements

Raw material (herbal drug)	Chemical composition	Pharmacological effect
Lady's Mantle herb- *Alchemillae Herba*	Tannins, flavonoids (catechins leycoantocyanidins) hydroxycinnamic acids	It has antioxidant, strengthens capillary, diuretic, regenerating activity
Meadowsweet herb - *Filipendulae ulmariae Herba*	Tannins, flavonoids (spireoside, hyperoside, avicuyarin etc.), phenol carboxylic acids (caffeic, ellagic), in flowers - essential oil	Has vasoprotective, anti-inflammatory, anti-ulcer, anti-stress, gastric, antacid, anti-inflammatory, anti-rheumatic action
meadowsweet rhizome and root *Filipendulae hexapetalae Rshizomata et radices*	Phenologlicoside gaulterin, tannins (33%), starch, flavonoids, ascorbic acid	Included in the antitumor herbal mixture by the prescription M.N. Zdrenko. Exhibits hepatoprotective, antioxidant and hemostatic activity
Hibiscus flower, Red-sorrel, Carcade - *Hibisci Flores*	Carboxylic acid (hibiscus acid), anthocyanins, flavones, mucilages, pectin	Used to improve appetite, as a mild laxative, diuretic, hypotensive and cholagogue, to treat circulatory disorders
Horrehound black herb - *Ballotae Herba nigrae*	Iridoids, diterpenes (marubiin, ballonigrin, ballotenol etc.), flavonoids, phenol carboxylic acids, phenolic glycosides (acteoside, acetilacteoside, essential oil	Antiemetic, sedative, astringent agent
Archangel root - *Angelicae Rhizoma et radix*	To 1.5% essential oil in its composition: fellandren, pinene, limonene, borneol, myrcene, linalool, p-cymene, caryophyllene; phurocumarin: ostol, bergapten arhangelitsin, apterin, marmezin, xanthotoxin, imperatorin, etc.	Bitterness, antispasmodic and diaphoretic agent
Lovage root - Levistici Radix	Essential oil (0.2-1.7%), which is composed of phtalids and terpenes: α-and β-pinene, carvacrol, α-and β-phellandrene, α-and β-terpinene, camphene, myrcene; furocumariny - psoralen, bergapten, and sitosterol and β-sitosterol-3-O-glycoside, resin, ferulic, caffeic and angelic	Antispasmodic, carminative and diuretic agent. Increases appetite.

	acids.	
Centella herb , Gotu cola (smart herb) - Centellae asiaticae Herba	Essential oil (pinene, myrcene, etc. mono-and sesquiterpenoids); triterpene saponins – barrigenol, asiaticoside and derivatives; flavonoids (rutin, kaempferol, quercetin, etc.), alkaloids, tannin, an amino acid	Adaptogen. Strengthens blood vessels, stimulates metabolism and is used as a diuretic, antiseptic, laxative, antirheumatic agent.
Ash tree leaves - Fraxini Folium	Chlorogenic, neochlorogenic acids, triterpenoids (ursolic acid, ornol), coumarins (esculin, esculetin, fraxin, tsihoriin), flavonoids (rutin, quercetin 3-glucoside)	Diuretic and cholagogue agent.
Garlic bulb - Allii sativi Bulbus	Alliin (S-methyl-L-cysteine sulfoxide), polysaccharides (fructans mainly), protein, free amino acids, essential oils, vitamin C, carotenoids, carboxylic acid, flavonoids	Exhibits hypoglycemic, hypocholesterolemic, anticoagulant, antihypertensive, antibacterial, antifungal, expectorant, diuretic effects
Iceland moss - Cetrariae islandicae Tallus	Lichen acid (3-5%), water-soluble carbohydrates (30-70%), the bulk of which is lihenin (linear polymer of β- D-glucose), galactomannan, a bitter substance tsetrarin, ascorbic and folic acid	Exhibits wound healing, antiseptic, activities, increases appetite. Used as a general tonic agent.
Ihsphagula husk - Plantaginis ovatae Seminis tegumentum	Mucilage (10-30%) - a mixture of polysaccharides on the base of xylose, arabinose, aldobiouronic acids, monoterpene alkaloids - boshniakin, boshniakinic and indikainin acid; iridoid glycoside aucubin, sugars, sterols, triterpenoids of amirin type, fatty acids, tannins.	Exhibits a mild laxative effect, used in the treatment of chronic constipation, dysentery, diarrhea and cystitis.
Mullein flower - Verbasci Flores	Polysaccharides (3.5% mucilage, gum), verbascosaponin, flavonoids (apigenin, luteolin and the 7-O-glucoside, kaempferol, rutin, hesperidin, verbaskoside) fenokarbonovye acid iridoids (aucubin, katalpol) essential oils, carotenoids, ascorbic acid, sterols, digiprolakton, choline, tannins	It is used as an expectorant agent
Serenoa fruit –Sabalis serrulatae Fructus	Invert sugar, mannitol, polysaccharides, fatty oils, steroids (β-sitosterol, stigmasterol, daukosterol), flavonoids, resins,	Used to treat benign prostatic hyperplasia. It has anti-inflammatory, anti, anti-androgenic, anabolic, immunostimulant and

	tannin, volatile oil	antispasmodic action.
Pygeum bark - Pruni africanae Cortex	Docosanol, fatty acids, sterols (β-sitosterol, sitosterol daukosterin), triterpene compounds including ursolic acid fridelin 2 - α-hydroxyursolic and oleanolic acid, epimaslinic acid	It is used to treat benign prostatic hyperplasia.
Olive leaves - Oleae Folium	Secoiridoids (oleuropein, oleuroside), flavonoids (rutin, hesperidin, apigenin, luteolin, chrizeriol, quercetin and their glycosides)	Leaf preparations decrease blood pressure, provide a wide range of antimicrobial and antiviral action, exhibit hypoglycemic, hypolipidemic and hypocholesterolemic, immunostimulatory and vasodilatory properties
Devil's claw root - Harpagophyti Radix	Iridoid glycosides (harpagoside, garpagid etc.); flavonoids (kaempferol, luteolin), triterpene glycosides, carbohydrates	Anti-inflammatory, cardiotonic, antiarrhythmic agent.
Mangosteen bark – Garciniae Cortex	Hydroxycitric acid, other organic acids, β-carotene, vitamin C.	It normalizes fat metabolism, has a diuretic effect
Cimicifuga rhizome – Cimicifugae Rhizomata	Phytoestrogens, phytosterol, and organic acids, starch, tannins, alkaloids, triterpene glycosides, phenolic compounds, gum, aromatic acids, saponins, flavonoids.	Has estrogenic and sedative effect
Cocklebur herb – Agrimoniae Herba	Essential oil, coumarin, steroid saponins, bitter, sugar, tannins, flavonoids, silicic acid.	Astringent, analgesic, diuretic and choleretic properties.
Tormentil white rhizome –Potentillae albae Rhizoma	Tannins, carbohydrates (starch), iridoids, saponins, phenol carboxylic acids, flavonoids (quercetin), macro-and micronutrients.	It helps eliminate thyroid function, increases diuresis
Couchgrass rhizome – Elytrigiae Rhizomata	Carbohydrates, saponins, mucilage, mineral salts, organic acids, and vitamins.	Preparations wheatgrass rhizomes have laxative, expectorant, anti-inflammatory effect; strengthen the walls of blood vessels.
Rooibos leaves – Aspalathi linearis Folia	Essential oil, phenol carbonic acids, flavonoids, macro-and microelements	Antioxidant, exhibits antiseptic, antispasmodic, sedative and antihypertensive activity.
Stevia (sweet herb)– Steviae Herba	Sweet glycosides - steviosides, polysaccharides, pectin, vitamins and minerals.	Sweetener

Marsh cinquefoil root –Comari Rhizomata cum radicibus	Tannins, derivatives of phenilcarbonic acids, flavonoids, vitamins, minerals	It has anti-inflammatory, cytotoxic, immunomodulatory and anticoagulant properties
Common comfrey root–Symphyti Radix	Alkaloids tsinoglossin liziocarpin, tannins, resins, gums, mucilage	Has antimicrobial, anti-inflammatory, hemostatic, regenerating, astringent and protective action
Mistletoe – Viscum album	Flavonoids, organic acids, aminoacids, resins, tannins, alkaloids, saponins, viskotoxin acetylcholine and viskol, vistserin, vitamin C, choline, beta-carotene, micro-and macroelements	Has a tonic, vasodilator, hemostatic, anti-inflammatory, wound healing, analgesic, anthelmintic, astringent, sedative and diuretic, used for the gastrointestinal, pulmonary, nasal, and uterine bleeding, hypertension.
Myrtle leaves – Myrti Folia	Essential oil (eugenol, cineol, camphor, etc.), resin, tannins, amino acids	It has bactericidal, immunomodulatory, expectorant and sedative effects
Ginger rhizome – Zinziberi Rhizoma	Essential oil - 1.5-3% (contains sesquiterpenoids zingiberen and camphene, cineole bizabolen, borneol, citral, linalool), resins, vitamins C, B1, B2.	Antiseptic and anti-inflammatory agent, it is used for motion sickness, gastric ulcer, to increase appetite and improve digestion, atherosclerosis, disorders of lipid and cholesterol metabolism, for the normalization of the blood vessels.
Red clover herb – Trifolii pratensis Herba	Isoflavonoids, Tannins, lipids, coumarins, saponins, vitamins, micro- elements	Used as a tonic, stimulates the immune system, has antibacterial, anti-toxic and analgesic effect. It used red clover for symptoms of menopause such as hot flashes; forbreast pain or tenderness (mastalgia); and for premenstrual syndrome
Fodder galega herb– Galegae Herba	Alkaloids (galegin), saponins, nitrogen-containing compounds, bitter tannins, organic acids (caffeic, coumaric, sinapic), vitamins	In folk medicine - as antidiabetic agent, is also used to increase lactation, as a diuretic and diaphoretic agent.
Fruits and leaves of grape – Vitis Fructus, Folium	Flavonoids, sugars, vitamins, organic acids, phenols (including *resveratrol*)	Anti-oxidant
Spirulina	Chlorophylls, β-carotene, protein, vitamins	Adaptogen, detoxicant, radioprotector
Chlorella	Chlorophylls, β-carotene, vitamins, minerals, dietary fiber	Adaptogen
Shiitake (Lentinula edodes) (mushroom)	Amino acids (including essential), micro and macronutrients, fatty acids, polysaccharides, vitamin D.	Immunostimulant and adaptogenic agent
Reishior, Lingzhi-Ganoderma	Essential and nonessential amino acids, organic acids, fatty acids, polysaccharides, triterpenoids,	It has immunomodulatory, antibacterial, antifungal, antiviral, anti-atherosclerotic effect

	coumarins, saponins, vitamins (B group, C, D), flavonoids, alkaloids, macro- and microelements	
Brewer's yeast-Saccharomyces	B vitamins, amino acids, trace elements	Stimulate the immune system, have regenerating activity
Mumie	Macro and micro elements (phosphorus, potassium, calcium, iron, etc.), carboxylic and amino acids	Biostimulyator. Exhibits anti-inflammatory and regenerative activity
Propolis (bee glue)	Flavonoid aglycons , Polyphenols, steroids, macro and micronutrients, vitamins, amino acids	It have antimicrobial, anti-inflammatory, analgesic activity and regenerating
Royal Jelly (Queen Jelly)	Proteins, fats, carbohydrates, vitamins, minerals, steroids, acetylcholine	Adaptogen, immunomodulator
Honey, Mel	Carbohydrates (mainly fructose and glucose), flavonoids, vitamins, enzymes	It has immunomodulatory, regenerating and antiseptic activity, improves metabolism
Pollen (bee pollen)	Vitamins, proteins, amino acids, macro and micronutrients	Adaptogen, an immunomodulator. It has hypolipidemic activity