

UDC 615.2796

Igor BELENICHEV

D. Sc. in Biology, Professor, Head of the Department of Pharmacology and Medical Formulation with Course of Normal Physiology, Zaporizhzhia State Medical and Pharmaceutical University, Stalevariv str., 31, Zaporizhzhia, Ukraine, 69035 (i.belenichev1914@gmail.com)

ORCID: 0000-0003-1273-5314

SCOPUS: 6602434760

Nadiya GORCHAKOVA

D. Sc. in Medicine, Professor, Professor at the Department of Pharmacology, Bogomolets National Medical University, Beresteysky ave., 34, Kyiv, Ukraine, 03057 (gorchakovan1941@gmail.com)

ORCID: 0000-0001-7311-7347

SCOPUS: 7003895729

Natalia SAVCHENKO

Ph. D., Associate Professor, Associate Professor at the Department of Pharmacology, Bogomolets National Medical University, Beresteysky ave., 34, Kyiv, Ukraine, 03057 (farma.savch@ukr.net)

ORCID: 0000-0003-3392-6638

Natalia YAKOVLEVA

Ph. D., Associate Professor, Associate Professor at the Department of Pediatrics, Pediatric Infectious Diseases, Immunology and Allergology, Shupyk National Healthcare University of Ukraine, Dorogozhitska str., 9, Kyiv, Ukraine, 04112 (n.yakovlevay@gmail.com)

ORCID: 0000-0002-8578-2501

Iryna VARAVKA

PhD in Medicine, Head, Municipal Institution “Zaporizhzhia Medical College” of the Zaporizhzhia Regional Council, Orihiv highway, 14, Zaporizhzhia, Ukraine, 69600

Pavlo VARVANSKYI

Head of the Department of Pharmacy, Municipal Institution “Zaporizhzhia Medical College” of the Zaporizhzhia Regional Council, Orihiv highway, 14, Zaporizhzhia, Ukraine, 69600 (vincoslav@ukr.net)

Kyrylo BELENICHEV

Lecturer, Municipal Institution “Zaporizhzhia Medical College” of the Zaporizhzhia Regional Council, Orihiv highway, 14, Zaporizhzhia, Ukraine, 69600 (venalainen17@gmail.com)

DOI 10.32782/2522-9680-2023-3-13

To cite this article: Belenichev I., Gorchakova N., Savchenko N., Yakovleva N., Varavka I., Varvanskyi P., Belenichev K. (2023). Roslynni ta inshi adaptoheny z aktoprotekornymy vlastyvostiamy (fitopreparaty ta kharchovi dobavky) [Vegetable and other adaptogens with actoprotective properties (phytodrugs and food supplements)]. *Fitoterapiia. Chasopys – Phytotherapy. Journal*, 3, 13–20, doi: 10.32782/2522-9680-2023-3-13

**VEGETABLE AND OTHER ADAPTOGENS WITH ACTOPROTECTORY PROPERTIES
(PHYTODRUGS AND FOOD SUPPLEMENTS)**

Actuality. The article, based on its own research and data from the literature, showed that in conditions of excessive loads in military and other extreme situations (hypoxia, cooling, immobilization stress, during training, in certain diseases, critical conditions) the demands on the functional systems of the body increase, as well as individual bodies. In this case, it is necessary to introduce protective low-toxic agents with adaptogenic activity.

The aim of the research. Bring the existing classification dietary supplements with actoprotective properties.

Research materials and methods. Analysis of data from domestic and foreign literature, information from printed and electronic publications.

Research results and their discussion. The appointment of metabolitotropic agents, including phytodrugs at extreme loads, led to a partial, and sometimes to a complete recovery of the functions of the affected organs and systems.

As it was shown, individual metabolotropic phyto remedies restore individual functions, and for a more active effect on function and metabolism, it is necessary to use them in a combination called dietary supplements. Most of the existing approved combined phyto remedies include extracts from plants that have soothing, cardio- and hepatoprotective activity. Therefore, in sports medicine and in other extreme situations, biologically active supplements from plants began to be used. These are combined means that have an adaptogenic effect, after conducting experimental and clinical tests, necessary for permission for their appointment and use as dietary supplements.

Conclusions. The article lists food additives containing synthetic metabolotropic drugs, as well as a complex of phyto remedies with an explanation of the need to create such combinations that can increase performance and resistance to adverse conditions.

Key words: adaptogenic action, ginseng, Eleutherococcus, Chinese lemongrass, Rhodiola rosea, Ginkgo biloba.

Ігор БЕЛЕНІЧЕВ

доктор біологічних наук, професор, завідувач кафедри фармакології та медичної рецептури з курсом нормальної фізіології, Запорізький державний медико-фармацевтичний університет, вул. Сталеварів, 31, м. Запоріжжя, Україна, 69035 (i.belenichev1914@gmail.com)

ORCID: 0000-0003-1273-5314

SCOPUS: 6602434760

Надія ГОРЧАКОВА

доктор медичних наук, професор, професор кафедри фармакології, Національний медичний університет імені О.О. Богомольця, просп. Берестейський, 34, м. Київ, Україна, 03057 (gorchakovan1941@gmail.com)

ORCID: 0000-0001-7311-7347

SCOPUS: 7003895729

Наталія САВЧЕНКО

кандидат медичних наук, доцент, доцент кафедри фармакології, Національний медичний університет імені О.О. Богомольця, просп. Берестейський, 34, м. Київ, Україна, 03057 (farma.savch@ukr.net)

ORCID: 0000-0003-3392-6638

Наталія ЯКОВЛЕВА

кандидат медичних наук, доцент, доцент кафедри педіатрії, дитячих інфекційних захворювань, імунології та алергології, Національний університет охорони здоров'я України імені П.Л. Шупика, вул. Дорогожиська, 9, м. Київ, Україна, 04112 (n.yakovlevay@gmail.com)

ORCID: 0000-0002-8578-2501

Ірина ВАРАВКА

кандидат медичних наук, директорка, КЗ «Запорізький медичний фаховий коледж» Запорізької обласної ради, Оріхівське шосе, 14, м. Запоріжжя, Україна, 69600

Павло ВАРВАНСЬКИЙ

завідувач відділення фармакології, КЗ «Запорізький медичний фаховий коледж» Запорізької обласної ради, Оріхівське шосе, 14, м. Запоріжжя, Україна, 69600 (vincoslav@ukr.net)

Кирило БЕЛЕНІЧЕВ

викладач, КЗ «Запорізький медичний фаховий коледж» Запорізької обласної ради, Оріхівське шосе, 14, м. Запоріжжя, Україна, 69600 (venalainen17@gmail.com)

DOI 10.32782/2522-9680-2023-3-13

Бібліографічний опис статті: Беленічев І., Горчакова Н., Савченко Н., Яковлева Н., Варавка І., Варванський П., Беленічев К. (2023). Рослинні та інші адаптогени з актопротекторними властивостями (фітопрепарати та харчові добавки). *Фітотерапія. Часопис*, 3, 13–20, doi: 10.32782/2522-9680-2023-3-13

РОСЛИННІ ТА ІНШІ АДАПТОГЕНИ З АКТОПРОТЕКТОРНИМИ ВЛАСТИВОСТЯМИ (ФІТОПРЕПАРАТИ ТА ХАРЧОВІ ДОБАВКИ)

Актуальність. У статті на підставі власних досліджень і даних літератури показали, що в умовах надмірних навантажень у разі військових та інших екстремальних ситуацій (гіпоксія, охолодження, іммобілізаційний стрес, під час тренувань, при деяких захворюваннях, критичних станах) підвищуються вимоги до функціональних систем організму, а також окремих органів. У такому разі необхідно вводити протективні малотоксичні засоби з адаптогенною активністю.

Мета дослідження. Привести існуючу класифікацію БАД з актопротекторною властивістю.

Матеріал і методи. Аналіз даних вітчизняної і зарубіжної літератури, відомостей із друкованих та електронних видань.

Результати дослідження. Призначення метаболітотропних засобів, у тому числі фітопрепаратів, за екстремальних навантажень призводило до часткового, а іноді й до повного відновлення функцій уражених органів і систем.

Як було показано, окремі метаболітотропні фітозасоби відновлюють окремі функції, а для більш активного впливу на функцію і метаболізм необхідно вживати їх у комбінації під назвою «БАД». Більшість існуючих затверджених комбінованих фітозасобів включає витяги з рослин, які володіють заспокійливою, кардіо-, гепатопротекторною активністю. Тому в спортивній медицині та у разі інших екстремальних ситуацій почали застосовувати біологічно активні добавки з рослин. Це комбіновані засоби, які проявляють адаптогенну дію після проведення експериментальних і клінічних випробувань, необхідних для дозволу на їх призначення і застосування як БАД.

Висновок. У статті перераховано харчові домішки, які містять синтетичні метаболітотропні препарати, а також комплекс фітозасобів із поясненням необхідності створення подібних комбінацій, які можуть підвищити працездатність та опір до несприятливих умов.

Ключові слова: адаптогенна дія, женшень, елеутерокок, лимонник китайський, родіола рожева, гінкго білоба.

Introduction. Actuality. In critical conditions, which include increased resistance to hypoxic situations and oxidative stress, overloads and other extreme situations, when the activity of vital organs and systems is disturbed, it is necessary to introduce protective low-toxic agents with adaptogenic activity. It has been established that metabolitotropic synthetic agents and phytodrugs can have such an effect, one of the main tasks at the same time is to identify the main points of application from the side of the body's metabolism, which should be affected by both synthetic agents and herbal drugs. On the one hand, the above components dietary supplements must be compatible with each other, on the other – act synergistically, not antagonistically. In all critical conditions, oxidative stress occurs, but at the same time, various types of metabolism (energy, protein, lipid, electrolyte) are disturbed, and a negative effect on the endocrine glands, the immune system, the organs of the cardiovascular system, the digestive tract, and the nervous system is also manifested (Sellami, 2018; Eichner, 2016). There are currently known collections of herbal remedies that can preferentially act on certain types of metabolism. In addition to the proven pharmacological activity and low toxicity of the components of dietary supplements, sports doctors, coaches and athletes should request documents officially confirming the effectiveness of dietary supplements: anti-doping certificate, compliance certificate and other documents in accordance with the legislation of Ukraine.

The aim of the research. Bring the existing classification dietary supplements with actoprotective properties.

Research materials and methods. Analysis of data from domestic and foreign literature, information from printed and electronic publications.

Research results and their discussion. Currently, there are several types of classification of adaptogens (Shaw, 2016; Chen, 2014; Pumpa, 2013; Iannitti, 2016).

Classification of adaptogens with actoprotective properties:

1. Drugs of plant origin:

1.1. Monodrugs: infusion and liquid extract of ginseng, tincture of Chinese lemongrass, liquid extract of Eleutherococcus, liquid extract of leuzea, tincture of aralia, tincture and liquid extract of echinacea, tincture of sterculia, tincture of rhodiola rosea, tincture of zamanicha.

1.2. Combined products: balm “Vyhor”, “Grail” and others.

2. Drugs of animal origin: pantocrine, rantarin and others.

3. Drugs of microbial origin: mumiyo, spirulina.

4. Synthetic agents: L-arginine, succinic acid (Mexidol, Mexicor), carnitine, glutamic acid (Glutargin) and others.

5. Vitamin drugs.

Sometimes the components are classified dietary supplements, which have an adaptogenic effect due to the predominant effect on certain metabolic processes. It was determined that fructose, honey, coenzyme Q, cytochrome C, alpha-ketoglutarate, pyridoxine, citric acid, polymalt extracts, creatinine and some others can act on energy supply during exercise due to the uniform supply of energy due to conversion (burning of carbohydrates) (Slimeni, 2017).

Eicosopentaenoic acid, chromium picolinate, chromium polypicolinate, L-citryl-carnitine, dioxygenin, hexagenin, docosahexaenoic acid, complexes of unsaturated fatty acids, lecithin, linoleic acid, myristic acid, oleic acid, stearic acid and others intensify lipid metabolism and promote fat burning. Means that facilitate amino acid and protein loading – L-methionine, acetyl-L-carnitine, L-alanine, L-arginine, L-histidine, L-aspartic acid, L-glycine, L-glutamic acid and other amino acids, and also ornithine, L-aurine, caseinates, egg white and others.

Means that correct electrolyte metabolism include potassium, calcium, magnesium, sodium, phosphorus, chlorides, talc and others. Vitamins and their complexes with microelements normalize metabolism, ensure

recovery during long-term loads. Such fruits as grapefruit, kiwi fruit, rose hip, ginkgo biloba and others have a similar effect.

Ginseng, ginger, blueberry, palm fruits, egg white, Caucasian hellebore and others affect the endocrine regulation system. Bromelain, artichokes, beet root, artichoke, pectin, licorice root, fennel, garlic and others suppress catabolism processes and help to remove toxins from the body. Stimulate energy processes in the muscles: ginseng, inositol, yohimbe, leuzea, glandular concentrate and others. Bromelain, lipase, fennel, garlic improve digestion. Increase the tone of the nervous system: ginseng, ginger, caffeine, pepper, eleutherococcus and others (Cui, 2022). Increase immunity: immunoglobulin, shark cartilage, echinacea, eleutherococcus, parsley and others. Improve the condition of blood vessels: ginkgo biloba, grape seed extract, green tea extract, Caucasian hellebore, bioflavonoids.

It is necessary to dwell on the properties of some herbal medicines that are often included in the composition of dietary supplements. Ginkgo biloba or tree fern is a representative of the genus Ginkgophytes, which appeared in the Permian period about 280 million years ago. Of all the representatives of this genus, only ginkgo biloba survived due to its excessive resistance to various negative factors (Nash, 2015). It has been used as a food product in China for the fifth millennium. Residents of the East appreciated its properties to prevent premature aging. Even in ancient treatises, the properties of ginkgo biloba fruits to tone and harmonize mental activity, help to sober up in case of intoxication, and remove toxins from the body were noted. Modern experimental and clinical data have established antioxidant, vasculoprotective, nootropic, hepatoprotective, antidepressant effect of biologically active substances of ginkgo biloba, ability to improve blood circulation (Van der Bijl, 2014).

Classic adaptogens include ginseng (*Panax*), *Aralia elata*, *Aralia cordata*, *Oplopanax elatus*, *Eleutherococcus senticosus*, safflower leuzea or *Maralia* root (*Rhaponticum carthamoides*), *Rhodiola* pink (*Rhodiola rosea*), Chinese lemongrass (*Schisandra chinensis*) and some others.

The popularity of these medicinal plants that improve performance has been known for a long time.

Leuzeia (maralium root) came to us from Chinese medicine. At the same time, in recent years, new aspects of the mechanism of its action have been established, and new pharmacological aspects have been discovered. The healing properties of leuzea were learned in Siberia, observing marals, who used maralii root before heavy battles. The hunters of Siberia also knew that using

lemongrass you can go without food for a week. *Aralia*, *Eleutherococcus* was also discovered first by residents, and then by scientists of the East and Siberia.

Medicinal products from deer horns began to be used as early as 3 700 before the birth of Christ. Later, it was found that there are many keratin-containing amino acids in the horns. In the folk medicine of East Asia, crushed spotted deer horns are used for exhaustion, weakness, and anemia. Taking galenic drugs of the indicated phytocompounds and crushed deer antlers increases the body's resistance to a wide range of infectious diseases – these drugs have an established immunogenic effect. They also increase resistance to stress.

Panax ginseng is the oldest adaptogen. Ginseng root contains many useful substances. These are panaxosides A, B, etc., ginsenosides, panaxytriol and others, alkaloids, vitamins, resins, iron, copper, zinc, free amino acids - the full complex of ginseng active substances is still being researched. It is believed that the main components that explain the effect of ginseng are glycosides, which are a complex complex of substances similar in properties. Ginseng has a very wide range of pharmacological properties, but the main ones are its effects on the central nervous system. At the same time, ginseng has an anti-inflammatory effect, affects carbohydrate metabolism, the cardiovascular system, the functioning of the gonads, and improves vision. It is prescribed for neuroses, neurasthenias, psychoses, diabetes, Botkin's disease and other diseases. Ginseng drugs increase gas exchange, stimulate respiratory tissues, lower heart rate, and normalize elevated blood pressure. With high blood pressure, it can prevent the penetration of calcium into the smooth muscle cells of blood vessels, which can lower blood pressure.

In China, seven main effects of ginseng have been identified in recent years (Khan, 2022; Bagherpour, 2022):

- 1) increasing the body's physical strength and relieving fatigue;
- 2) treatment of anemia, hypotension, weakening of cardiac activity;
- 3) calming effect on the psyche – effective treatment of neuroses, neurasthenia, disorders of nervous system functions;
- 4) stimulation of the secretory function, quenching of thirst;
- 5) improvement of lung function and suppression of asthma attacks;
- 6) normalization of the function of the digestive tract, increase in appetite;
- 7) neutralization of poisons, improvement of skin condition.

The effect of ginseng is slow, which partly makes it difficult to determine the effectiveness of the application. It can act differently on organisms with the same diagnosis, the effect is manifested with long-term use of the drug and leads to an improvement in the body's condition in general. With a single dose of the drug in a double or triple dose, fatigue is reduced and work capacity is increased. The stimulating effect of ginseng is most clearly manifested in the increase of mental capacity, while primarily it increases the quality of the completed task (psychological test). Unlike synthetic drugs, ginseng when stimulating the nervous system does not keep the body excited for a long time, its effect is milder. Unlike psychomotor stimulants, ginseng can also be used by healthy people, because after a period of stimulation, it does not increase adverse reactions, does not deplete the body's natural reserves, and helps overcome stress. It enhances the formation of enzymes, normalizes stress-induced biochemical indicators. At a critical moment, a person taking ginseng receives an additional surge of strength. In large doses, ginseng drugs are dangerous: they cause dizziness, difficulty breathing, tremors, bleeding and other disorders. The biggest typical contraindications to taking ginseng are children's age, pregnancy, taking it with other immunostimulating drugs, in acute diseases, on the background of acute inflammatory processes, with high blood pressure, with a tendency to bleeding.

Zamanikha high is taken in the form of galenic drugs, which are prepared from rhizomes and roots. The intake of zamanikha seeds led to an increase in the strength and frequency of heart contractions. In the conditions of the clinic, the low toxicity of the infusion of zamanikha, its stimulating effect on the central nervous system, increased motor activity, reflex activity, increased contraction amplitude and heart muscle tone were established. Tincture of zamanikha is used as a stimulator of the activity of the central nervous system, in neuroses and mental diseases, asthenia, astheno-depressive debilitating diseases, in order to support dietary supplements anger with physical and mental fatigue, with sexual weakness, with some forms of diabetes. Hypotension and depressive states are indications for the appointment of zamanikha tincture. Contraindications include hypertension, fever, heart failure, insomnia.

Levzea safflower or maralium root is used in the form of galenic drugs from leaves, stems and roots in the folk medicine of Altai. They have biologically active substances; alkaloids, ecdystene, sugars, essential oils, phosphoric acid oils, tannins, biological substances, copper. Ecdystene is a steroid compound that is

secreted from leuzea. It has a pronounced anabolic and tonic effect. In general, leuzea drugs have a tonic and stimulating effect. In addition, they increase the force of contractions and muscle performance, improve blood circulation in the muscles and brain. Leuzea tincture is used for functional disorders of the central nervous system, loss of strength, mental and physical exhaustion, when working in extreme conditions, insomnia, diabetes, chronic alcoholism. With long-term use of the drug, self-assessment of the state of health improves, heart rate decreases during physical exertion, physical endurance, hand coordination, and mental performance improves. After a single intake of leuzea extract, they note an improvement in physical performance, a stimulation of the effect on the central nervous system, a hemodynamic response to physical exertion is also reduced, and the recovery period after it is shortened (less than after taking eleuterococcus, but more than after taking ginseng). There are no special contraindications to taking leuzea drugs, but it is not recommended to be taken by patients with schizophrenia, especially during exacerbations.

Fruits, stems, leaves, and shoots are used to prepare galenic drugs from lemongrass. The active substances are monosaccharides, phenolic compounds, mainly catechins, mineral compounds. The tonic power of lemongrass is high, it manifests itself in general fatigue, weakness, increased drowsiness. Lemongrass normalizes blood pressure, suppresses thirst, suppresses appetite and acidity of the digestive tract, eliminates muscle fatigue and pain. It is used as a preventive measure for atherosclerosis and decreased visual acuity. Like other adaptogens, it enhances the process of excitation in the central nervous system, significantly increases physical and mental performance. It is often prescribed to athletes participating in game sports, weightlifters, and wrestlers. Lemongrass drugs are low-toxic, do not cause side effects, but it is contraindicated in case of nervous excitement and insomnia, severe hypertension, heart disorders.

Rhodiola pink or golden root was simultaneously used both in the East and in Europe. Rhizomes containing glycosides, saponins, sugars, tannins, oils, organic acids, fats, wax, flavonoids were used to prepare galenic drugs. Rhodiola drugs have tonic and stimulating activity, they are used in the treatment of diseases of the respiratory tract, neurosis, asthenic states, hypotension, they reduce pain in the heart, fatigue, and increase work capacity. Rhodiola rosea and Eleutherococcus significantly increase the tone of skeletal muscles, with long-term administration significantly improve muscle strength. At the same time, Rhodiola rosea drugs normalize the activity of the cardiovascular system and increase

mental capacity. It is believed that the drugs of *Rhodiola rosea* mainly affect the nuclei of the hypothalamus and the cortex of the large hemispheres.

Indications for prescribing *Rhodiola rosea* drugs are considered to be:

1) use as a psychostimulant for fatigue and during the rehabilitation period, for somatic and infectious diseases;

2) for taking by healthy people with a tendency to asthenia during work that requires increased mental stress and also during preparation for future work;

3) to support performance during performance and recovery during heavy physical exertion (Lu, 2022; Tinsley, 2023; Liu, 2023).

Rhodiola rosea in galenic drugs is low-toxic. Among the contraindications are high blood pressure, emotional temperature and excitement.

Eleutherococcus prickly is used in the form of a liquid extract. A rhizome with roots is used to make a galena preparation. active substances eleutherosides (A, B, B1, C, D, etc.), pectin substances, polysaccharides, sugars, coumarin derivatives, flavonoid and essential oils, vegetable wax, resins, starch. *Eleutherococcus* increases physical and mental performance, resistance to harmful environmental factors. *Eleutherococcus* liquid extract stimulates the cardiovascular system, weakens stress reactions, has some stimulating gonadotropic, hypoglycemic effect. A liquid extract of *Eleutherococcus* is prescribed for physical and mental fatigue, psychasthenia, hypotension, functional exhaustion of the central nervous system, which is accompanied by reduced work capacity, irritation and insomnia. It is prescribed as part of complex therapy for vegetative neurosis, after complex surgical operations, for acute and chronic radiation sickness. *Eleutherococcus* liquid extract is contraindicated in case of hypersensitivity, hyperthermic syndrome, arterial hypertension, increased excitability, acute infectious diseases, myocardial infarction, arrhythmia, insomnia, neurocirculatory dysfunction, fever, epilepsy.

Sekurenega bush grows wild in the East and Siberia. Galena drugs from young shoots and leaves are used as an adaptogen. They contain a large number of alkaloids – securenine, alosecurenine, securinol A, B, C, sufruticodine, sufrutikonine. The tonic properties of *sekurenega* are used for weakening of cardiac activity, general and sexual weakness, diseases of the trigeminal nerve, facial nerves, and lesions of the central nervous system and peripheral nervous system. *Sekurinega* drugs are contraindicated in hypertension, angina pectoris, atherosclerosis, kidney diseases and reduced excretory function.

Sterculia platanolista, like *Eleutherococcus* and ginseng, stimulates performance and anabolic processes. *Sterculia* drugs are considered mild psychostimulants. *Sterculia* leaves contain essential oil, resins, organic acids, a small amount of alkaloids, caffeine and organic acids are found in the seeds. *Sterculia* infusion is prescribed as a stimulant for mental and physical fatigue, overfatigue, asthenic states, after debilitating illnesses.

Echinacea purple contains active substances with pronounced immunomodulatory and anti-inflammatory properties. All parts of the plant contain polysaccharides and essential oil, the glycoside echinacoside, betaine, resins, organic acids (palmitic, linoleic and others) are found in the root. *Echinacea* drugs are prescribed for various pathological conditions by increasing the body's natural defenses. As a result of experimental studies, the effect of *Echinacea* on cells and humoral immunity has been established. This effect is manifested not only in adults, but also in children and the elderly. *Echinacea* drugs are prescribed for diseases associated with weakening of the functional state of the immune system caused by chronic inflammatory diseases. Taking *echinacea* drugs can stimulate the immune system in diabetes, liver diseases, poisoning by toxic substances in the air, food products. *Echinacea* drugs are non-toxic, in significant doses they can increase salivation, *echinacea* juice increases blood coagulation. The only contraindication is hypersensitivity.

Hydrobionts (algae) are active biological substances that affect the physical and sexual activity of a person. They are rich in vitamins, hydrobionts that actively affect metabolism, especially in pathological conditions. In many countries, it is believed that they can affect the performance of athletes. The concentrate and extract of kelp, the preparation laminal, which contain optimal concentrations of trace elements, polysaccharides, and fatty acids, are prescribed (Leonard, 2023). These agents have a stimulating effect on metabolic processes, hematopoiesis, RNA and DNA synthesis. They have an immunocorrective effect in primary or secondary immunodeficiencies. Kelp extract is also used for baths, compresses, and massages (Kostrakiewicz-Gierałt, 2022; Avigan, 2016).

Beekeeping products are used to prevent overstrain during training to increase the sports performance of highly qualified athletes without the use of doping. They are well combined with vitamins, trace elements, adaptogens and other non-doping biologically active substances. Honey is a carbohydrate food for bees in the non-beneficial period. This product easily penetrates into body tissues that do not require energy loss, very easily penetrates into body cells that require energy.

Honey contains 20 amino acids, B vitamins₂, B₆, C, B₁₂, K, E, organic acids, minerals. Honey is especially useful for athletes training to develop endurance (for example, climbers), as well as military personnel of special units.

These adaptogens not only increase the body's resistance to stress. They also:

1) contribute to increasing resistance to infectious and viral diseases;

2) have almost zero toxicity, affect the vital parameters of the body;

3) increase resistance to a wide range of infectious diseases, have a systemic immunocorrective effect;

4) exhibit stress-limiting aspects of action: absence of stress-inducing ones, for example, in case of operative, metastasizing immunodeficiency;

5) exhibit pronounced detoxification properties, for example, in relation to poisons affecting the central nervous system, such as drugs that cause seizures, as well as anticonvulsants, cytostatics, hepatotoxic poisons, medicines, carcinogens, methemoglobin-forming agents and others;

6) adjust metabolism in general and exhibit neuroendocrine regulation, affect carbohydrate, lipid, protein metabolism, RNA, DNA synthesis;

7) typical for phytoadaptogens is a gonadotropic, antidiabetic effect with an increase in the synthesis and exocytosis of insulin, a positive regulatory effect on the functions of the adrenal glands, the ability to prevent the development of hypocorticism during steroid therapy, as well as to reduce an excessive increase in the concentration of 17-OKS in the blood during stress;

Drugs from plants that have an adaptogenic effect also show a moderate stimulation of mental and physical performance. This effect is realized mainly due to the content of alkaloids. This property is expressed when they are taken in significant doses, because in small doses, as it was determined, they can have a calming effect on the central nervous system. The following properties are also distinguished:

1) increasing the body's resistance to unfavorable factors through the adaptive restructuring of metabolism, including the implementation of radioprotective effects;

2) anti-stress effect;

3) increased sensitivity of the visual and auditory nerves;

4) hematopoietic effect;

5) improvement of the functions of the myocardium, liver and other organs;

6) acceleration of the processes of regeneration, repair, immunomodulatory action;

7) normalization and moderate stimulation of endocrine system functions;

8) stimulation of sexual function.

The possible anabolic effect of these agents is manifested only during physical exertion. The appointment in other cases is considered irrational because it causes disruption of daily biorhythms (desynchronization). Daily excretion of catecholamines, which rises in the morning and is established in the first half of the day, is taken as a guide. These agents can increase the processes of excitation and inhibition in the central nervous system, so it is necessary to choose the correct dosage and intervals between administrations.

Adaptogen drugs are taken before competitions if there are no contraindications. During competitions, intake of biologically active adaptogens should be limited. After the competition comes the time of rehabilitation. During this period, in order to accelerate rehabilitation, a wide range of different biologically active natural drugs are prescribed. They should have a particularly effective effect on the body immediately after the competition, when functional changes in the body are most significant. During this period, it is necessary to take adaptogens, the effect of which is most pronounced against the background of fatigue and weakening of the body. This is primarily an extract of *Rhodiola rosea* – an effective remedy for exhaustion of the body, which is taken in a long course. In addition to adaptogens of plant origin, during the rehabilitation period, you can take drugs of animal origin that contain microbiomes (various algae) (Chen, 2014).

Conclusions. The range of actoprotective agents is expanding every year. These include phytodrugs, systemic metabolites, metabolotropic agents, vitamins, hydrobionts. At the same time, to the composition dietary supplements add drugs that improve appetite, improve digestion, have a hepato- and cardioprotective effect. Herbal medicines are often the basis dietary supplements and determine the main mechanism of actoprotection.

REFERENCES

- Avigan, M., Mozersky, R., & Seeff, L. (2016). Scientific and regulatory perspectives in herbal and dietary supplement associated hepatotoxicity in the United States. *International Journal of Molecular Sciences*, 17(3), 331. <https://doi.org/10.3390/ijms17030331>.
- Bagherpour, T., Yaghobi, A., & Nemati, N. (2022). Comparison of the effect of creatine and ginseng supplementations on the aerobic power, anaerobic power, and muscle strength of the male players of the Iran National Epee Team. *Thrita*, 11(1). <https://doi.org/10.5812/thrita-128754>.

- Chen, C.-Y., Hou, C.-W., Bernard, J.R., Chen, C.-C., Hung, T.-C., Cheng, L.-L., Liao, Y.-H., & Kuo, C.-H. (2014). Rhodiola crenulata and cordyceps sinensis-based supplement boosts aerobic exercise performance after short-term high altitude training. *High Altitude Medicine & Biology*, 15(3), 371–379. <https://doi.org/10.1089/ham.2013.1114>.
- Cui, P., Li, M., Yu, M., Liu, Y., Ding, Y., Liu, W., & Liu, J. (2022). Advances in sports food: Sports nutrition, food manufacture, opportunities and challenges. *Food Research International*, 157, 111258. <https://doi.org/10.1016/j.foodres.2022.111258>.
- Eichner, E.R. (2016). Fighting muscle cramps with two spices and one hot fruit. *Current Sports Medicine Reports*, 15(5), 304–305. <https://doi.org/10.1249/jsr.0000000000000298>.
- Iannitti, T., Morales-Medina, J.C., Bellavite, P., Rottigni, V., & Palmieri, B. (2016). Effectiveness and safety of Arnica Montana in post-surgical setting, pain and inflammation. *American Journal of Therapeutics*, 23(1), 184–197. <https://doi.org/10.1097/mjt.000000000000036>.
- Khan, N., Sharma, S., Dahiya, I., Khan, J., Sharma, S., & Sharma, R.K. (2022). Dose-response and temporal ergogenic effects of ginseng supplementation in athletes and active participants: A systematic review and meta-analysis. *Journal of Sports Sciences*, 40(21), 2444–2460. <https://doi.org/10.1080/02640414.2022.2162753>.
- Kostrakiewicz-Gierałt, K. (2022). Plants, algae, cyanobacteria and fungi in diet of vegan and vegetarian sportsmen—a systematic review. *Central European Journal of Sport Sciences and Medicine*, 37, 23–43. <https://doi.org/10.18276/cej.2022.1-03>.
- Leonard, M., Maury, J., Dickerson, B., Gonzalez, D.E., Kendra, J., Jenkins, V., Nottingham, K., Yoo, C., Xing, D., Ko, J., Pradelles, R., Faries, M., Kephart, W., Sowinski, R., Rasmussen, C.J., & Kreider, R.B. (2023). Effects of dietary supplementation of a microalgae extract containing fucoxanthin combined with guarana on cognitive function and gaming performance. *Nutrients*, 15(8), 1918. <https://doi.org/10.3390/nu15081918>.
- Liu, C., Zhao, H., Yan, Y., Yang, W., Chen, S., Song, G., Li, X., Gu, Y., Yun, H., & Li, Y. (2023). Synergistic effect of rhodiola rosea and caffeine supplementation on the improvement of muscle strength and muscular endurance: A pilot study for rats, resistance exercise-untrained and -trained volunteers. *Nutrients*, 15(3), 582–586. <https://doi.org/10.3390/nu15030582>.
- Lu, Y., Deng, B., Xu, L., Liu, H., Song, Y., & Lin, F. (2022). Effects of rhodiola rosea supplementation on exercise AND SPORT: A systematic review. *Frontiers in Nutrition*, 9. <https://doi.org/10.3389/fnut.2022.856287>.
- Nash, K.M., & Shah, Z.A. (2015). Current perspectives on the beneficial role of ginkgo biloba in neurological and cerebrovascular disorders. *Integrative Medicine Insights*, 10, 1–6. <https://doi.org/10.4137/imi.s25054>.
- Pumpa, K.L., Fallon, K.E., Bensoussan, A., & Papalia, S. (2013). The effects of topical arnica on performance, pain and muscle damage after intense eccentric exercise. *European Journal of Sport Science*, 14(3), 294–300. <https://doi.org/10.1080/17461391.2013.829126>.
- Sellami, M., Slimeni, O., Pokrywka, A., Kuvačić, G., D Hayes, L., Milic, M., & Padulo, J. (2018). Herbal Medicine for Sports: A Review. *Journal of the International Society of Sports Nutrition*, 15(1). <https://doi.org/10.1186/s12970-018-0218-y>.
- Shaw, G., Slater, G., & Burke, L.M. (2016). Supplement use of elite Australian swimmers. *International Journal of Sport Nutrition and Exercise Metabolism*, 26(3), 249–258. <https://doi.org/10.1123/ijsnem.2015-0182>.
- Slimeni, O., Sellami, M., Ben Attia, M., Dhahbi, W., Rhibi, F., & Ben Abderrahman, A. (2017). Effect of myrtus communis supplementation on anaerobic performance and selected serum biochemical parameters. *Medicina Dello Sport*, 70(2), 150–162. <https://doi.org/10.23736/s0025-7826.17.03055-1>.
- Tinsley, G., Jagim, A., Potter, G., Garner, D., & Galpin, A. (2023). Rhodiola rosea as an adaptogen to enhance exercise performance: A review of the literature. *British Journal of Nutrition*, 1–13. doi:10.1017/S0007114523001988.
- Van der Bijl, P. (2014). Dietary supplements containing prohibited substances: A review (part 1). *South African Journal of Sports Medicine*, 26(2), 59–61. <https://doi.org/10.17159/2413-3108/2014/v26i2a398>.

Стаття надійшла до редакції 23.05.2023
Стаття прийнята до друку 03.07.2023

Конфлікт інтересів: відсутній.

Внесок авторів:

Беленічев І. – збір та аналіз літератури, анотації, висновки, резюме;

Горчакова Н. – ідея, дизайн дослідження, коректування статті;

Савченко Н. – участь у написанні статті;

Яковлева Н. – анотації, висновки, резюме;

Варавка І. – збір та аналіз джерел інформації;

Варванський П. – участь у написанні статті;

Беленічев К. – збір літературних джерел за ключовими словами, аналіз.

Електронна адреса для листування з авторами:

gorchakovan1941@gmail.com