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Conflict of interest:

The authors declare no conflict of interest.

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A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval of the article.

Received 04.06.2023

Accepted 10.11.2023

DOI 10.29254/2077-4214-2023-4-171-24-29

UDC 616.36-002:615.322.582

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PHYTODRUGS WITH ANABOLIC EFFECT

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Galenic and neogalenic phytodrugs, which were widely used in traditional medicine, have not lost their importance even today due to their lower cost, lower toxicity and wide spectrum of action and availability. Special attention began to be paid to medicinal phytozombs, which can activate protein and nucleic acids associated with work capacity and are used not only for physical exertion, but also for military and clinical purposes, for diseases of internal organs, cardiovascular and nervous systems, during the period of viral and infectious diseases.

One of the first plants whose root extract was found to have an anabolic effect was creeping wheatgrass. Already in experiments on intact anesthetized rats, the level of total protein, which is associated with the activation of the level of nucleic acids, increased in the tissues of the liver, kidneys and heart when intramuscularly the extract of creeping tyria was administered. Pharmacological anabolic activity of creeping wheat extract was also confirmed in experiments on rats with food deprivation and hydro-induced cortisol-induced protein catabolism. Food deprivation was simulated by leaving animals without food for 7 days. Hydrocortisol suspension was administered intramuscularly to rats for 8 days. The anabolic effect of the creeping wheat extract exceeded the effect of the reference drug potassium orotate. It has been established that, in addition to the anabolic effect, the extract of creeping wheat also has an immunomodulatory, antioxidant, and anti-inflammatory effect, which is the basis for the possibility of its use in clinical practice.

Metabolic and anabolic activity was also established in the wild wolf. At the same time, attention was paid to wound-healing, immunomodulating effects. At the same time, anti-inflammatory, adhesive, hepatoprotective, diuretic, antioxidant, vasodilator, hypozotemic activity was established.

Preparations of beet roots, along with anabolic activity, also show hypoglycemic, antichenobacterial effect, and also normalized blood pressure, revealed antioxidant, anti-ischemic, cardioprotective, neuroprotective and antioxidant activity, influencing the content of nitric oxide.

Due to the presence of phytosterols, organic acids and other biologically active substances, the extract of the roots of creeping wheatgrass, field wolfberry, prickly wheatgrass and beetroot has an anabolic, organoprotective, reparative, hepatoprotective, diuretic, antioxidant, vasodilator, anti-inflammatory, hyponitrogenous effect.

Key words: extract of the roots of creeping wheat, extract of beet roots, extract of wild lupine, anabolic action.

Connection of the publication with planned research works.

The presented article was carried out according to the research plan of the department of pharmacology «Experimental substantiation of the combined use of cardiotropic drugs» (state registration number 0111U009417).

Introduction.

In the clinic of internal neurological patients in surgical departments, especially in the postoperative period, it is necessary to carry out complex pharmacotherapy, including the inclusion of herbal preparations, which often enhance the main pharmacological effect of other means with more accessible, cheaper and less harmful analogues [1-3]. In addition, now, thanks to their anabolic and anti-stress activity, they are important in the combat

zone, when they not only support the condition of the muscles, but also have a wound-healing effect.

It is known that phytodrugs are also prescribed in sports medicine during preparation for competitions, as well as during recovery after training. The main pharmacological effect of these agents should be an anabolic effect, which explains both the wound-healing effect and the intensification of metabolism in vital organs and systems: cardiovascular, nervous, immune, liver and others. Special attention regarding the anabolic effect was directed to the pharmacodynamics of creeping wheatgrass cultivated in Ukraine. Later, attention was paid to its other properties.

But the main task at first was to detect the anabolic effect in rats when simulating food deprivation and glucocortisone-induced anabolism. When reproducing these experiments, it was proved that the extract of creeping wheat, including in tablets, stimulates protein synthesis and nucleic exchange. Also, the anabolic effect of the creeping wheat extract was confirmed against the background of the toxic effect of antibiotics and a violation of the protein metabolism of the liver and kidneys.

The effectiveness of the extract of creeping wheat was confirmed by the study of the morphostructure of organs, the anabolic and cardioprotective effect of this compound was confirmed on the model of adrenaline damage to the heart.

Separate studies also made it possible to establish the effect of creeping wheatgrass extract on the content of thyroid and steroid hormones.

In the future, special attention was paid to the pharmacology of the extract of the wolfberry. In this case, they emphasized the anabolic effect of the extract, because it was they who allowed us to assert the presence of its wound-healing effect. In addition, studies have been conducted that confirm the presence of the wolfberry extract anabolic, wound-healing, anti-inflammatory, antipyretic, antiarrhythmic, antifungal, antiseptic effects.

Thus, the anti-inflammatory effect of the extract was studied by determining the effect on the permeability of blood vessels in rats. A separate series of studies is devoted to the antibacterial and immunotropic activity of the extract of wild wolfberry and its interaction with the area of membranes and lipopolysaccharides.

There is an extract of beet root, which, in addition to the anabolic effect, has a number of other properties. For example, the ability to influence the nitric oxide system was determined and anti-ischemic activity was noted. The anti-inflammatory activity of beet root extract is expressed due to inhibition of DNA binding to NF- κ B, inhibition of cyclooxygenase 2. Due to the antioxidant effect of exposure to NO₂, the antihypertensive effect of beet extract has been proven. In addition, the effect of beetroot extract on the content of glucose and insulin has been proven, which makes it possible to recommend it for type II diabetes.

Thus, extracts of creeping wheatgrass, thorny wolfberry and beet root can be prescribed in clinical practice and in extreme situations.

Due to its polyphenolic structure, wheatgrass extract can directly interact with DNA molecules and affect the processes of replication, transcription, replication and the activity of a number of enzymes involved in the reparative synthesis of DNA and RNA [4].

The aim of study.

A definition of anabolic and other metabolic properties of phytodrugs of creeping wheatgrass, beetroot and wolfberry.

Object and research methods.

A search and analysis of scientific literature, including PubMed, Google Scholar, Scopus, was carried out on the topic of the study.

Research results and their discussion.

Among the domestic phyto remedies with an anabolic effect, one of the first to attract attention was the thick aqueous extract of rhizomes from the roots of creeping heather, as well as the effect of tablets based on it. Found that the extract of rhizomes and roots of creeping wheat when administered intragastrically to rats at a dose of 100 mg/kg has pronounced anabolic activity against the background of food deprivation and hydrocortisone-induced catabolism. Revealed advantages of wheatgrass root extract and its tablets in terms of anabolic action compared to the anabolic action of the reference drug potassium orotate in tetracycline-induced kidney and liver damage. The hepatoprotective effect of the creeping wheat extract was established against the background of tetrachlorometal hepatitis simulation. When studying the mechanism of the anabolic effect of the extract of creeping wheatgrass, it was associated with the activation of nucleic acid synthesis and increased the level of 11 oxyketosteroids, testosterone, and decreased the activity of the thyroid gland, which confirmed the adaptive effect of the drug. Among other useful properties of the drug, anti-allergic activity and anti-inflammatory effect on the model of carrageenan edema should be noted. Anabolic and other positive effects of creeping wheatgrass extract are realized due to its composition of polysaccharides, amino acids, flavonoids, hydroxyradical acids, micro- and macroelements. It was noted that the mechanism of anabolic action of the creeping wheat extract is related to the intensification of the synthesis of nucleic acids, RNA, DNA, as well as the hormone regulation of protein synthesis [4].

At the same time, we became interested in a plant of the legume family, field wolfberry (*Ononis L.*). Phytochemically, the roots of wild lupine are characterized by the presence of isoflavonoids – trifolirizin, formononetin, together with its 7-O- β -D-glucoside-6-malokatal and 7-O- β -D-glucoside, biochanin- α -7-O- β -D-glycoside and pterocarpan, medicarpin. Pyriterpenes contain α -opicerine as the main compound.

Antimicrobial, anti-inflammatory, antifungal, antiseptic properties were one of the first to be determined, and the extract of wild wolfberry began to be used for the treatment of dermatological diseases and gout. Later, it began to be prescribed for diseases of the urinary tract and kidney diseases [5].

Lupine root extract (*Ononis spinosa*) has traditionally been prescribed to patients with disorders of the urinary system due to its mild diuretic effect through inhibition of renal hyaluronidase-1 by isoflavonoids. Previous studies have also noted an anti-inflammatory effect. In the future, the anti-inflammatory effect of various extracts of lupine, made with impurities of various attractants, was established. The dichloromethane extract mainly contains isoflavonoids and triterpenes and can inhibit the release of interleukin-8 and tumor necrosis factor- α from the polysaccharide of stimulated human neutrophils.

Recently, similar compounds such as onogenin, satsavon, norneolignan, and clitorienolactone have also

been discovered. The presence of phytosterols, especially β -sitosterol, deoxybenzenes, as well as deoxybenzoins, especially ononetin, phenolic acids, minerals and volatile oils with transanetol, carvane, menthol are also considered the main compounds for the implementation of pharmacodynamics. This plant has been widely studied in other countries. For example, in Turkish medicine, it is used as an antidiabetic drug and a means for the treatment of skin diseases. In Jordanian folk medicine there is a reference to the use of lupine extract for the treatment of oncological diseases.

Lupus extract has a number of pharmacological properties, thanks to which it is included in some food additives, but it is the anabolic effect of this phytonutrient that was determined when studying its wound-healing properties [6].

The wound-healing effect of wolfberry on rats was studied in parallel with the anabolic effect. The wound-healing effect was modeled on rats by reproducing two linear cuts of the skin 5 cm long and at a distance of 1.5 cm from the midline of each side of the spine. The drug was applied to the wound once a day for 9 days. On the 9th day, the sutures applied to the wound were removed. To determine the strength of the wound, a tensiometer was used, and the skin in the wound and after healing was subjected to histological examination.

The wound healing process consisted of 3 stages – inflammation, proliferation, remodeling. Water and alcohol extracts were used to heal the wound. Histological studies determined the content of nucleic acids in the healing tissue, which made it possible to confirm the anabolic effect. Inflammation was caused by applying acetic acid to the skin, the anti-inflammatory effect was also confirmed by histological studies.

Decoctions are made from lupine roots to treat diseases of the urinary tract, especially inflammatory ones and in case of damage to the kidney structure, which was approved in 2015 by the European Scientific Congress on Phytotherapy. Therefore, for inflammatory diseases of the urinary tract, a decoction of lupine roots, which also has antimicrobial properties, was recommended for auxiliary treatment [7]. This action is realized due to the presence of phytochemically determined isoflavonoids of trifolirizin.

Often, protein molecules acquire resistance through certain mutations in them, which enhances the treatment of infectious diseases with antimicrobial agents. This is due to the stability of bacterial enzymes that do not respond to repeated administration of the drug. Thus, some strains of *B. coli* have developed resistance to trimethoprim. Resistance to the drug was determined due to the exclusive mutation of genes encoding dihydrofolate reductase. The search for structures analogous to dihydrofolate has begun. Therefore, the main task became the development of new generation antibiotics or antimicrobial agents. For three mutant variants, studies of promising oponectin and resveratrol compounds were conducted. The effective dose of these compounds was determined for the three mutant variants. The effective doses of oponectone and resveratrol were approximately the same. These compounds can inhibit the drug resistance of mutant variants, and the enzymes of the mutation causing drug resistance can be localized in or proximal to the substrate binding pocket. These small molecules inhibit, mutants and microorganisms can again become sensitive to trimethoprim [8].

Along with the anti-inflammatory effect of wild wolfberry, its immunomodulatory effect was also studied. Patients suffering from diseases of the urinary tract were selected and were prescribed a liquid extract of wolfberry. Due to mild diuretic activity due to inhibition of renal hyaluronidase-1 by isoflavonoids. Previous studies have confirmed the therapeutic effect of these extracts with different solvents. dichloromethane extract contained triterpenes and isoflavonoids and its effect depended on concentration. Significant activity was observed by a decrease in the level of interleukin-8 and tumor necrosis factor- α , which were released from lipopolysaccharide of stimulated neutrophils.

Otocetrin and chlorenolactone also had a significant effect, which decreased the expression of adhesion molecules CD11b/CD18 and conversely increased the expression of CD21 in liposaccharide-activated human neutrophils. This indicates an anti-inflammatory effect due to the inhibition of adhesion and migration of immune cells. It is toll receptors that have one transmembrane fragment and recognize the conservative structures of microorganisms and activate the cellular immune response.

The aqueous extract of wild wolfberry contains a significant amount of isoflavonoid glycosides and saponins, which realize an anti-inflammatory effect by acting on signaling pathways. The anti-inflammatory effect is realized through antagonism with tol receptor 4. It is alpha-oncerim that is considered the active substance responsible for the production of cytokines. The comparison drugs are quercetin and dexamethasone. In order to realize the anti-inflammatory effect of the lupine extract, the presence of several targets of the signaling pathways is mandatory.

In addition, the effect on the kidneys is realized due to the action on hyaluronidase-1 due to isoflavonoids, which have proven their effectiveness in the treatment of patients with chronic renal failure [7, 9-12].

Anabolic activity was also established in beetroot. Recently, beets are a source of many nutrients and promising for use due to their effectiveness in diseases of internal organs, the central nervous system, and hormonal disorders. So, beets are recommended as a food additive in the treatment of diabetes and insulin resistance. Beets contain ascorbic acid, carotenoids, phenolic acids, bioflavonoids. It is one of the few vegetables that contain a group of highly biologically active pigments known as betaine. Members of the betaine family can be classified as betacyanin pigments, which have a red-violet color. Many in vivo and in vitro experiments on various models have determined that betaines have high antioxidant and anti-inflammatory activity. This caused significant interest in beets and predicted its use in various pathological conditions characterized by oxidative stress and chronic inflammation, such as liver disease and cancer [13].

Betains and beetroot extract have become powerful anti-inflammatory agents. Most important in the mechanism of this action is the nuclear factor kappa β (NF- κ B) cascade, as it directly activates and transcribes most of the target genes that regulate and enhance the overall response (ie, cytokines, chemokines, apoptotic and phagocytic cells). Thus, NF- κ B activity plays a central role in the inflammatory processes that occur in chronic disease.

The study found that NF- κ B DNA-binding activity was dose-dependently attenuated in nephrotoxic rats given

250 mg/kg or 500 mg/kg beet extract intragastrically for 28 days. In addition, beet extract-treated rats had reduced immune cell concentrations (TNF α , IL-6, and MPO) and had less signs of oxidative damage (reduced MDA content), which is directly related to inhibition of the NF-kB pathway.

These effects are likely mediated, at least in part, by the betaines present in beets. Studies show that treatment with betaine at a dose of 25-100 mg/kg for 5 days significantly inhibits the binding of DNA-CRJV in rats with acute kidney injury. Betaine also significantly inhibits the expression of cyclooxygenase-2 (COX-2) in vitro, which is an important precursor molecule for the pro-inflammatory metabolites of arachidonic acid known as prostaglandins. They also found that betaine at a dose of 100 mg/kg inhibits COX-2 activity by 97%. It is noted that a higher concentration of betaine was required, its COX-2 inhibitory effects were comparable or greater than those of some phenolic compounds (cyanidin-3-O-glycoside, lycopene chlorophyll, beta-carotene, bixin) and anti-inflammatory drugs (ibuprofen, celebrex). This raises the possibility that beetroot admixtures rich in betaine, in sufficient doses, may exhibit greater anti-inflammatory activity than systemic drugs. The effect of beetroot extract on glucose and insulin levels and the potential hypoglycemic effect of beetroot juice when administered to healthy models and patients with various diseases after the end of animal studies were studied separately.

When beetroot juice was administered to healthy volunteers, a postprandial hypoglycemic effect was observed with a decrease in blood glucose. This effect is related to the content of bioactive compounds (polyphenols, flavonoids, nitrates). In addition to hypoglycemia, lipid metabolism disorders were observed. The decrease in blood sugar occurred not only thanks to the beetroot substances, but also to ethyl alcohol, which is used to extract active substances. In parallel, the content of other biologically active substances was studied after taking beet juice. Thus, an increase in the cortisol content was observed, an increase in gluconeogenesis was associated with stress, a decrease in the glucose level was associated with a modification of intracellular transcription [14-15].

Food and hormonal stress could cause inhibition of alpha-amylase or alpha-glucosidase and an increase in peroxone. The increase in cortisol can be compared to the activation of ACTH or to the mechanism of action at the level of the adrenal glands. A special place is occupied by studies related to the influence of beetroot juice and

extract on the cardiovascular and nervous systems. Beetroot juice, like other biologically active substances, has an anabolic effect.

In type 2 diabetes, beetroot juice not only controls glucose, but also lowers lipid metabolism and lowers blood pressure [16-17].

It was established that beetroot juice significantly lowers blood pressure in patients with hypertension than in healthy people, which is explained by the speed of expression of xanthine oxidase in the erythrocytes of these patients [18]. Taking beet juice reduces mortality in patients with cardiovascular diseases. In addition, beetroot juice improves kidney function: the use of juice in animals reduces nephrotoxicity and improves kidney metabolism. When consuming juice, the activity of antioxidant enzymes – catalase and others increases, the level of proteins containing thiol groups normalizes.

Antioxidant properties are related to the content of antioxidant substances [19]. Antioxidant properties are also associated with the content of nitrites and nitrates, which also play a role in the implementation of antihypertensive and analgesic activity. Significant consumption of juice with nitrates can strengthen blood pressure [20-21]. Beetroot juice is able to maintain a normal level of NO due to betaine pigments, ensures the biological activity of the body [22-25].

Beetroot juice has an analgesic effect, which allows it to be recommended for chronic pain. Beets contain sodium, potassium, magnesium, phosphorus, zinc, folic acid, carotene, vitamin C, vitamin B6, thiamin, riboflavin, nicotinic acid. Taking beetroot juice can block the entry of calcium and have a diuretic effect. [26-28] It also contains tryptophan, a derivative of dopamine [29-30].

The anti-pain effect is associated with anti-inflammatory activity and is realized due to the reduction of biologically active substances: histamine, bradykinin, substance P, biologically active substances contained in the juice [31].

Conclusions.

The presented literary data show that the extracts of wheatgrass, lupine and beetroot juice have an anabolic and wide-spectrum metabolic effect, which is the basis for including them as a food additive in the treatment of diseases of the cardiovascular and nervous systems, hormonal disorders, and disorders of the digestive tract.

Prospects for further research.

It is planned to find and justify the use of other phytochemicals with an anabolic effect.

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ФІТОПРЕПАРАТИ З АНАБОЛІЧНОЮ ДІЄЮ

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Резюме. Галенові і новогаленові фітопрепарати, що широко застосовували в народній медицині, не втрачили свого значення і сьогодні завдяки меншій вартості, меншій токсичності і широкому спектру дії та доступності.

Метою дослідження є визначення анаболічних та інших метаболічних властивостей у фітопрепаратів пірію повзучого, буряка та вовчуга.

Об'єкт і методи дослідження. За темою дослідження проведений пошук і аналіз наукової літератури, включаючи PubMed, Google Scholar, Scopus.

Результати. Однією з перших рослин, у екстрактів коренів якої визначили анаболічний вплив був пірій повзучий. Фармакологічна анаболічна активність екстракту пірію повзучого була підтверджена також в експериментах на щурах з харчовою депривацією та гідроіндукованим кортизоліндукованим катаболізмом білків. Анаболічна дія екстракту пірію повзучого перевищувала ефект референтного препарату калію оротату. Встановлено, що крім анаболічної дії екстракт пірію повзучого володіє також імунomodуючим, антиоксидантним, протизапальним ефектом, що є підставою для можливості призначення в клінічній практиці.

Метаболічну та анаболічну активність встановили також у вовчуга польового. При цьому звернули увагу на ранозагоюючу, імунomodуючу дію. Одночасно встановили протизапальну, адгезивну, гепатопротекторну, діуретичну, антиоксидантну, судинорозширювальну, гіпеазотемічну активність.

Препарати коренів буряка, поряд з анаболічною активністю, проявляють також цукрознижуючу, антихенобактерну дію, а також нормалізували артеріальний тиск, виявили антиоксидантну, протиішемічну, кардіопротекторну дію, нейропротекторну та антиоксидантну активність, впливаючи на вміст оксиду азоту.

Екстракт коренів пирію повзучого, вовчуга польового, пирію колючого і буряка, завдяки наявності фітостеролів, органічних кислот та інших біологічно активних речовин, проявляють анаболічну, органопротекторну, репаративну, гепатопротекторну, діуретичну, антиоксидантну, судинорозширювальну, протизапальну, гіпоазотенічну дію.

Висновки. Представлені літературні дані свідчать, що екстракти пирію, вовчуга і соку буряка володіють анаболічною та широким спектром метаболічної дії, що є підставою для включення їх як харчової домішки при лікуванні захворювань серцево-судинної, нервової системи, гормональних розладів, порушень травного каналу.

Ключові слова: екстракт коренів пирію повзучого, екстракт коренів буряка, екстракт вовчуга польового, анаболічна дія.

PHYTODRUGS WITH ANABOLIC EFFECT

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Abstract. Galenic and neogalenic phytodrugs, which were widely used in traditional medicine, have not lost their importance even today due to their lower cost, lower toxicity and wide spectrum of action and availability.

The purpose of the study there is a definition of anabolic and other metabolic properties of phytodrugs of creeping wheatgrass, beetroot and wolfberry.

Object and research methods. A search and analysis of scientific literature, including PubMed, Google Scholar, Scopus, was carried out on the topic of the study.

The results. One of the first plants whose root extract was found to have an anabolic effect was creeping wheatgrass. Pharmacological anabolic activity of creeping wheat extract was also confirmed in experiments on rats with food deprivation and hydro-induced cortisol-induced protein catabolism. The anabolic effect of the creeping wheat extract exceeded the effect of the reference drug potassium orotate. It has been established that, in addition to the anabolic effect, the extract of creeping wheat also has an immunomodulatory, antioxidant, and anti-inflammatory effect, which is the basis for the possibility of its use in clinical practice.

Metabolic and anabolic activity was also established in the wild wolf. At the same time, attention was paid to wound-healing, immunomodulating effects. At the same time, anti-inflammatory, adhesive, hepatoprotective, diuretic, antioxidant, vasodilator, hypoazotemic activity was established.

Preparations of beet roots, along with anabolic activity, also show hypoglycemic, antichenobacterial effect, and also normalized blood pressure, revealed antioxidant, anti-ischemic, cardioprotective, neuroprotective and antioxidant activity, influencing the content of nitric oxide.

Due to the presence of phytosterols, organic acids and other biologically active substances, the extract of the roots of creeping wheatgrass, field wolfberry, prickly wheatgrass and beetroot have anabolic, organoprotective, reparative, hepatoprotective, diuretic, antioxidant, vasodilator, anti-inflammatory, hyponitrogenous effects.

Conclusions. The presented literary data show that the extracts of wheatgrass, lupine and beetroot juice have an anabolic and wide-spectrum metabolic effect, which is the basis for including them as a food additive in the treatment of diseases of the cardiovascular and nervous systems, hormonal disorders, and disorders of the digestive tract.

Key words: extract of the roots of creeping wheat, extract of beet roots, extract of wild lupine, anabolic action.

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Conflict of interest:

The authors have no conflicts of interest to declare.

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Received 25.05.2023

Accepted 07.11.2023