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STUDY OF SOME APIPRODUCTS AS NATURAL IMMUNOMODULATORS

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ИЗУЧЕНИЕ НЕКОТОРЫХ АПИПРОДУКТОВ КАК ПРИРОДНЫХ ИМУНОМОДУЛЯТОРОВ

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ВИВЧЕННЯ ДЕЯКИХ АПІПРОДУКТІВ ЯК ПРИРОДНИХ ІМУНОМОДУЛЯТОРІВ

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Summary / Резюме

The work contains data from the review of professional literature of the last decade, which demonstrate the effectiveness of bee products for strengthening the immune system. Currently, medical research is being actively conducted work on apiary therapy to prevent diseases and improve the function of the immune system. Clinical testing of new methods takes place in many clinics and research centers not only in Ukraine but also in other countries, which confirms the prospects and relevance of this area.

The problem of the modern world is the deterioration of public health due to unhealthy diet and other harmful and dangerous factors. One of the possible solutions to this problem is the regular use of foods rich in proteins, fats, carbohydrates, vitamins and minerals, that can have a positive effect on the body.

By studying the chemical composition and biological activity of apiary products, according to the latest literature, it was found that they are of great practical importance and may be promising for use in medicine and other industries. However, the mechanisms of their action on the body require more detailed study.

The use of bee products in the correction of health and treatment of diseases is possible only with a thorough study of this industry, a thorough knowledge of the pharmacological effects of bee products. Therefore, this topic is relevant and has prospects for further research. Key words: royal jelly, bee bread, bee pollen, highly active biological substances, immunity.

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Работа содержит данные по обзору литературных источников последнего десятилетия, которые демонстрируют эффективность продуктов пчеловодства для укрепле-

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ния иммунитета. В настоящее время активно проводится медицинско-исследовательская работа по апитерапии для профилактики заболеваний и повышения функции иммунной системы. Клиническая апробация новых методов происходит во многих клиниках и научно-исследовательских центрах не только в Украине, но и других странах, что подтверждает перспективность и актуальность этого направления.

Проблемой современного мира является ухудшение здоровья населения из-за неправильного питания и других вредных и опасных факторов. Один из возможных путей устранения этой проблемы — это регулярное использование продуктов, богатых белками, жирами, углеводами, витаминами и минеральными веществами, которые могут положительно влиять на организм.

Исследуя химический состав и биологическую активность апипродуктов, согласно новейшим литературным источникам, выявлено, что они имеют большое практическое значение и могут быть перспективными для использования в медицине и других отраслях. Тем не менее, механизмы их действия на организм нуждаются в более детальном изучении.

Применение продуктов пчеловодства в коррекции здоровья и лечения заболеваний возможно только при совершенном изучении данной отрасли, совершенном знании фармакологического действия продуктов пчеловодства. Поэтому данная тема актуальна и имеет перспективы дальнейших исследований.

Ключевые слова: *маточное молочко, перга, пыльца, высокоактивные биологические вещества, иммунитет.*

Робота містить дані з огляду фахових літературних джерел останнього десятиліття, які демонструють ефективність продуктів бджільництва для зміцнення імунітету. В даний час активно проводиться медично-дослідницька робота з апітерапії для профілактики захворювань та підвищення функції імунної системи. Клінічна апробація нових методів відбувається в багатьох клініках та науково-дослідних центрах не тільки в Україні, але і в інших країнах, що підтверджує перспективність та актуальність цього напрямку.

Проблемою сучасного світу є погіршення здоров'я населення через неправильне харчування та інших шкідливих і небезпечних чинників. Один із можливих шляхів усунення цієї проблеми — це регулярне використання продуктів, багатих на білки, жири, вуглеводи, вітаміни та мінеральні речовини, які можуть позитивно впливати на організм.

Досліджуючи хімічний склад та біологічну активність апіпродуктів, згідно новітнім літературним джерелам, виявлено, що вони мають велике практичне значення та можуть бути перспективними для використання у медицини та інших галузях. Проте, механізми їх дії на організм потребують більш детального вивчення.

Застосування продуктів бджільництва в корекції здоров'я та лікування захворювань є можливим тільки при довершеному вивченні даної галузі, досконалому знанні фармакологічної дії продуктів бджільництва. Тому дана тема актуальна і має перспективи подальших досліджень.

Ключові слова*: маточне молочко, перга, пилок, високоактивні біологічні речовини, імунітет.*

Introduction

Since its inception, medicine has developed many methods and means of treating various diseases. However, despite the constant progress, pharmacotherapy remains the main method of treating acute and chronic diseases. Despite certain successes, modern pharmacological drugs

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have their limitations and drawbacks, such as insufficient effect, common complications, allergic reactions and negative impact on various organs and systems of the body.

That is why there is a need to find alternative methods, non-pharmaceutical treatments. Particular attention is paid to the prevention of diseases, which is an important step in maintaining health and reducing the risk of diseases.

Using the concept of risk factors, scientists have identified certain factors related to lifestyle, environment and genetic characteristics of a person, that contribute to the development of diseases. Scientific research in the field of disease prevention have convincingly confirmed the effectiveness of disease prevention programs. It is clear that the key to a healthy future lies not only in the development of new medicines, but also in the active promotion of a healthy lifestyle and the introduction of non-drug therapies that will help boost immunity and reduce the risk of disease.

One of the most promising pharmacological groups of drugs and foods containing highly active biological substances are bee products. They are so unique that scientists could not help but to be interested in them. Apiary products include: honey, royal jelly, bee seed, propolis, bee venom, wax, bee pollen, flower pollen, etc. They have a wide range of pharmacological effects and are not harmful to the body. They are characterized by a high concentration of organic and mineral substances. These products contain all the necessary components: proteins, lipids, carbohydrates, vitamins, minerals, enzymes, hormones. Their high biological activity has a positive effect on the body's functioning. Beekeeping products can be excellent natural adaptogens, agents that increase the body's defenses, performance and reduce fatigue under unfavorable environmental conditions, the presence of stress factors, high emotional and physical stress, as well as in combination with other drugs to treat certain diseases.

The objective is to investigate and reveal the biological activity of some apiary products (royal jelly, bee pollen, bee bread), to find out their composition, actions and useful properties by analyzing the publications of the last decade.

Results and their discussion

Royal jelly is one of the most amazing bee products. It is used to treat numerous diseases and prevents the appearance of disorders in the body [1].

Chemical composition of royal jelly. It contains about 110 different substances and compounds. According to the total data covering regional, age, seasonal fluctuations in composition, differences in methods of harvesting, processing, canning storage, and analysis, royal jelly contains 60-70 % water and 30-40 % dry matter, including protein dry matter, including proteins — 10-58 %, lipids — 1,5-19 %, carbohydrates — 9-28 %, organic acids and amino acids — 7-32 %, minerals — up to 3 % substances — up to 3 % [2].

In the protein fraction of royal jelly, the bulk of globulins is represented by г-globulin [3], which performs antiviral, antimicrobial and antitoxic functions that inhibit the aging process and increase the overall resistance to the body. Many proteins have enzymatic activity, participating in metabolic processes [4].

All proteinogenic amino acids have been found in proteins, including many of them are essential [5]. 35 free amino acids have been identified, including of great importance is г-aminobutyric acid, which plays an important role in the transmission of nerve impulses and improves metabolism in the brain.

Royal jelly contains nucleic acids [6], which play an important role in regulating the processes of substance synthesis.

Royal jelly contains lysozyme in large quantities, a humoral resistance factor that causes lysis of cell membranes bacteria, which stimulates the production of antibodies and is involved in antimicrobial and immunomodulatory activity. The main part of carbohydrates in royal jelly is represented by monosaccharides: glucose — up to 20 %,

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fructose — up to 10 %, in small small amounts of ribose, sucrose, maltose, mannose, etc.

The mineral composition of royal jelly is represented by potassium compounds, sodium, calcium, phosphorus, magnesium, manganese, copper, silver, and gold. The most high content of zinc, iron, and cobalt, which is used in the treatment of anemia [7].

The lipid fraction of royal jelly plays an important role in the biological activity of royal jelly, fraction, which is important in redox processes [8]. Free fatty acids make up an average of 77,2 % of the ether extract, including succinic, adipic, pimelic, azelaic, sebacic, lauric, palmitic, aleic, decenic, and others [9].

Royal jelly contains high levels of B vitamins, including nicotinic and pantothenic acids, pteridine compounds (biopterin and neopterin), which are part of the folic acid group of vitamins that play an important role in hematopoiesis and some metabolic processes [10].

Each component of royal jelly has its own pharmacological effect. The combined effect of all biologically active components gives a general therapeutic effect.

Royal jelly is used in the treatment of anemia, and is used as a biologically active food supplement as a preventive, adaptogenic immunostimulating agent; it is also used in gerontology [11].

The regulatory effect of royal jelly on the elimination of diseases is associated with its effect on the central nervous system and on the function of the endocrine glands [4].

Royal jelly has a tonic effect on some centers of the hypothalamus, resulting in increased secretion of adrenocorticotropic hormone, which is responsible for the formation of glucocorticoid hormones in the adrenal glands. They improve the body's defenses of the body and increase the intensity of metabolic processes [12].

It should be remembered that the appointment of uterine milk has a number of contraindications. These include hypersensitivity and intolerance, Addison's disease and acute viral hepatitis (as factors of nonspecific defense are formed in the center of inflammation of the liver tissue, leading to the stimulation of бglobulins) [13].

Pollen is not directly a bee product, but it is classified as an apiary product because it plays a huge role for the bee family because of its nutritional properties.

The pollen collected by bees is called nectar because the bee carries it in the baskets of its hind legs. When forming the pollen, bees wet granulation, covering each grain with agglutinating substances [14]. Pollen consists of pollen grains moistened with nectar or honey. In this regard, the chemical composition of the pollen is a mixture of substances of plant and animal origin.

About 250 components have been identified in bee pollen [15]. Among these components, it was found that proteins, fatty acids, vitamins and minerals exhibit antibacterial, antioxidant, antifungal, antiallergic, anti-inflammatory, antitumor, and hepatoprotective effects [16]. The nutritional value of bee pollen is explained by sugars, proteins and lipids, which are in a balanced ratio in its composition [17].

Chemical composition of bee pollen. On average, it contains 24 % of proteins, 25 % minerals, 0,5 % lactic acid, 3,3 % fats, 18 % sugar. In addition, it contains micro- and macronutrients, substitutable and essential amino acids, vitamins, minerals, phenolic compounds, nucleic acids, hormones, growth stimulants, natural antibiotics and other biologically active substances. Bee pollen is rich in such vitamins as: vitamin A, D, E, B vitamins (B_1, B_2, B_5, B_6, B_9), vitamins C, PP, and minerals such as: Fe, Co, Mn, Cu, Mo, Cr [18]. It contains albumin, globulins, mucoproteins, enzymes (amylase, invertase, phosphatase, peroxidase, etc.); from nitrogenous substances — peptides, and 32 amino acids in free form in protein hydrolyzates. Essential amino acids are approximately 22-40 %: arginine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, tryptophan [19]. Pollen is also

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rich in fats and fat-like substances (phospholipids, phytostearins). The composition of fats includes lauric, myristic, palmitic, stearic, arachidonic, oleic, linoleic and other fatty acids that have antioxidant properties [20].

The benefits of eating bee pollen for humans are enormous. Regular use improves heart muscle function, reduces vascular permeability and increases their elasticity, normalizes blood supply to the brain vessels, normalizes blood pressure, increases physical and mental activity, reduces the effect of radiation and free radicals, promotes metabolic processes in the body, normalizes the functioning of the gastrointestinal tract, increases the reproductive functions of men and women, helps to accelerate wound healing processes, slows down the growth and development of certain types of cancer cells, strengthens local and general immunity [21].

Pollen is not recommended for people with diabetes and honey allergies. You should be careful when consumed by people with hormonal imbalances. In such cases, the product can both improve and worsen their condition. Therefore, before starting consuming pollen, you should consult an endocrinologist [13].

Bee bread is a flower pollen converted by bees under the influence of lactic acid. The process of making bee pollen is a long one. When pollen is delivered to the hive, the bees process it in their goblet saliva, put it in a honeycomb cell, and then pour fresh honey and sealed with wax. Under the influence of lactic acid in the cells, it is preserved and dehydrated [22].

Bee bread is a combination of nutritional and biologically active components of plant and animal (bee) origin, containing a number of substances: minerals, amino acids, carbohydrates, essential oils, vitamins, lipids, fatty acids, etc. Bee bread has a pronounced biological effect on the human body, helps to normalize all types of metabolism, has stimulating properties, accelerates the growth and development of organs and tissues. Bee bread is a biological stimulant, increases appetite, improves tissue tone and turgor, and stimulates the body's defenses [23].

Bee bread has a unique chemical composition. By $^1/_3$ of it consists of proteins, the rest are trace elements, enzymes, amino acids and vitamins. Composition of bee bread are vitamins E, C, D, K, P, B_1, B_2;

- 20 amino acids (alanine, leucine, lysine, arginine, valine, histidine, etc.);
- trace elements: iron, cobalt, potassium, magnesium, zinc, phosphorus, manganese, copper, chromium;
- organic acids;
- fatty acids;
- glucose and fructose;
- carotenoids;
- hormone-like substances.

The uniqueness of bee bread is that it contains all amino acids [24]. Their presence explains the wound healing property of the beehive. This bee product is also rich in vitamins. Bee bread is a source of B vitamins, which are necessary for normalizing the nervous and cardiovascular systems, improving intestinal function, and strengthening the immune system. The product contains vitamin E, which supports blood circulation in the body, provides regeneration of damaged tissues. Vitamin D is essential for the health of osteoarticular system, for normalization of blood pressure and heart rate. Bee bread contains a significant amount of carbohydrates — about 30 % [25]. The main part is fructose and glucose, and sucrose is also present, maltose, starch, and fiber. The product contains a large number of enzymes (catalase, amylase, peroxidase, etc.) that regulate metabolic processes in the body.

For the use of pollen and bee bread in medical nutrition, the most important are their following biological properties: anabolic, adaptogenic, immunostimulating, antioxidant, stimulating regeneration, erythro- and leukopoiesis.

The anabolic effect of bee bread and

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pollen is associated with the presence of amino acids, the content of which is higher in these products than in milk and beef. The antioxidant properties are attributed to the presence of vitamin E, carotenoids, and vitamin C.

Stimulation of regeneration is explained by the presence of vitamins A, E, B1, as well as folic acid, which, in turn, enhances the synthesis of nucleic acids. The stimulation of erythro- and leukopoiesis is explained by the presence of proteins, iron and cobalt and copper.

Immunostimulating effect occurs due to increased phagocytic activity of neutrophils, T- and B-lymphocytes, while it is believed the activity of bee bread to be 2 times higher than that of pollen.

The adaptogenic effect is the ability to increase the body's resistance to adverse physical, chemical influences, stresses and is determined mainly by protein composition [26, 27].

Conclusions

Despite the significant progress in medicine and pharmaceuticals, the incidence among the population continues to grow. New pathological conditions and diseases are emerging pathological conditions and diseases, often caused by the use of various medicines, excessive and not always appropriate use of antibacterial drugs and hormones, as well as their cross-action with each other. This problem remains relevant and requires new approaches to its solution. Increasing the therapeutic potential of natural products, especially bee products, has been attracting the attention of researchers for the last decades. They have high nutritional and therapeutic value due to their chemical composition. Recent research and the definition of their biologically active compounds responsible for generating antiviral, antibacterial, antifungal, antitumor, antiparasitic, and hepatoprotective and immunomodulatory effects require comprehensive further study.

A key aspect of successful apitherapy is the availability of an experienced specialist with in-depth knowledge of beekeeping, pharmacology of apiproducts, and is constantly improving their skills and knowledge.

Thus, the results of the analysis of publications of the last decade showed that further research and study of biologically active components of bee products are relevant and promising.

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