

Medicinal plants in nutricosmetics

Rośliny lecznicze w nutrikosmetykach

ABSTRACT

Nutricosmetics are nutritional supplements that affect the condition of the skin and its appendages. They are available as ampoules, capsules, or tablets which improve skin elasticity and tone, as well as increase its hydration. Supplements, that prevent excessive hair loss and support the proper growth of nails, are also classified as nutricosmetics. Many supplements contain compounds of plant origin that are rich in active ingredients and exhibit a beneficial effect on the physiology of the skin and its appendages.

The aim of this study was to assess the health-promoting effects of selected species of medicinal plants used in nutricosmetics based on the latest literature reports. During the analysis of specific species, the herbal raw material, main biologically active substances, their action, and application were taken into account.

Active ingredients are obtained from many parts of plants, including fruits, leaves, and herbs. They are a source of flavonoids, mineral salts, vitamins, and antioxidants of anti-aging, and anti-inflammatory properties. The wide use of plant raw materials of popular species and the richness of active ingredients of multidimensional action obtained from them, creates great opportunities for the dietary supplement industry.

Keywords: nutricosmetics, medicinal plants, active ingredients, plant substances, dietary supplements

STRESZCZENIE

Nutrikosmetyki to dodatki dietetyczne wpływające na stan skóry oraz jej wytwory. Dostępne są jako ampułki, kapsułki czy tabletki poprawiające elastyczność i koloryt skóry, a także zwiększające stopień jej nawilżenia. Często są nimi suplementy przeciwdziałające nadmiernemu wypadaniu włosów oraz wspomagające prawidłowy wzrost paznokci. Wiele z nich zawiera w swoim składzie związki pochodzenia roślinnego, które są bogate w składniki aktywne wywierające korzystny efekt na fizjologię skóry i jej przydatki.

Celem niniejszej pracy było dokonanie oceny, na podstawie najnowszych doniesień literaturowych, prozdrowotnego działania wybranych gatunków roślin leczniczych mających zastosowanie w nutrikosmetykach. Podczas analizy określonych gatunków, uwzględniono wykorzystywany surowiec zielarski, główne substancje biologicznie czynne oraz ich działanie i zastosowanie.

Składniki aktywne pozyskiwane są z wielu części roślin, m.in. z owocu, liścia czy ziela. Są one źródłem flawonoidów, soli mineralnych i witamin działających głównie antyoksydacyjnie, przeciwstarzeniowo oraz przeciwzapalnie. Szerokie wykorzystanie surowców roślinnych popularnych gatunków oraz bogactwo pozyskiwanych z nich składników aktywnych o wielowymiarowym działaniu, stwarza duże możliwości dla przemysłu suplementów diety.

Słowa kluczowe: nutrikosmetyki, rośliny lecznicze, substancje aktywne, substancje roślinne, suplementy diety

INTRODUCTION

Actions aimed at improving lifestyle, well-being, and thus health, are increasingly attracting interest of the public. Among the most frequently promoted pro-health practices, the popularization of various forms of physical activity,

dissemination of knowledge about healthy eating, innovative forms of supplementation and cosmetic treatments can be distinguished. Currently, attention is also paid to multi-directional health promotion in order to increase the



effectiveness of actions and improve them. Proper eating habits have a significant impact on health. A properly balanced and personalized diet can significantly determine the condition of the body, due to above it is important to choose the right amount of nutrients tailored to individual needs. Nutrition has a significant impact on the condition of the skin. In the therapies of several lesions, e.g. psoriasis, atopic dermatitis, or acne vulgaris, in addition to pharmacological treatment and proper care with the use of preparations for external use, dietary forms of treatment support are also used [1, 2]. Micro- and macroelements, vitamins, or compounds of plant origin can be supplied to the body not only with food but also with the use of appropriate supplementation. Currently, the increased demand for dietary supplements creates many new opportunities for manufacturers. There is a desire for a multidimensional approach when creating new forms or methods of using specific preparations, combining knowledge from many fields, including the aforementioned pharmacology, dietetics, and cosmetology. Among the innovative preparations popular on the market nutricosmetics can be distinguished – dietary supplements supporting the condition of the skin, hair, and nails [1, 3].

NUTRICOSMETICS AS A GROUP OF DIETARY SUPPLEMENTS

A significant part of the legal systems in the world classifies products as dietary supplements, cosmetics, and medicinal products. The sphere of nutricosmetics is legally subject to the Food and Nutrition Safety Act or legal regulations concerning cosmetics. The Food and Nutrition Safety Act defines a dietary supplement as a food used to supplement a proper diet, which is a concentrated source of vitamins, minerals, or other substances with a nutritional or other physiological effects [4].

There is a wide range of dietary supplements, including improving concentration, and sleep quality, intended for physically active people, as well as supporting the reduction of body fat or affecting the condition of the skin. The Foundation for Innovation in Medicine introduced the concept of nutricosmetics in 1979 in the United States, and it was finally defined in 1999. These products are referred to as dietary supplements, which provide a concentrated form of a given bioactive ingredient delivered to improve health, in doses higher than those supplied with normal food [5]. Nutricosmetics are most often in the form of ampoules, capsules, and tablets. Their oral supplementation may affect the physiological processes occurring in the skin and its appendages and thus contribute to improving their condition. Depending on the application, nutricosmetics contain a certain number of active substances. Most often, these are amino acids (including arginine, cystine, cysteine, methionine), enzymes (bromelain, papain), polyphenols, polysaccharides, prebiotics and probiotics, mineral salts (micro- and macroelements, including zinc and

selenium), polyunsaturated acids fatty acids (docosahexaenoic, eicosapentaenoic, linoleic, linolenic), vitamins (A, group B, C, E) and compounds of plant origin [6].

COMPOUNDS OF PLANT ORIGIN IN NUTRICOSMETICS

Substances of plant origin are common components of multi-ingredient dietary supplements, including nutricosmetics. These compounds are characterized by a beneficial effect on the skin and its appendages, while their safety when used in dietary supplements, may be problematic.

The ease of registering dietary supplements is one of the factors threatening the health of a potential consumer. In order to place the product on the market, filling the form available on the website of the Chief Sanitary Inspectorate is only needed. Therefore, an in-depth multifaceted analysis of the raw material used is important. Proper identification of the species, including its Latin name, the part of the plant used from which the active substances were obtained, or the form used in the preparation is an important step in verifying the safety of products of plant origin. Another important procedure that minimizes the risk to the consumer's health is the standardization of plant material due to the fact that it is an optional activity for those who want to introduce a product for sale. Equally important is the assessment of the origin of the species in order to eliminate raw materials contaminated with heavy metals and microorganisms or adulterated with another, sometimes dangerous plant substance [7].

Paying attention to the above-mentioned aspects regarding the safety of using substances of plant origin in dietary supplements allows for avoiding a threat to the health and life of consumers. It is therefore important to choose products from a reliable source. In the next part of the article, several species of medicinal plants commonly used in the production of nutricosmetics are listed and described.

Asparagus officinalis (*Asparagus officinalis* L.)

- Raw material: stalk (*stipes*).
- Main biologically active substances: amino acids, anthocyanins, phenols (3-O-feruloylquinic acid, asparanin), flavonoids (rutin, quercetin, kaempferol, isorhamnetin), ascorbic acid, asparagus acid, folic acid), polysaccharides (dietary fibre), saponins, mineral salts (copper, zinc, manganese, potassium), thiazole, thiophene, vanillin, and their methyl and ethyl esters.
- Action and application in nutricosmetics: asparagus extract has an antioxidant effect, mainly due to the content of flavonoids that scavenge free radicals. The extract also has anti-wrinkle features, primarily due to the presence of polyphenols. These compounds inhibit the activity of enzymes that break down collagen and elastin (MMP-1, elastase) and hyaluronic acid (hyaluronidase) - the basic

building blocks of the skin. In addition, flavonoids such as kaempferol or isorhamnetin inhibit the activity of tyrosinase - an enzyme involved in the synthesis of melanin in the skin. For this reason, asparagus extract can potentially be used as a discoloration and brightening agent [8-11].

Aloe vera (*Aloe vera* (L.) Webb.)

- Raw material: leaf (*folium*).
- Main biologically active substances: alkaloids, amino acids (alanine, arginine, aspartic acid, cysteine, glutamic acid, glycine, histidine, hydroxyproline, isoleucine, leucine, lysine, methionine, phenylalanine, proline, threonine, serine, tyrosine, and valine), anthraquinones (homonataloin B, aloinoside B, microdontin B), enzymes (oxidase, alkaline phosphatase, amylase, bradykinase, carboxypeptidase, catalase, cellulase, lipase, and peroxidase), phytohormones (auxins and gibberellins), flavonoids, tannins, organic acids (uronic, salicylic), mineral salts (calcium, sodium, chlorine, zinc, iron, potassium, copper, magnesium ions), sterols (campesterol, β -sitosterol and lupeol), triterpenes, tannins, carbohydrates (arabinose, cellulose, fructose, fucose, galactose, glucose, lactose, maltose, mannose, pectic substance rhamnose, sucrose, uronic acid and xylose), vitamins (A, C, E, D, B1, B2, B3, B12).
- Action and use in nutricosmetics: juice obtained from aloe leaves contain a wealth of active substances with antibacterial, antioxidant, anti-allergic, and anti-inflammatory properties. The compounds also strengthen skin blood vessels and the protective hydrolipid barrier of the skin. In addition, they improve cellular metabolism, among others by stimulating the synthesis of collagen from fibroblasts [12-14].

Hemp (*Cannabis sativa* L.)

- Raw material: inflorescence (*inflorescentia*), seeds (*semen*).
- Main biologically active substances: cannabinoids (cannabidiolic acid (CBDA)) found in the largest amount in female inflorescences and phenylamides, phytosterols, flavonoids, ligandamides, essential fatty acids (EFA): omega-6 (linoleic acid), omega-3 linoleic acid); polyphenols, vitamin E (α -, δ - and γ -tocopherols) found mainly in hemp seeds.
- Action and use in nutricosmetics: dietary supplements containing hemp seed oil have properties that strengthen the hydrolipid barrier of the skin (counteracting epidermal hyperproliferation and preventing transepidermal water loss). Cannabinoids obtained from inflorescences, in particular cannabidiolic acid, have antioxidant (protection against reactive oxygen species) and anti-inflammatory (lowering the level of pro-inflammatory chemokines / cytokines) properties. CBDA also exhibits antibacterial activity against Gram-negative bacteria (*P. aeruginosa* and *E. coli*) and Gram-positive bacteria (*S. aureus*), thanks

to which it can be useful as an ingredient supporting the treatment of bacterial skin infections [15-18].

Common figus (*Ficus carica* L.)

- Raw material: fruit (*fructus*).
- Main biologically active substances: alkaloids (kinin), amino acids (cysteine, tryptophan, tyrosine), anthocyanins, phytosterols, flavonoids (luteolin, quercetin), organic acids (citric, fumaric, malic, shikimic), minerals (sodium, potassium, and calcium), polysaccharides, vitamins (thiamine, riboflavin, and niacin).
- Action and use in nutricosmetics: fig fruit extract has an antioxidant effect on the skin (protection against reactive oxygen species), which results in an anti-aging influence. In addition, it has moisturizing (strengthening the hydrolipid barrier of the skin), antibacterial and antifungal, anti-inflammatory, immunostimulating, and seboreregulating properties. In addition it supports the reduction of body fat by inhibiting the enzymes α -amylase, α -glucosidase, and pancreatic lipase [19-21].

Barley (*Hordeum vulgare* L.)

- Raw material: herb (*herba*).
- Main biologically active substances: β -carotene, chalcones, quinones, chlorophyll, enzymes (superoxide dismutase and catalase), flavanones, flavonoids, isoflavonoids (saponarin and 2-O-glycosyl isovitexin), benzoic acid, cinnamic acid and its derivatives, flavones, proanthocyanides, mineral salts (zinc, magnesium, copper, potassium, calcium, iron), vitamins (B1, B2, B5, B6, B9, C, E), aminophenolic compounds.
- Action and use in nutricosmetics: the ingredients of barley grass powder or freeze-dried barley grass extract have moisturizing and anti-aging effects. They contribute to protection against the harmful effects of reactive oxygen species, including those formed as a result of skin exposure to UV radiation. Active substances regulate the process of fibroblast proliferation and inhibit hyaluronidase, thus ensuring the proper construction of collagen fibers and increasing the content of hyaluronic acid in the skin. These physiological processes result in anti-aging and moisturizing effects. Another property of the extract is also the inhibition of the melanogenesis process, which allows using it as eliminating discoloration ingredient [22-24].

Tomato (*Solanum lycopersicum* L.)

- Raw material: fruit (*fructus*).
- Main biologically active substances: amino acids (cystine, methionine), dietary fiber, β -sitosterol, glycoalkaloids (solanine and tomatine), carotenoids (β -carotene, lycopene), fatty acids (linoleic, oleic, palmitic, stearic, linolenic), mineral salts (zinc, phosphorus, magnesium, manganese, copper,

potassium, calcium, iron), vitamins (A, B1, B3, B9, C, D, E, K), phenolic compounds (quercetin, kaempferol, naringenin, lutein, caffeic, ferulic and chlorogenic acids).

- Action and use in nutricosmetics: tomato extract contains antioxidants that prevent cell damage caused by reactive oxygen species (including superoxide anion radicals, hydroxyl radicals, and hydrogen peroxide). The active substances also have immunostimulating and anti-inflammatory effects, and also improve blood circulation within the skin's blood vessels, thus oxygenating the cells and regulating their division. The extract is therefore a component with strong anti-aging properties [25, 26].

Evening primrose (*Oenothera biennis* L.)

- Raw material: herb (*herba*).
- Main biologically active substances: anthocyanins, flavonoids, tannins, fatty acids (linolenic, γ -linolenic), tocopherols, phenolic compounds (ellagic acid, gallic acid, luteolin-7-glucuronide, quercetin-3-glucuronide).
- Action and application in nutricosmetics: evening primrose extracts and oils have antioxidant properties (the ability to scavenge free radicals and metal chelation), whitening features (reducing the activity of cellular tyrosinase, and thus the content of melanin in melanocytes), improving skin elasticity and hydration (inhibiting expression of MMP-2 and MMP-9, increasing the synthesis of hyaluronic acid, reducing the level of transepidermal water loss) and anti-inflammatory action (decreasing the number of pro-inflammatory cytokines and mast cells initiating an inflammatory reaction, including those caused by skin exposure to UVB radiation) [27-29].

SUMMARY

Dietary supplements are characterized by great diversity. Some of them are nutricosmetics, the use of which serves not only health but also visual aspects by affecting the physiology of the skin, hair, and nails. The demand for this type of dietary supplement and the combination of knowledge in the field of health promotion provides many new opportunities for producers. One of them may be the use of the newest combinations of plant-derived compounds. Such innovations undoubtedly diversify the supplementation market, but potential consumers should pay attention to the composition and safety of nutricosmetics to avoid any side effects. Examples of popular species of medicinal plants used in dietary supplements intended for the skin and its appendages are asparagus (*Asparagus officinalis* L.), aloe vera (*Aloe vera* (L.) Webb), hemp (*Cannabis sativa* L.), common fig (*Ficus carica* L.), barley (*Hordeum vulgare* L.), tomato (*Solanum lycopersicum* L.) and evening primrose (*Oenothera biennis* L.). These species are characterized by a wealth of biologically active substances,

such as flavonoids, vitamins, and mineral salts, thus affecting skin elasticity and tone, anti-inflammatory processes, proper growth of hair and nails, and hydration of the epidermis.

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