



Application History and Beneficial Therapeutic Features of Echinacea

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Abstract

Nowadays, in the age of increased chemical contamination of the environment, the consumption of drugs that have a minimal negative side impact on the human body, which are the derivatives of natural plant compounds are increasing. One of the most pressing issues facing the science of medicine and pharmacy is the preparation of syrups rich in a complex of biologically active substances for the treatment of the immune system diseases. In recent years, echinacea drugs have been successfully used in the regulation of the immune system in the various forms Echinacea drugs have pronounced immunomodulating properties that make them irreplaceable in the fight against infections and parasites. In this article we look at the history of the unique properties of echinacea discovery and give an overview of its multifaceted impact on the body. In this article, we discuss the composition of echinacea and consider the healing properties of some of its components.

Keywords: Anti-inflammatory properties, Anti-parasitic properties, Echinacea, Immunomodulating effect

Introduction

History of Echinacea

It was Kh.K. Fom, who first revealed the healing properties of Echinacea, family Asteraceae [1]. Since 1871, it has been used in complex therapy as a «blood purifier» in various diseases (rheumatism, migraines, infectious diseases, eczema, wounds, pain of various etiologies, dizziness, poisoning, bee stings, tumors, syphilis, malaria, haemorrhoids, etc.)(Figure 1).

Echinacea Purpurea is mainly in the United States [2], European countries, Moldova, Ukraine and Russia. It was brought to Russia in the XII-th century as an ornamental plant, this flower grows along streams and in sparse forests, mostly in Ukraine and Kazakhstan.

The most common specie is the Echinacea Purpurea cultivated in the XXVII-th century in Europe as an ornamental plant.



Figure 1: Widespread Echinacea Purpurea.

In 1920, echinacea products became the most popular drugs and is still successfully used in medicine. In 1930, echinacea was introduced to Europe, and in the 1950s its intensive research began. In West Germany, more than 250 pharmaceuticals are prepared from echinacea, including extracts, ointments and beverages. In 1997, the amount of echinacea drugs sold worldwide helped raise \$1 million. Echinacea is mainly popular in the United States and Europe. According to the sales rating, it is in the top ten most used herbs in the world, it acts like an antibiotic. It exhibits a positive effect in angina, hepatitis, prostatitis, impotence, eczema, psoriasis, wounds and burns, and even depression [3].

Currently, 3 species of echinacea are used in medicine: red, thin-leaved (*E. Angustifolia*), pale. Various drugs including ointments, are obtained from *Echinacea Purpurea*. Echinacea accelerated the healing of wounds of fleeing horses, what helped to form the first idea about echinacea usage as wound healing compound. In 1871, the first drug from this plant was obtained; its author, a non-professional physician Mayer (USA), trust in the power of this plant so much that he let the snake bite him in present of people and performed blood purification with echinacea. After this incident, the specialists interested in the healing properties of the plant began to study it purposefully. In 1930, Dr. Madanus (founder of a leading company for the production of drugs from echinacea in Germany) came to the United States to buy swollen *Echinacea Simulata* seeds. He bought and cultivated the seeds taken from Chicago company, but during the the plant growth, it was discovered this specie is *Echinacea Purpurea*, not *Echinacea Simulata*. Since the healing properties of the *Echinacea Purpurea* were far superior to those of *Echinacea Simulata*, its research continued. In the early XXth century, echinacea ore was the most popular medicine in the United States. The growing interest in chemicals in the 1930's virtually stopped the use of echinacea in medical practice in United States, but in Germany the study of its pharmacological properties and the cultivation continued, where its valuable experience in therapeutic and prophylactic purposes were collected, and an industry for the production of medicines from plant raw materials has been established. In the late 80's, with the discovery of new pharmacological properties of this plant, interest in echinacea raised again in America and Eastern Europe.

According to Ukrainian and Belarusian scientists, echinacea should be added to baby food and products. The addition of echinacea to the juice increases the body activity, regulates memory and attention, improves vision and sleep, enhances immunity. Professor SA.Tamilin from Kiyev studied this plant well and found that it is effective in depression, mental and physical fatigue, angina, tonsillitis, inflammatory diseases of internal organs, acute and chronic infectious diseases (typhoid, diphtheria, osteomyelitis, cerebral meningitis); he recommended to use its positive effect

in wounds and burns treatment. LI. Seleznenko recommended echinacea for the treatment and prevention of influenza, herpes simplex, hepatitis, nephritis, rheumatoid arthritis, rheumatism, cystitis, prostatitis, impotence, leukopenia, eczema, psoriasis, vasomotor rhinitis, stomatitis. In medical practice, tincture «Immunal», « Echinacin liquid», «Echinacea composition S», «Estifan», «Galenofarm», « Echinacea Hexel», « Echinacea Ratiofarm» and others are used as medicines. Currently, echinacea drugs are used in prostatitis, thrombophlebitis, hepatitis, kidney, gynecological & upper respiratory tract diseases [4]. Echinacea is also used to treat psoriasis, eczema, burns and trophic ulcers. Echinacea drugs have a therapeutic effect in various pathological conditions by strengthening the body's natural defenses by stimulating immune system. Therefore, echinacea is prescribed for chronic inflammatory diseases, diseases characterized by weakening of the functional state of the immune system due to radiation, ultraviolet radiation, chemotherapy, long-term treatment with antibiotics. Echinacea is effective in children whose immune systems not fully formed yet, and in the elderly, whose immune function is reduced due to age [5]. In diseases of the upper respiratory tract, echinacea is used for complex therapy and prophylaxis as well [6]. Echinacea contains biologically active substances that destroy staphylococci, streptococci, herpes viruses, intestinal spores. The echinacea containing drugs are used in carbuncles, abscesses, burns I-III stage, severe infectious diseases. Its antiviral properties are due to the induction of anabolic processes in the organism. This brings to light a wide range of opportunities for elimination the side effects of chemotherapy in oncological diseases, to fight AIDS, and to treat chronic fatigue syndrome. Echinacea also found a wide way in dental practice. It is included in various toothpastes produced in Germany; systematic use of Paradontax and Dentafor prevents pus and bleeding the gums, improves the condition of periodontal tissues and protects tooth enamel. The root active compounds of the plant regulate metabolism, have antiseptic, laxative, adaptogenic properties.

Content: All plant parts contain polysaccharides and essential oils. The essential oil is non-cyclic sesquiterpene derivative. Underground organs of plant contain glycosides, betaine, resin, echinosides & several organic acids as well. In addition, the plant is rich in phytosterols. The plant is native to America & Canada.

Echinacea Purpurea contains polysaccharides (heteroxylanes, arabinoramno-galactans), essential oils (0.5% in flowers, 0.35% in grass, 0.05-0.25% in roots; the main part of essential oil is non-cyclic sesquiterpenes), flavonoids, oxy-acids (gambling, coffee), tannins, saponins, phenylpropanoids. It is rich in echinasin (amides of unsaturated acids), echinolone (unsaturated ketoalcohol), echinacoside (glycoside-containing coffee acid and pyrocatechin), organic acids, resins, phytosterols (Figure 2).

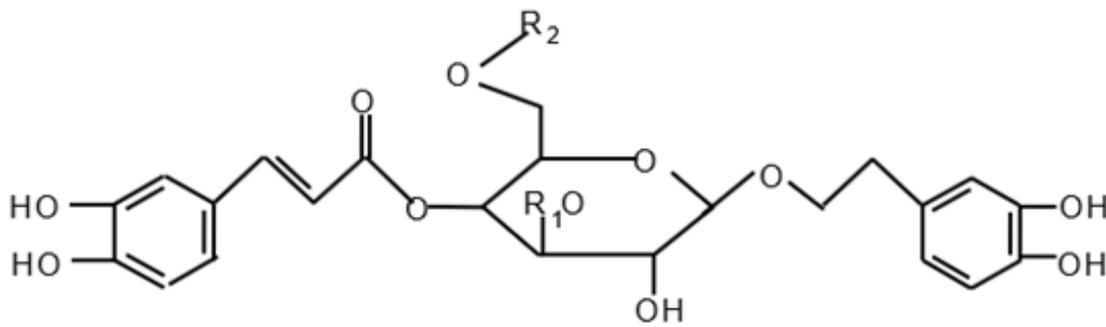


Figure 2: Echinacoside. R1 - rhamnose; R2 - glucose.

The plant contains antioxidants, organic acids, essential oils, waxes, macro- (K, Ca), & microelements (Ag, Co, Se, Mg, Zn, Mn), vitamins A, C, E in all parts. All these substances facilitate each other's therapeutic effect, creating a natural multifaceted drug complex. The surface of the plant is rich in polysaccharides, essential oil, echinacoside, betaine, resins. The roots contain inulin (up to 6%), glucose (7%), essential and fatty oils, phenolic acids, betaine, resin. Immunostimulating and anti-inflammatory effects are due to plant specific polysaccharides. These polysaccharides surround the cell and protect it from pathogenic microorganisms. Inulin improves in betaine metabolism. In particular, 85% of patients with high levels of leukocytes due to the liver and kidneys disease fall to the norm. The discovery of echinacea drugs mechanism of immunosuppressive effect dates back to the late 80's and early 90's of last century. The therapeutic properties of echinacea drugs are determined by the 3 main biologically active substances contained in the plant: alkamides, arabinogalactones and glycoproteins. It was determined that:

- Alkamides stimulate phagocytic activity, block *cyclooxygenase* and *5-lipoxygenase*, which provide anti-inflammatory effect.
- Arabinogalactone stimulate interferon synthesis, activate macrophages, have anti-inflammatory, antifungal and anti-parasite activity (*listeria, leishmaniasis*) [7].

Glycoproteins of echinacea stimulate the activity of B-cells, increase the secretion of interleukin-1. Under the influence of echinacea, the permeability of the cell membrane to pathogenic microorganisms in the body decreases, so it inhibits the movement of microbes in the body. In addition, the plant substances enhance the activity of all immune cells and accelerate their movement. It also produces many substances in the body to protect against infections. Echinacea is reminiscent of the hormone cortisone, which fights various diseases in the body. Some of its properties can be compared to the effects of benzidamine or indomethacin. Echinacea has the

ability to enhance the proliferation of macrophages and leukocytes, as well as B-lymphocytes & phagocytosis. Under the influence of the plant, the production of *lymphokines* and *lymphocytes* is enhanced, strengthens antiviral and antibacterial protection. Other biological activities of the plant such as antioxidant, larvicidal activities have been reported [8]. Echinacea exhibits an anti-tumor effect by enhancing the ability of interferon to form in *lymphocytes*. Under the influence of the plant, an anti-tumor factor is formed in the body, as well as the work of macrophages is intensified to disrupt the formation of malignant cells, after which the growth of tumor stops.

Interesting results were also obtained in the study of the effect of echinacea on the main scourge of *alveolocytes* in COVID infection: cytokine storm. Since Echinacea increase immune cells activity, there was a concern it could worsen the clinical manifestations in COVID infection by over-activation of the cytokine storm; however, clinical trials show that Echinacea decreases levels of cytokine storm [9]. Due to this, Echinacea-based medicines may be administrated in COVID-19 infection.

Conclusion

The rich Echinacea content allows it to be used for treatment of COVID-19 infection.

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