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# The importance of soybean (*Glycine max*) as a source of biologically valuable substances

**Abstract:** In the paper the biological valuable components of soybean are discussed. Soya is widespread product in the world. Soya is a prevention agent against of cardiovascular diseases, tromboembolosm. Consumption of soybean protein is decreased the content of cholesterol in blood, the risk of osteoporosis, promotes preservation of bones in the elderly. The useful futures of soybean are provided by the large content of protein, izoflavonoids, lecithin, micro- and macroelements and vitamins. High concentrations of biological active components in soybean allow using them in the pharmaceutical industry for production of drugs and dietary supplements. Phytopreparations like Inoclim, Estroel, produced by pharmaceutical companies on the basis of soybean extract, containing soybean isoflavonoides against menopausal syndrome are reviewed. Soybean isoflavonoids like genistine and daidestin have antioxidant, anticarcinogenic effect, normalize the function of the immune system and hemostasis The study of biological valuable components of Kazakhstan soybean varieties are required.

**Key words:** soybean, microelements, protein, izoflavonoids, lecithin.

Soya got a status of one of the most important crops as a source of protein, oil and nutraceuticals. The high content of isoflavonoids and folic acid has made this universal to use it for a healthy diet. Soy proteins are becoming increasingly important as a plant source for protein products with a high number of essential amino acids. The content of quality fats and polyunsaturated fatty acids is also important from the nutrichetic point of view [1]. Soy (*Glycine max*, Leguminosae) – is not only a valuable oil culture, but also as a feed for livestock and aquaculture. Soy is home to China, the main producers of soy products in the world are the USA, Brazil, Argentina and India. Soybean has been cultivated in China for more than 4000 years. Soy is a commercial crop and grown in 35 countries as the main seed of oilseeds [2]. On a global scale, 38% of the total soybean crop is grown in the US; in Brazil and – 25%, Argentina – 19%, China – 7%, India – 3%, Canada – 2% and Paraguay (2%) [3].

Soy is used as an important source of dietary protein and oil all over the world. Soy is of high nutritional value due to the high concentration of oil (18-25%) and protein (38-50%) and is a popular food all over the world [4]. Production and consumption of soy products is increasing every day in Western countries. In Asian countries, soy is used as a fermented and unfermented food product, such as soy sauce, Miso, natto, yoghurts, kinako, fresh protein, desserts, baby food and soy milk, which is further processed into tofu [5]. The main product of soybean is used as the primary source of protein for diseases, such as lactose intolerance and severe gastroenteritis in infants [6]. Mature soybean seeds contain approximately 35% protein, 31% carbohydrates, 17% fat, and 5% minerals [7].

Soy protein contains a significant amount of essential amino acids, that is, histidine, isoleucine, leucine, lysine, phenylalanine, tyrosine, threonine, tryptophan and valine, which are recommended for daily consumption as a balanced diet [8]. It is known that soy reduces the level of cholesterol in blood plasma [8] and is used in the prevention of cancer [9], improves bone density [10] and provides protection against bowel and kidney disease [11]. These properties are supported by the presence of isoflavonoids, saponins, protein and peptides in soybeans [12; 13]. Soy contains 35-40% protein, this includes globulins, 11S glycine and 7S β-conglycinin. These proteins contain all the amino acids necessary for human nutrition, which makes soy products almost equivalent to animal protein sources, but with less saturated fat

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and no cholesterol. Soy also contains biologically active protein components of hemagglutinin, trypsin inhibitors, α-amylase and lipoxygenases [14]. Soy is not only a high-quality protein, but now it is considered that it plays preventive and therapeutic roles for a number of diseases [15].

Soya contains about 19% oil, of which triglycerides are the main component. Soybean oil is characterized by a relatively large number of polyunsaturated fatty acids (PUFA) – 51% linoleic acid and 8% α-linolenic acid, stearic acid – 4, palmitic acid – 10, oleic acid – 23% of the total.

The oil also contains 1-3% phospholipids, ~ 35% phosphatidylcholine, ~ 25% phosphatidylethanolamine, ~ 15% phosphatidyl inositol, ~ 5-10% phosphatidic acid. Soybeans contain ~ 35% carbohydrates, polysaccharides, oligosaccharides, such as stachyose (4%) and raffinose (1.1%). Stachyose is a tetrose with galactosehaving structure of galactose-glucose-fructose, whereas raffinose is a triose with the structure of galactose-glucose-fructose [15]. When used as a dietary supplement to fiber, soluble polysaccharides are used to modify the physical properties of various products [16].

Soy is the best source of B vitamins compared to cereals, although B12 and vitamin C are not enough [14]. Soybean oil also contains tocopherols, which are natural antioxidants. Soy also contains 5% of minerals. It is relatively rich in K, P, Ca, Mg and Fe. Soy ferritin can extract a significant amount of iron [17].Traditionally, products based on soybeans have been used for many centuries in most Asian countries, and lately this food has been used.

Traditionally, soya bean products have been used for centuries in most Asian countries, and recently this food has been very popular in the western hemisphere [18]. Transgenic soybeans are included in agricultural technology to increase productivity mainly by reducing costs and, consequently, the cost of production. Soy is gaining momentum as a nutritious product, and is also becoming popular for nutraceuticals because it contains an essential amino acid and secondary metabolites such as isoflavonoids, saponins, phytic acids, phytosterols, trypsin inhibitors and peptides [19].

Soya as a functional ingredient influences lowering of cholesterol and the prevention of cardiovascular diseases, diabetes, bone strength and the prevention of cancer. It is believed that food based on soybeans can help lower cholesterol levels [7]. Transgenic soybean with α-tocopherol content by expression of the γ-tocopherol methyltransferase gene of the plant *Perilla frutescens* prevents oxidative damage to lipids during seed storage and germination [20]. The use of soybeans, which are good sources of calcium and protein and a simple way to help in maintaining strong bones and reduce the risk of osteoporosis. Studies show that it is isoflavones, genistein and dieldin in soybeans, prevent bone loss or bone destruction. In addition, protein in soy helps keep calcium in our bodies. Soy is the richest source of isoflavones (up to 3 mg/g dry weight) [21]. Isoflavonoids prevent various types of disease, such as bone fragility, cancer, cardiovascular diseases, menopause, diabetes and obesity [22-24]. Epidemiological and clinical studies of soy isoflavonoids have shown that soy consumption is associated with a reduced risk of breast cancer [25]. The influence of consumption of yellow soybeans, black soybeans (*Glycine max*) or beans (sword bean) (*Canavalia gladiate*) at the level of lipids and oxidative stresses in rats was evaluated. They suggested that consumption of various types of beans can inhibit oxidative stress in postmenopausal women, increasing antioxidant activity and improving lipid profiles [26]. In addition to isoflavones, soy contains other sub-classes of flavonoids, including flavonols, aurones, flavones, flavanols, chalcons, red and blue anthocyanin pigments. Folic acid, present in soybeans, has a synergistic effect in preventing loss of bone mass. It should be noted that the consumption of black soy has led to the greatest improvement in risk factors associated with cardiovascular diseases. Folic acid has a therapeutic effect in many other health disorders, such as anemia, poor absorption of nutrients, brain development in infants, treatment of Alzheimer's disease, age-related hearing loss, etc. Therefore, diets rich in soy, are a good source of this vitamin, can be useful for nutrition. The importance of polyphenols increases due to their dual role in the food industry as a stabilizer of lipids and in the prevention of diseases associated with oxidative stress. Polyphenols as natural antioxidants are able to inhibit lipid peroxidation and protect against damages caused by free radicals [27].

Soybeans, soy products and preparations based on soybeans (Figure 1) have found wide application for the treatment of menopausal syndrome due to the high content of phytoestrogens in them that have a unique selective effect on the β-receptors of estrogens, in contrast to endogenous estrogens and estrogens in the hormone replacement. It has been established from a number of studies that soy isoflavones are not only more effective in eliminating tides in women in menopause, but the effectiveness of soy isoflavones is comparable to that of hormone replacement therapy. In addition to influencing the neuro-

vegetative symptoms of menopause, soy isoflavones reduce the level of total cholesterol in the blood serum, reduce the level of low and very low density lipoproteins, and increase the level of high-density lipoproteins. In addition, according to some data, soy isoflavones exhibit an antithrombotic effect [28].


**Figure 1** – Phytopreparations, containing soybean extract (http://climaxhelp.ru/drugs/fito/)

In the treatment of climacteric syndrome, hormone replacement therapy continues to be the main method of treatment. But many women have contraindications or prejudices to the use of hormonal drugs. In connection with this, it is urgent to search for alternative methods of treating climacteric syndrome, including herbal preparations. It has been established that bioflavonoids are able to inhibit, and in some cases stimulate a large number of enzymatic systems, both in experimental animals and in humans. Flavonoids have antioxidant, anticarcinogenic effect, normalize the function of the immune system and hemostasis. In this case, the toxic effect of flavonoids on human and animal cells is either absent or minimal, and has protective properties for breast cancer [30].

Laboratory Innotech Internacional (France) produces the drug "Inoklim". At its core the preparation contains soybean extract, rich in two important isoflavones: genistin and daidzein, recommended for the treatment of patients with menopausal syndrome [31].

The effectiveness and acceptability of "Inoklim" in relation to the frequency and intensity of symptoms of climacteric syndrome, as well as the tolerability and safety of this drug was studied.

The severity of menopausal syndrome was assessed using a questionnaire to calculate the Kupperman index (vasomotor symptoms, insomnia, nervousness, dizziness, general weakness, headache, rapid heartbeat), and a second questioning was conducted against the background of ingestion of "Inoklim".

The study shows the high effectiveness of soy isoflavones in the treatment of the pathological symptoms of the climacteric symptom. Against the backdrop of the application of "Inoklim" for 3 months in postmenopausal women with pathologic menopause, the general condition significantly improved, the severity of psychoemotional and vegetative-vascular disorders decreased. Evaluation of the effectiveness of the drug by patients was high.

Phytopreparation "Inoklim" possesses an estrogen-like action, it helps to prevent and reduce the intensity of symptoms of menopause (hot flashes, osteoporosis, and emotional instability), stabilize the condition, improve sleep. The drug has no side effects inherent in hormone replacement therapy. It includes soybean extract Novasoy, soy lecithin, fish gelatin and other auxiliaries.

Thus, the study allows to consider the "Inoklim" containing soybean extract, rich in two important isoflavones: genistin and daidzin, as a highly effective method of stopping the pathological manifestations of climacteric syndrome, as well as an alternative method of its treatment in the presence of contraindications to the use of hormone replacement therapy or in case of failure from taking hormonal drugs.

The Estroel phytopreparation contains a zymicifugacaramose extract of the root of wild yam, contains soy extract. In addition to plant extracts, this preparation contains indole-3-carbinol, extract of nettle leaves, boron, vitamin E, vitamin B6, folic acid, amino acids (5-hydroxytryptophan, D, L-phenylalanine). Estroel helps eliminate estrogen deficiency, reduce the intensity of tides, correct the psycho-emotional state, reduce the risk of estrogen-dependent tumors, normalize hematological parameters, immunocorrection, prevent osteoporosis, and eliminate vitamin deficiency [32].

Thus, soy is one of the promising crops as a source of important components for the pharmaceutical industry, necessary for maintaining human health. Soy is currently grown in many regions of Kazakhstan. Soy is grown in the Almaty region (Aksu, Sarkan and Alakol regions) [28], in the farms of Northern Kazakhstan [29]. This crop is profitable, as it has a high purchase price and is successfully used in crop rotation. The investment cluster program "MaJiCo – 2020" provides, along with other crops, an increase in soybean crops in Kazakhstan to 400 thousand hectares with production of 1 million tons of beans per year. The future research works by the estimation and extraction of biologically valuable components from Kazakhstani soybean varieties are required.

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