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## THERAPEUTIC AND PREVENTIVE PROPERTIES OF MILK THISTLE

**Resume:** *In the modern world, the problem of preserving the biological diversity of medicinal plants is acute due to the irrational use of raw materials. The most relevant are studies of the intraspecific diversity of medicinal plants in order to identify the most productive forms with a given accumulation of biologically active substances. In this regard, the polymorphic species of milk thistle (*Silybum marianum* (L.) Gaertn.) of the Compositae family (Asteraceae) was chosen as the object of the study. It is worth noting that almost all parts of this amazing plant can be used for medicinal purposes, but traditionally milk thistle seeds are used as the most effective medicine, as well as oil, meal and flour obtained from them, which, with regular use, have an immunostimulating, bactericidal, anti-inflammatory, antispasmodic, radioprotective action. After analyzing the studies of foreign and domestic scientists on milk thistle, we can conclude that they mainly studied the morphology of the fruit of *S. marianum* and the accumulation of flavolignans in them. Studies on the accumulation of the sum of flavonoids in the fruits and leaves of *S. marianum* are fragmentary. The chemical composition of milk thistle is still being studied, because this species, depending on the origin and growing conditions, contains a different qualitative and quantitative composition of biologically active compounds. Therefore, depending on the milk thistle chemorassa, certain pharmacological properties will prevail. Despite the fairly well-studied composition of fruits, in the literature, there is practically no information on the chemical composition, as well as scientific data on the study and pharmacological use of milk thistle herb, which indicates the prospects of studying milk thistle herb as a new type of medicinal plant material.*

**Key words:** *milk thistle (*Silybum marianum* (L.) Gaertn.), chemical composition, medicinal properties, micronutrients, macronutrients, seeds.*

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### СҮТ ОШАҒАННЫҢ ПРОФИЛАКТИКАЛЫҚ - ЕМДІК ҚАСИЕТТЕРІ

**Түйін:** Қазіргі таңда шикізат ресурстарын ұтымсыз пайдалануға байланысты дәрілік өсімдіктердің биологиялық алуантүрлілігін сақтау аса маңызды мәселелердің бірі. Биологиялық белсенді заттардың өнімділігін анықтау үшін дәрілік өсімдіктердің соңық ішінде түрішілік әртүрлілігін зерттеу ең өзекті болып табылады. Осыған байланысты зерттеу нысаны ретінде полиморфты түр сүт ошаған (*Silybum marianum* (L.) Gaertn.) (Asteraceae) тұқымдасы таңдалды. Айта кету керек, емдік мақсатта осы өсімдіктің барлық дерлік бөліктерін қолдануға болады, бірақ дәстүрлі түрде сүт ошағанының тұқымдары, сондай-ақ олардан алынған май, ұн ең тиімді дәрі ретінде қолданылады сонымен қатар им-

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### ЛЕЧЕБНО-ПРОФИЛАКТИЧЕСКИЕ СВОЙСТВА РАСТОРОПШИ

**Резюме:** В современном мире остро стоит проблема сохранения биологического разнообразия лекарственных растений в связи с нерациональным использованием сырьевых ресурсов. Наиболее актуальными становятся исследования внутривидового разнообразия лекарственных растений с целью выявления наиболее продуктивных форм с заданным накоплением биологически активных веществ. В связи с этим, объектом исследования был выбран полиморфный вид расторопша пятнистая (*Silybum marianum* (L.) Gaertn.) семейства сложноцветные (Asteraceae). Стоит отметить, что в лечебных целях можно использовать практически все части этого удивительного растения, но традиционно в качестве наиболее эффективного лекарственного средства

муностимуляциялық, бактерицидтік, қабынуға қарсы, антиспазматикалық, радиопротекторлық әсерге ие. Шетелдік және отандық ғалымдардың сүт ошаған туралы зерттеулерін талдай келе, олар негізінен *S. marianum* жемісінің морфологиясын және оларда флаволиндердің жиналуын зерттеген деген қорытынды жасауға болады. *S. marianum* жемістері мен жапырақтарында флавоноидтар мөлшерінің жинақталуы туралы зерттеулер жеткіліксіз болып табылады. Сүтті ошағанның химиялық құрамы әлі де зерттелуде, өйткені бұл түрдің шығу тегі мен өсу жағдайына байланысты биологиялық белсенді қосылыстардың әртүрлі сапалық және сандық құрамы бар. Сондықтан, сүт ошаған химорассаға байланысты белгілі бір фармакологиялық қасиеттері басым. Жемістері жеткілікті түрде зерттелген құрамына қарамастан, әдебиеттерде химиялық құрамы туралы ақпарат іс жүзінде жоқ. Сүт ошаған түрін зерттеу және фармакологиялық пайдаланудың ғылыми деректеріне сәйкес, бұл түр дәрілік өсімдік материалының жаңа түрі ретінде зерттеудің болашағын көрсетеді.

**Түйінді сөздер:** сүтшаған (*Silybum marianum* (L.) Gaertn.), химиялық құрам, емдік қасиеттер, микроэлементтер, макроэлементтер, жеміс.

используют в основном семена расторопши, а также получаемые из них масло, шрот и муку, оказывающие при регулярном применении иммуностимулирующее, бактерицидное, противовоспалительное, спазмолитическое, радиопротекторное действие. Проанализировав исследования зарубежных и отечественных ученых по расторопше пятнистой, можно сделать вывод, что в основном изучали морфологию плода *S. marianum* и накопление флаволигнанов в них. Исследования по изучению накопления суммы флавоноидов в плодах и листьях *S. marianum* носят обрывочный характер. Химический состав расторопши пятнистой изучают и в настоящее время, потому что этот вид, в зависимости от происхождения и от условий произрастания, содержит разный качественный и количественный состав биологически активных соединений. Следовательно, в зависимости от хеморассы расторопши пятнистой, будут превалировать те или иные фармакологические свойства. Несмотря, на достаточно хорошо изученный состав плодов, в литературных источниках, практически отсутствует информация о химическом составе, а также научные данные по вопросам изучения и фармакологического применения травы расторопши, что свидетельствует о перспективности исследования травы расторопши пятнистой как нового вида лекарственного растительного сырья.

**Ключевые слова:** расторопша пятнистая (*Silybum marianum* (L.) Gaertn.), химический состав, целебные свойства, микроэлементы, макроэлементы, семена.

**Introduction.** Providing the population of Kazakhstan with effective and safe medicines is one of the priority tasks of pharmacy. Herbal medicines occupy an important place among the drugs used in various human diseases. The use of plants and their individual parts as medicines is deeply rooted in human history. Even in ancient times, people sought healing from their diseases in plants, which modern medicine explains by the presence in them of a large number of biologically active substances with a wide spectrum of action. The current state of the problem of the use of herbal medicines with hepatoprotective activity has increased significantly in recent years, especially in connection with the growth of toxic-allergic diseases associated with the treatment with synthetic agents. [1-6]. Studies show that medicinal plants owe their healing properties to the optimal ratio of biologically active substances contained in them, which have an evolutionary and genetically greater affinity for the human body than synthetic agents and requires a balanced approach. Medicinal products of plant origin have therapeutic and regulatory effects that affect the metabolic processes in the body, increase its protective properties, meeting modern medical and biological requirements. [7-8].

The purpose of this review was to search, analyze and study the data on modern preventive and therapeutic properties of "*Silybum marianum*" (L.), available in the literature. Long-term use of certain drugs, antibiotics, strong anti-inflammatory drugs, cancer drugs, even conventional paracetamol, ketarol and nimesulide [9] can lead to drug-induced damage to the gastrointestinal tract, especially the liver. The liver is the organ that processes any foreign substances that enter the body

through the digestive tract, cleansing the blood, neutralizing toxins and producing bile. Excessive consumption for more than two to three weeks antibiotics can provoke blockage of the bile ducts, the development of acute toxic hepatitis or intrahepatic cholestasis is possible [10]. However, a real scientific breakthrough in the study of the medicinal properties of milk thistle in liver diseases occurred with the discovery of biologically active substances and some mechanisms of their action, as well as the beginning of clinical studies in Central Europe [11-12]. The study of milk thistle and the development of medicines based on it were carried out in Germany, Bulgaria, the Czech Republic, the USSR and other countries.

Milk thistle (*Silybum marianum*) is rightfully considered a storehouse of nutrients and vitamins for the human body and a widespread popular medicinal plant in folk and official medicine. The pharmacological value of milk thistle fruits is due to the presence of silymarin in them, a strong anti-inflammatory agent of natural origin, capable of exerting a restorative effect, exhibiting pronounced antioxidant, anti-inflammatory, hepatoprotective, immunostimulating and antidepressant properties [13-18]. The main biologically active substances of milk thistle fruits are flavonolignans 1.5–3.0%, collectively known as silymarin, an active complex that not only protects the liver from aggressive factors, but also restores its damaged cells, normalizes the production and outflow of bile, improving the work of the gastrointestinal tract, the protective functions of the body [19-20]. It has been established by German scientists that silymarin protects and restores the liver, strengthens the walls of liver cells, protecting them from harmful factors. In addition, it promotes their

rapid regeneration when destroyed by toxic substances, and also destroys cells with damaged DNA [21–23]. Silymarin has a gastroprotective effect by suppressing the inflammatory process and oxidative stress in the gastric mucosa, tension, increasing antioxidant cytoprotective processes, preventing the development of gastric ulcers when taking non-steroidal anti-inflammatory drugs [24]. The main components of this complex are silybin, or silibinin, which accounts for 60–70%, silicristin (20%), silidianin (10%) and isosilybin (5%) [25], which effectively act in such liver diseases as hepatitis, dystrophy and cirrhosis of the liver, toxic lesions. Scientists have found that milk thistle silibinin, one of the components of silymarin, blocks the damaging effect of the hepatitis C virus on liver hepatocytes. This prevents the reproduction of this virus [26]. Milk thistle fruits contain a class of derivatives of flavonoids and phenylpropanoids - flavolignans: silybin, isosilybin, 2,3-dehydrosilybin, silyndrin, silycristine, silydianin, silymonin, 2,3-dehydrosilychristin, isosilychristin, silygermine, flavolignans are predominant: silybin - it accounts for 60-70%, silidianin - 10%, silicristin 20% of the total amount of flavonoids [27]. Milk thistle fruits are also rich in macro- and microelements, the content of potassium, calcium, magnesium and iron in them is 9.20, 16.60, 4.20 and 0.08 mg/g, respectively, the trace element composition is manganese (0.10 mg/g), d), copper (1.16 mg/g), zinc (0.71 mg/g), chromium (0.15 mg/g), nickel (0.20 mg/g), which protect and treat the membrane representing a shell of cells in our body, which have excellent preventive and therapeutic agents that help prevent or cure diseases.

Experimental studies have shown that silymarin (Legalon) restores impaired functions of hepatocytes caused by paracetamol in normotensive and hypertensive animals [28]. In general, it can be said that milk thistle preparations do not have a toxic effect even after prolonged use of more than one year [29–30]. Scientific experiments have shown that vegetable glycosides, silymarin and isosilybin strengthen the shell of liver cells and make it inaccessible to viruses, improving the production of new liver cells and the ability to speed up metabolism and activate the breakdown of fat cells. It has been proven in a large number of experimental *in vitro* and *in vivo* and clinical studies around the world that the hepatoprotective effect of silymarin helps to protect liver cells from various adverse effects. It has been established that the hepatoprotective effect of silymarin is associated with its antioxidant activity. The formation of free radicals in the human body is a normal physiological process, the intensity of which increases sharply in pathological conditions. Milk thistle interacts with free radicals in the liver and reduces their toxicity, interrupting the process of lipid peroxidation, preventing further destruction of cellular structures. In damaged hepatocytes, it stimulates the synthesis of structural and functional proteins and phospholipids due to the specific stimulation of RNA polymerase A, stabilizing cell membranes, preventing the loss of cellular components and intracellular transaminase enzymes, and accelerating the regeneration of liver cells. Long-term use significantly increases the survival rate of patients suffering from liver cirrhosis. Free radicals take part in many biochemical processes; without their formation in neutrophilic granulocytes and macrophages, the body dies as

a result of a violation of the neutralization of microbes. The damaging effect of free radicals in the body is opposed by the ability of silymarin and silybin to react with free radicals, that is, to exhibit antioxidant activity, as well as to suppress lipid peroxidation processes, thereby contributing to the stabilization of the cell membrane structure. Also in experimental studies, the ability of silybin to reduce the degree of ischemic damage to non-parenchymal liver cells and improve the postischemic function of the liver was established. After treatment of isolated rat hepatocytes with a solution of silymarin or silybin, the suppression of LPO processes and a decrease in the consumption of glutathione reserves induced by the toxic effect of allyl alcohol were observed [31–32]. It has been established that silybin stimulates the biosynthesis of macromolecules *in vitro* and *in vivo*. The drug enhances the synthesis of ribosomal ribonucleic acid (RNA) by activating DNA-dependent RNA polymerase I. It binds to the regulatory subunit, DNA-dependent RNA polymerase I at the site of estrogen binding, thus acting as a natural steroid effector, resulting in there is an activation of the enzyme and the synthesis of ribosomal RNA. Silybin, in comparison with other medicinal compounds, has a very unique ability to neutralize the action of toxicants. Silybin does not affect the transcription of RNA polymerase II or III. Increased synthesis of ribosomal RNA in the liver stimulates the formation of mature ribosomes, and hence protein biosynthesis. Moreover, in the liver of rats after the application of silybin and subsequent partial hepatectomy (removal of 70% of the liver), an increase in the synthesis of DNA, RNA, protein and cholesterol was observed, which reflects the processes of regeneration in the liver. The mechanism of action of silybin in the composition of silymarin is characterized by the normalization of fat metabolism in the hepatocytes themselves, a decrease in the formation of fat, including cholesterol in proportion to the increase in its intake from the blood, changes the synthesis of fats towards an increase in the proportion of low-density lipoproteins, prevents damage to the structure of the external and internal membranes of liver cells, which protect hepatocytes from the penetration of toxins into them, restores glutathione reserves in hepatocytes, with the help of which cells detoxify various toxins, alcohol, xenobiotics, activates the synthesis of structural proteins in hepatocytes, which promotes the regeneration of damaged cells [33]. Points of application of silymarin based on its mechanism of action in the main clinically significant syndromes of liver diseases can be determined based on the analysis of pathogenetic mechanisms and diagnostic signs of diseases [34–35]. The therapeutic efficacy of preparations from the fruits of milk thistle is based on several processes of action, where silybin stimulates protein synthesis, leading to an increase in the regenerative capacity of the liver and the formation of hepatocytes. All flavolignans have a stabilizing effect on hepatocyte membranes and prevent the penetration of hepatotoxins into the inner part of the cell. In addition to hepatoprotective, silymarin exhibits anticancer, anti-inflammatory, immunomodulatory and cardioprotective activity [36]. Silymarin forms the main pharmacological action of milk thistle, has cardioprotective properties, exerting an antidepressant effect by acting on the monoaminergic system of inhibition of inflammatory cytokines, oxidative stress, modulating the re-

sponse to corticosterone, restoring the antioxidant defense system of the cerebral cortex and hippocampus [37-38]. Experimental animal studies have shown that consumption of milk thistle in acute myocardial infarction protects cardiomyocytes from further damage and increases the rate of regeneration, protects liver cells from various toxic substances. In earlier studies on the study of the flavolignan composition of milk thistle fruits, it is mentioned that the quantitative ratio of flavolignans in the fruit extract can be different, which is primarily associated with the place where the plant grows, in particular, with the difference in climatic and geographical conditions. Such differences in the qualitative composition of milk thistle fruits create certain difficulties in the standardization of raw materials [39]. However, the assessment of the quality of preparations based on one component is insufficient, since it is known that the biological activities of flavolignans included in silymarin differ. Thus, it was found that silidianin has a more pronounced hepatoprotective effect in relation to intoxication with galactosamine, while silybin turned out to be the most effective hepatoprotector in case of intoxication. The study of milk thistle preparations showed that they do not have genotoxic and immunotoxic properties [40]. Experimental studies have shown that silymarin, especially at high doses of 100 and 200 mg/kg/day, can lead to fetal absorption, intrauterine growth retardation of the spinal column, and deformities of the craniofacial zone [41]. Studies have shown that silymarin and the flavonolignans silybin, isosilybin, silychristin and silydianin have no phototoxicity, while 2,3-dehydrosilybin has been identified as a compound with phototoxic potential [42]. Based on these data, there is an assumption that 3-deoxyflavolignans have more pronounced hepatoprotective properties [43]. For medicinal purposes, in the form of a decoction, tincture or powdered fruit, the plant is used in complex therapy for the treatment of liver cirrhosis, hepatitis, inflammation of the bile ducts and cholelithiasis, toxic liver damage, hemorrhoids and colitis with constipation, varicose veins of the extremities. Dry milk thistle fruit powder is taken 1-2 teaspoons 4-5 times a day 20-30 minutes before meals [44]. It should be noted that there is no hepatoprotective effect when taking the infusion, since it has been experimentally proven that flavolignans have low solubility in water. This fact causes distrust of milk thistle on the part of the population, including medicines from this plant. The results of experimental studies confirm that milk thistle preparations have a pronounced antitumor effect against malignant neoplasms of various localizations of the prostate, large intestine, lungs, bladder, ovaries, and others. In vitro studies revealed the property of silymarin and silybin to suppress the proliferation of cancer cells, and in vivo experiments - to inhibit the growth of tumor xenograft and reduce the incidence of neoplasms in chemically induced carcinogenesis. The antitumor properties of silymarin are due to a combination of its antioxidant and anti-inflammatory effects with mechanisms such as cell cycle regulation, apoptosis induction, angiogenesis inhibition, invasion, and metastasis [45]. The use of milk thistle preparations is promising in the treatment and prevention of nephropathy. Silymarin has been found to have a stimulating effect on kidney cells similar to its effect on hepatocytes. Sonnenbichler et al. demonstrated that silybin and silicristin in-

crease the proliferation rate, protein and DNA biosynthesis in kidney cells, and increase lactate dehydrogenase activity. Another feature of milk thistle is its rich macro- and microelement composition, including a rare essential element such as selenium 22.90 mg per 1 g of seeds, the deficiency of which in food leads to the development of endemic microelementoses in humans. For medicinal purposes, its achene fruits are used, containing substances that accumulate in the cells of the liver and gallbladder enhance the blood-purifying function of the liver. After entering the human body, foreign substances are neutralized in the liver. In this organ of the digestive system, new compounds are synthesized, toxic substances are neutralized, and functions are realized [47-48]. That is why, when pathological processes occur in the liver, serious metabolic disorders occur in general, ending in recovery, leaving metabolic disorders that persist for many years and often require drug correction [49]. Pathogenetic mechanisms of liver damage are diverse. However, all of them lead to a rather limited set of pathological processes, damage to liver cells, which is accompanied by an inflammatory reaction, cytolysis, and the development of fibrosis [50]. The main liver diseases include fatty infiltration of the liver, where fat droplets are deposited in hepatocytes, viral infection leads to an inflammatory process in hepatocytes, chronic hepatitis often occurs due to incurable hepatitis caused by toxic substances, liver cirrhosis [51-52]. Milk thistle perfectly activates the liver, accelerates the formation of new cells and the restoration of this most important organ. In the treatment of alcohol addiction, milk thistle is an important remedy. Contraindications for the use of milk thistle and side effects have not been established. At the same time, natural recipes from its seeds are much stronger than tablets. Milk thistle seed oil neutralizes the harm done to the body by alcohol and toxic substances. It activates metabolic processes, improves immunity, and has a wound healing effect. The biochemical composition of milk thistle seeds contains up to 30% of valuable vegetable oil, there are proteins, mono- and disaccharides, flavonoids and flavolignans. Milk thistle seeds are also distinguished by a high content of "youth vitamin" E, which has a wound healing and anti-inflammatory effect, improves skin condition and strengthens the immune system. Sprouted milk thistle seeds have valuable vitamin, anti-inflammatory and regenerating properties. Necessary for the normal functioning of the gonads and full reproductive function, vitamin E plays an important role in the process of embryonic development, takes an active part in the work of the nervous and muscular systems, has a beneficial effect on the functional state of the organs of vision and the cardiovascular system, and regulates blood sugar [53-54]. Milk thistle seeds, due to the antioxidant complex silymarin included in their composition, significantly improve metabolism in the liver, increase the resistance of the liver to the destructive effects of bacterial and viral infections, alcohol, toxins, heavy metal compounds, have a pronounced choleric effect, stimulate the process of regeneration of damaged hepatocytes. In addition, milk thistle seeds improve intestinal motility, normalize the balance of beneficial intestinal flora, have a wound-healing and anti-inflammatory effect in case of erosive and ulcerative lesions of the mucous membranes of the gastrointestinal tract, thanks to vitamins

A and E, chlorophyll, fatty acids, flavonoids, which are part of milk thistle seeds. and flavolignans, magnesium, manganese and zinc. Milk thistle seeds, rich in vitamins of group B, potassium, magnesium, calcium, are necessary for the smooth and rhythmic work of the heart muscle, contribute to the normalization of water-salt metabolism and the elimination of edema associated with certain diseases of the cardiovascular system. The complex of vitamins, minerals and biologically active substances contained in milk thistle seeds, including vitamin E, Omega-6 and Omega-9 acids, magnesium, zinc manganese, flavonoids and flavolignans, helps to normalize blood pressure, increases the elasticity and strength of the walls of blood vessels, stops the development of inflammatory processes in the cardiovascular system, helps to reduce the content of low-density lipoproteins in the blood, provoking the formation of atherosclerotic plaques on the walls of blood vessels, and at the same time increases the level of high-density lipoproteins in the blood of substances that cleanse the walls of blood vessels from cholesterol deposits [55-56]. That is why the seeds of milk thistle, and the products obtained from them, meal, oil and flour of milk thistle, are useful to regularly eat for the prevention and as part of the complex treatment of atherosclerosis, varicose veins, coronary heart disease, arterial hypertension, inflammatory diseases of the heart and blood vessels, vasculitis, myocarditis, pericarditis, endocarditis, etc. Introduction to the diet of various products based on milk thistle seeds is an excellent way to prevent heart attacks and strokes. Milk thistle oil, which has antibacterial, anti-inflammatory, anti-allergic and wound-healing properties, as well as decoctions, infusions or tinctures based on milk thistle seeds, can bring tangible benefits in the treatment of hemorrhoids, proctitis, acne, urticaria, hyperkeratosis, neurodermatitis, eczema, lichen, psoriasis, vitiligo, trophic ulcers, burns, difficult-to-heal wounds and skin ulcers. In the treatment of diseases of the mouth and throat, as well as diseases of the teeth, accompanied by toothache, rinses with decoctions and infusions of milk thistle seeds and applications with milk thistle oil are very useful. In turn, these methods of external use of milk thistle seeds are most effective in combination with the introduction of milk thistle meal or flour from milk thistle into the daily diet. Diseases of the organs of vision, milk thistle seeds contain substances necessary for the full functioning of the visual apparatus - carotenoids, vitamins E, D and group B, magnesium, manganese, zinc, selenium, chromium, copper. Having a diuretic, bactericidal and anti-inflammatory effect, milk thistle seeds have long been used in folk medicine to treat prostatitis, urethritis, cystitis, kidney and bladder diseases. The flavonoids, flavolignans, zinc and manganese contained in milk thistle seeds in a complex combination contribute to the relief of pain and inflammation in the articular joint, carotenoids, vitamins E, B1, B3, potassium, manganese, magnesium, zinc, chromium and selenium play an important role in the regulation of production insulin by the pancreas. For patients with diabetes, fiber from milk thistle seeds prevents a rapid increase in blood glucose levels, decoctions and infusions for breastfeeding women increase lactation. In the treatment of gynecological diseases of cervical erosion, colpitis, endocervicitis, vaginitis, douching with a decoction, infusion of milk thistle seeds or in-

travaginal applications with milk thistle oil is used. As part of radiation and chemotherapy courses, medicines and natural products from milk thistle seeds significantly reduce the risk of unwanted side effects. Milk thistle seeds are effective herbal hepatoprotectors and have a wide range of medicinal properties, improving the functioning of the digestive system, helping with poisoning, lowering sugar and cholesterol levels in the blood, strengthening the walls of blood vessels, restoring their tone and elasticity. Milk thistle fights free radicals that severely damage the liver, silymarin strengthens the walls of blood vessels, thereby protecting them from harmful factors, and contributes to a faster process of regeneration of liver cells [57-60]. Milk thistle seeds are a raw material for obtaining hepatoprotective drugs. In dermatology, milk thistle oil is used in the treatment of many dermatoses, including allergic diseases, psoriasis, vitiligo, acne, and baldness. Preparations from the fruits of milk thistle enhance the formation and excretion of bile, increase the protective properties of the liver against infections and various kinds of poisoning. They exhibit antioxidant activity, stimulate the synthesis of structural proteins and phospholipids, stabilize membranes and accelerate the regeneration of liver cells. The beneficial properties of milk thistle make it possible to use the plant for the treatment of acute and chronic hepatitis, cirrhosis, cholecystitis, as well as for toxic chemical poisoning, diabetes mellitus, chronic gastrointestinal diseases, and varicose veins of the lower extremities [61-64]. In folk medicine, milk thistle leaf juice is used as a mild laxative, diaphoretic, diuretic and choleric agent. A decoction of the roots is used for gastritis, diarrhea, sciatica, convulsions, urinary retention, the use of milk thistle powder from the seeds of meal, flour lowers blood sugar levels, cleanses the blood, and helps with varicose veins. Milk thistle herb is prescribed by many herbalists for psoriasis, as well as for simpler dermatological problems, and is effective in the treatment of vitiligo and eczema. The use of young milk thistle also has a beneficial effect on digestion, because with a sufficient amount of bile produced, the body successfully digests fats and their optimal absorption occurs. Milk thistle oil is not inferior in its biological activity to sea buckthorn oil, having anti-burn, wound-healing properties [65-66].

Based on the foregoing, it can be seen that milk thistle (*Silybum marianum*) is a well-known medicinal plant rich in valuable biologically active substances, macro and microelements, and vitamins. Milk thistle belongs to nutraceuticals, the study of the composition of the seeds of the plant is of practical importance for the creation of oils of functional value to meet the physiological needs of a person in useful substances necessary for the body. A study was made of the vitamin composition of milk thistle in accordance with the standard, as well as the composition of mineral elements. In the course of experimental studies, the presence of  $\beta$ -carotene, vitamin B1, vitamin B2, vitamin B4 and vitamin E was found in the seeds of milk thistle. Choline (B4) has the highest content. The presence of  $\alpha$ -tocopherol, or vitamin E, prevents the oxidation of body lipids, including polyunsaturated fatty acids and lipid components of cells and membrane organelles. It was also found that oilseeds contain iron, zinc, manganese, iodine, selenium, copper, chromium, potassium, calcium, magnesium, phosphorus. The content of iron,

zinc prevails among microelements, the amount of phosphorus and calcium among macroelements. The seeds are a potential source of oil that can be used as functional food and dietary supplements. Oil derived from milk thistle seeds may be an interesting functional food component, but detailed analysis is needed to confirm its applicability and impact on human health. Cold-pressed milk thistle seed oil is of better quality and can be considered as a valuable source of new multi-purpose products or by-products for industrial, cosmetic and pharmaceutical uses [67-75]. Studies have shown that milk thistle (*Silybum marianum*) contains useful substances such as proteins, alkaloids, saponins, and sulfur compounds. The introduction of milk thistle into the diet helps to strengthen the immune system and prevent diseases. The milk thistle plant can be used as a raw material for medicines, because it contains useful substances that do not lose their original properties when conditions change. It helps to improve liver function, normalize lipid metabolism, cleanse the body of toxins and toxins, which in turn contributes to the natural weight loss of an overweight person. The fiber contained in milk thistle seeds prevents the rapid increase in blood glucose levels. It contains many useful substances and is quite actively used in traditional medicine. Unfortunately, milk thistle is not included in the list of drugs, but you can find drugs that include in their composition as a dietary supplement. In scientific medicine, milk thistle fruits and preparations from it are used to treat liver diseases, in particular acute and chronic hepatitis, cirrhosis, toxic-metabolic lesions of the liver, as well as the gallbladder and biliary tract. Despite the obvious prog-

ress made in recent years in understanding the pathogenesis of diseases and developing approaches to their pathogenetic therapy, interest in this problem has not waned. The progressive course of various diseases requires not only the use of all currently available diagnostic and therapeutic options, but also the further development of new effective methods of treatment and methods for their primary and secondary prevention. Recent studies suggest that milk thistle preparations can be used to treat diabetes mellitus due to their antihyperglycemic properties and protective effect on the pancreas. Active study of milk thistle preparations made it possible to discover new properties of these drugs along with the already known hepatoprotective effect [75-82]. An analysis of the literature data shows the effectiveness of the use of the herb milk thistle in medicine, which is used in the treatment of cholelithiasis, liver dystrophy, poisoning, including alcohol poisoning, and is also often recommended after a course of radiation and chemotherapy. Based on the data, such integral effects of silymarin as antioxidant, anti-hepatotoxic, anti-inflammatory and anti-allergic, stimulation of liver tissue regeneration are sufficiently studied. These effects satisfactorily explain the hepatoprotective effect of silymarin, which is widely used in clinical practice up to 30–40% of patients with liver diseases. At the same time, as noted above, in recent years, interest in silymarin has not only not decreased, but has significantly increased due to the identification of new effects and properties of the drug and testing of promising areas for their therapeutic and prophylactic use.

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**Authors' Contributions.** All authors participated equally in the writing of this article.

**No conflicts of interest** have been declared.

This material has not been previously submitted for publication in other publications and is not under consideration by other publishers. There was no third-party funding or medical representation in the conduct of this work. Funding - no funding was provided.

**Авторлардың үлесі.** Барлық авторлар осы мақаланы жазуға тең дәрежеде қатысты.

**Мүдделер қақтығысы** – мәлімделген жоқ.

Бұл материал басқа басылымдарда жариялау үшін бұрын мәлімделмеген және басқа басылымдардың қарауына ұсынылмаған. Осы жұмысты жүргізу кезінде сыртқы ұйымдар мен медициналық өкілдіктердің қаржыландыруы жасалған жоқ. Қаржыландыру жүргізілмеді.

**Вклад авторов.** Все авторы принимали равносильное участие при написании данной статьи.

**Конфликт интересов** – не заявлен.

Данный материал не был заявлен ранее, для публикации в других изданиях и не находится на рассмотрении другими издательствами. При проведении данной работы не было финансирования сторонними организациями и медицинскими представительствами. Финансирование – не проводилось.

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