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BIOLOGICAL CHARACTERISTICS OF MILK THISTLE (SILYBUM MARIANUM) AND ITS ROLE IN LIVER HEALTH

Mangliyeva Marjona Rashid kizi
Teacher of the "General.Sciences" department of the
Asia International University, Bukhara, Uzbekistan,
E-mail:mangliyevamarjona@oxu.uz

Abstract: Liver diseases represent one of the most significant global health challenges due to the increasing prevalence of metabolic disorders, alcohol consumption, environmental pollutants, and drug-induced hepatotoxicity. The search for effective and safe hepatoprotective agents has stimulated interest in medicinal plants with therapeutic potential. Milk thistle (Silybum marianum), a medicinal plant widely used in traditional and modern medicine, contains biologically active compounds, particularly silymarin, which exhibit hepatoprotective, antioxidant, anti-inflammatory, and regenerative properties. The present study aims to analyze the biological characteristics of Silybum marianum and evaluate its role in maintaining liver health based on contemporary scientific literature. The findings indicate that silymarin contributes significantly to liver cell protection, reduction of oxidative stress, enhancement of hepatocyte regeneration, and prevention of chronic liver diseases. These results support the growing importance of milk thistle as a natural therapeutic agent in liver disease management.

Keywords: Silybum marianum, milk thistle, silymarin, liver health, hepatoprotector, antioxidant, hepatocyte regeneration.

Introduction: he liver is one of the most vital organs responsible for metabolism, detoxification, protein synthesis, and immune regulation. In recent decades, the incidence of liver diseases, including hepatitis, non-alcoholic fatty liver disease (NAFLD), alcoholic liver disease, and liver cirrhosis, has increased worldwide. According to recent epidemiological studies, liver disorders account for a substantial proportion of global morbidity and mortality. Conventional pharmacological treatments for liver diseases are often associated with adverse effects and limited efficacy. Consequently, increasing attention has been directed toward medicinal plants as alternative or complementary therapeutic agents. Among these plants, Silybum marianum (milk thistle) has attracted considerable scientific interest because of its unique phytochemical composition and hepatoprotective activity.

The major bioactive component of milk thistle is silymarin, a flavonolignan complex consisting primarily of silibinin, isosilibinin, silychristin, and silydianin. Numerous experimental and clinical studies have demonstrated the beneficial effects of silymarin on liver function and cellular protection. The aim of this study is to examine the biological characteristics, phytochemical composition, and pharmacological properties of Silybum marianum, as well as its therapeutic significance in liver health.

Methods: This study was conducted using a systematic literature review approach. Scientific publications, peer-reviewed journal articles, conference proceedings, and pharmacological reports published between 2020 and 2025 were analyzed. Data were collected from academic databases focusing on medicinal plants, hepatology, pharmacology, and phytotherapy. The collected information was evaluated through comparative and descriptive analysis methods. Particular attention was given to studies investigating the biochemical composition of Silybum marianum, mechanisms of action of silymarin, and clinical evidence regarding its hepatoprotective effects.

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Results: Biological Characteristics of Silybum marianum: Milk thistle belongs to the Asteraceae family and is a biennial herbaceous plant native to the Mediterranean region. The plant is characterized by large spiny leaves with distinctive white veins and purple flowers. It is widely cultivated for medicinal purposes due to its rich content of bioactive compounds. The seeds contain flavonolignans, flavonoids, fixed oils, proteins, vitamins, and minerals. Among these compounds, silymarin is considered the principal pharmacologically active substance responsible for most therapeutic effects.

Hepatoprotective Activity: The analysis revealed that silymarin exerts hepatoprotective effects through multiple mechanisms:

Stabilization of hepatocyte membranes against toxic substances;

Prevention of toxin penetration into liver cells;

Enhancement of protein synthesis and liver tissue regeneration;

Promotion of hepatocyte recovery following injury.

These mechanisms contribute to improved liver function and protection against chemical, viral, and metabolic damage.

Antioxidant Properties: Oxidative stress plays a crucial role in the development of chronic liver diseases. Silymarin demonstrates strong antioxidant activity by scavenging free radicals and increasing intracellular glutathione levels. Consequently, it reduces lipid peroxidation and protects cellular structures from oxidative damage.

Anti-inflammatory Effects: Chronic inflammation is a major factor in liver fibrosis and cirrhosis development. Studies indicate that silymarin suppresses inflammatory cytokines and modulates immune responses, thereby reducing inflammatory processes within hepatic tissues.

Clinical Relevance: Several clinical investigations have reported improvements in liver enzyme levels, including alanine aminotransferase (ALT) and aspartate aminotransferase (AST), following silymarin administration. Positive outcomes have also been observed in patients with non-alcoholic fatty liver disease, chronic hepatitis, and toxin-induced liver injury.

Discussion: he findings of this study demonstrate that Silybum marianum possesses significant therapeutic potential for liver protection and recovery. The multifunctional nature of silymarin distinguishes it from many conventional hepatoprotective agents. The hepatoprotective action of milk thistle is closely associated with its antioxidant capacity, membrane-stabilizing properties, and ability to stimulate hepatocyte regeneration. These mechanisms collectively reduce liver damage and support tissue repair processes.

Furthermore, the relatively low incidence of adverse effects makes milk thistle a promising candidate for long-term use in liver disease prevention and management. Nevertheless, variations in dosage, extraction methods, and patient characteristics may influence therapeutic outcomes. Therefore, additional randomized clinical trials are necessary to establish standardized treatment protocols and determine optimal therapeutic doses.

Conclusion: Milk thistle (Silybum marianum) is an important medicinal plant with substantial hepatoprotective potential. The bioactive flavonolignan complex silymarin plays a central role in protecting liver cells, reducing oxidative stress, suppressing inflammation, and promoting tissue regeneration.

The evidence reviewed in this study suggests that milk thistle may serve as an effective natural adjunct in the prevention and treatment of various liver disorders, including hepatitis, fatty liver disease, and cirrhosis. Further experimental and clinical investigations are recommended to enhance understanding of its pharmacological mechanisms and therapeutic applications.

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