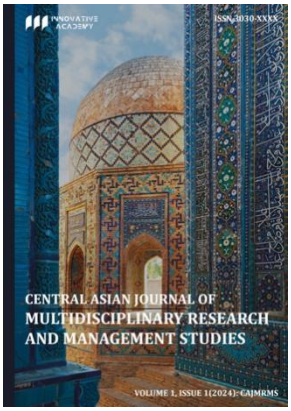

PHARMACOGNOSY OF MEDICINAL LICORICE (GLYCYRRHIZA GLABRA L.) AND PHARMACOLOGICAL PROPERTIES OF ACIDS OBTAINED FROM IT

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ABSTRACT

Medicinal licorice (Glycyrrhiza glabra L.) is one of the most important medicinal plants widely used in traditional and modern medicine due to its rich phytochemical composition and diverse pharmacological activities. The main biologically active compounds of licorice are triterpenoid saponins, flavonoids, polysaccharides, and phenolic compounds. Among them, glycyrrhizin and its hydrolysis product glycyrrhetinic acid demonstrate significant therapeutic potential. This article reviews the pharmacognostic characteristics of licorice, chemical composition, extraction methods, and pharmacological properties of acids obtained from this plant. Particular attention is given to glycyrrhizic acid, glycyrrhetinic acid, and their derivatives, including anti-inflammatory, hepatoprotective, antioxidant, antiviral, antimicrobial, and immunomodulatory activities. The relationship between chemical structure and biological effects is discussed. The obtained data demonstrate that licorice-derived acids represent promising natural compounds for pharmaceutical development.

Introduction. Medicinal plants remain an important source of biologically active compounds used in pharmaceutical research and healthcare. Among these plants, licorice (Glycyrrhiza glabra L.), belonging to the Fabaceae family, occupies a special place due to its long history of medicinal application and scientifically confirmed pharmacological properties.

Licorice root has been used for thousands of years in traditional medicine systems, including European, Chinese, Arabic, and Central Asian medicine. The plant is traditionally applied for the treatment of respiratory disorders, gastrointestinal diseases, inflammatory conditions, and liver disorders.

The pharmacological activity of licorice is mainly associated with its secondary metabolites. The most important compound is glycyrrhizin (glycyrrhizic acid), which represents approximately 5–10% of the dry root extract depending on plant origin and growing

conditions. Glycyrrhizin is a triterpenoid saponin consisting of glycyrrhetinic acid and two glucuronic acid molecules.

During hydrolysis, glycyrrhizic acid produces glycyrrhetinic acid, which possesses stronger biological activity due to increased interaction with cellular targets. These acids have attracted significant attention because of their anti-inflammatory, antioxidant, antiviral, and hepatoprotective effects.

The aim of this article is to analyze the pharmacognosy of medicinal licorice and evaluate the pharmacological properties of acids obtained from this plant.

2. Materials and Methods

2.1. Pharmacognostic Analysis. Scientific publications related to Glycyrrhiza glabra L., its chemical composition, and pharmacological effects were analyzed. The following pharmacognostic characteristics were evaluated:

botanical features;

anatomical structure of roots;

active chemical constituents;

identification and quality control parameters.

2.2. Phytochemical Investigation. The main groups of biologically active substances were studied:

triterpenoid saponins;

flavonoids;

polysaccharides;

coumarins;

phenolic compounds.

Special attention was given to glycyrrhizic acid and glycyrrhetinic acid.

2.3. Evaluation of Pharmacological Activity

The pharmacological effects of licorice-derived acids were analyzed based on experimental and clinical studies, including:

anti-inflammatory activity;

antioxidant properties;

antiviral effects;

hepatoprotective action;

immunomodulatory effects.

3. Results.

3.1. Pharmacognostic Characteristics of Medicinal Licorice

Botanical Description

Glycyrrhiza glabra L. is a perennial herbaceous plant with a strong root system. The plant usually reaches 50–150 cm in height. The underground part consists of thick roots and rhizomes, which are the main medicinal raw materials.

The roots are cylindrical, yellow-brown externally, and have a characteristic sweet taste due to the presence of glycyrrhizin.

Microscopic Characteristics

The anatomical structure of licorice root includes:

cork layer;

parenchymal tissues;

secretory structures;

vascular bundles;

starch-containing cells.

These characteristics are used for pharmacognostic identification of raw materials.

3.2. Chemical Composition of Licorice Root. Licorice contains a complex mixture of biologically active compounds.

Triterpenoid Saponin. The main representative is glycyrrhizic acid. Chemical structure:

aglycone part: glycyrrhetinic acid;

sugar component: glucuronic acid residues.

Glycyrrhizic acid is responsible for the characteristic sweetness of licorice.

Flavonoids. Important flavonoids include:

liquiritin;

isoliquiritin;

liquiritigenin;

glabridin.

They contribute to antioxidant and anti-inflammatory effects. Other Compounds

Licorice also contains:

polysaccharides;

amino acids;

essential oils;

minerals;

phenolic compounds.

3.3. Glycyrrhizic Acid and Its Properties

Glycyrrhizic acid is a pentacyclic triterpenoid saponin. Main properties:

high biological activity;

ability to form complexes with proteins;

anti-inflammatory effects;

antiviral activity.

Glycyrrhizic acid is metabolized in the intestine into glycyrrhetinic acid, which is the active metabolite.

3.4. Glycyrrhetinic Acid: Chemical and Pharmacological Characteristics

Glycyrrhetinic acid belongs to the oleanane-type pentacyclic triterpenoids.

The molecule contains:

hydroxyl group;

ketone group;

carboxylic acid group.

These functional groups determine its chemical reactivity and biological activity.

Anti-inflammatory Activity. Glycyrrhetinic acid inhibits inflammatory mediators and affects corticosteroid metabolism. It reduces production of inflammatory cytokines and decreases tissue inflammation.

Hepatoprotective Activity. Licorice acids protect liver cells by:

reducing oxidative stress;

stabilizing cellular membranes;

improving antioxidant defense systems.

Antiviral Activity. Glycyrrhizic acid and glycyrrhetinic acid demonstrate antiviral effects against several viruses by:

inhibiting viral replication;

modifying immune responses;

preventing viral penetration into cells.

Antioxidant Activity

The antioxidant effect is associated with:

scavenging reactive oxygen species;

protecting biological membranes;

regulating oxidative processes.

Discussion. The pharmacognostic study of medicinal licorice confirms that this plant is a valuable source of biologically active compounds. The presence of triterpenoid saponins, especially glycyrrhizic acid, determines the major therapeutic effects.

Glycyrrhizic acid itself has moderate biological activity, while its metabolite glycyrrhetinic acid demonstrates stronger pharmacological effects due to increased interaction with biological membranes and enzymes.

The chemical structure of these compounds explains their activity. The pentacyclic triterpenoid skeleton provides hydrophobic interactions, while functional groups influence receptor binding and enzyme inhibition.

One of the important advantages of licorice acids is their multifunctional activity. They simultaneously demonstrate:

anti-inflammatory;

antiviral;

antioxidant;

hepatoprotective;

immunomodulatory properties.

However, several limitations exist, including low solubility and possible mineralocorticoid-like effects during excessive consumption. Therefore, structural modification and controlled pharmaceutical application are important directions for future research.

Modern studies focus on the development of new derivatives and delivery systems to increase therapeutic efficiency and reduce adverse effects.

Conclusion. Medicinal licorice (Glycyrrhiza glabra L.) is an important pharmacognostic source of biologically active compounds. Its main acids, glycyrrhizic acid and glycyrrhetinic acid, demonstrate significant pharmacological potential.

The chemical composition of licorice explains its wide range of biological activities, including anti-inflammatory, antioxidant, antiviral, hepatoprotective, and immunomodulatory effects.

Further investigation of licorice-derived acids and their derivatives may contribute to the development of new natural pharmaceutical agents with improved therapeutic properties.

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