

PHYTOCHEMICAL COMPOSITION OF SCUTELLARIA BAICALENSIS GEORGI AND THE PHARMACOLOGICAL SIGNIFICANCE OF ITS BIOLOGICALLY ACTIVE FLAVONOIDS

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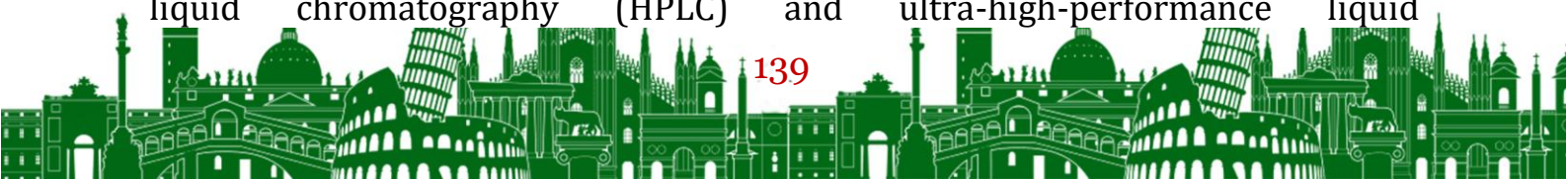
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Relevance. Currently, the search for biologically active substances from natural sources, the study of their chemical composition, and the assessment of the possibilities of using them to develop pharmaceutical preparations are of significant importance. *Scutellaria baicalensis* Georgi, belonging to the family Lamiaceae, is of particular interest among medicinal plants as a rich source of various flavonoids. Its dried root is used in traditional Chinese medicine under the name *Scutellariae Radix* (Huang-Qin), and this medicinal raw material is included in the Chinese, European, and British Pharmacopoeias. The pharmaceutical significance of the plant is primarily associated with the specific composition of its flavonoids. Scientific literature identifies baicalin, baicalein, wogonin, wogonoside, oroxylin A, and other flavonoids as the main biologically active components of *S. baicalensis*. The activity of these compounds associated with inflammatory processes, oxidative stress, infectious processes, and other biological mechanisms makes them promising natural compounds for pharmaceutical research.

Aim of the study. To analyze the phytochemical composition of *Scutellaria baicalensis* Georgi based on scientific literature, characterize its main flavonoids, and evaluate their pharmaceutical significance.

Materials and methods. The study material consisted of the root of *Scutellaria baicalensis* Georgi, which is used as medicinal raw material, and its biologically active compounds. The study was conducted as a literature review. Scientific articles and review materials published in the PubMed and PubMed Central databases and scientific journals were used for the analysis. Data on the phytochemical composition of the plant, the main structural classes of flavonoids, their biological activities, pharmaceutical applications, and quality control of the raw material were studied using a comparative analytical approach. Scientific data on the application of instrumental methods, including high-performance liquid chromatography (HPLC) and ultra-high-performance liquid



chromatography–mass spectrometry (UHPLC–MS), for the identification and quantitative determination of flavonoids were also analyzed.

Results of the study. The literature analysis demonstrated that *Scutellaria baicalensis* Georgi has a complex and diverse phytochemical composition. In particular, a comprehensive review published in 2018 reported that 126 small-molecule compounds and 6 polysaccharides had been isolated from the plant. The small-molecule compounds include free flavonoids, flavonoid glycosides, phenylethanoid glycosides, and compounds belonging to other structural classes. Among the flavonoids, baicalein, wogonin, and oroxylin A are important representatives of free flavonoids. Baicalin is one of the important flavonoid glycosides found in *S. baicalensis* and has been extensively studied. In addition, flavonoid glycosides such as wogonoside and oroxylin A-7-O-glucuronide are also among the biologically active components of the plant. Analysis of the scientific literature indicates that the antioxidant, anti-inflammatory, antibacterial, antiviral, hepatoprotective, and neuroprotective activities of baicalin and baicalein have been investigated. The biological effects of these compounds are explained by mechanisms associated, in particular, with the modulation of cellular signaling pathways involved in oxidative stress and inflammatory processes. Studies on wogonin have investigated not only its anti-inflammatory and antiviral activities but also its neuroprotective and antitumor potential. At the same time, it should be taken into account that a significant proportion of these properties have been identified in in vitro and in vivo preclinical studies. Therefore, these findings cannot be interpreted as direct evidence of clinical efficacy. From a pharmaceutical perspective, an important aspect is the standardization of medicinal plant raw materials and the control of the content of biologically active components. Modern studies have demonstrated the possibility of identifying and quantitatively determining baicalin, baicalein, wogonin, and wogonoside using HPLC, ultra-fast liquid chromatography with a diode-array detector (UFLC–DAD), and UHPLC–MS. These chromatographic methods are important for determining the chemical profile of raw materials, assessing the content of biologically active components, and comparing the quality of different samples. The pharmacokinetic and biopharmaceutical properties of flavonoids should be taken into account when they are used in pharmaceutical preparations. In particular, problems associated with the solubility, absorption, and bioavailability of compounds such as baicalin and baicalein may limit their therapeutic potential. Therefore, the development of



modern drug delivery systems for these biologically active compounds, including the use of nanoformulations, is considered one of the promising areas of research.

Conclusion. The literature analysis demonstrated that *Scutellaria baicalensis* Georgi is a promising natural source of biologically active flavonoids. The presence of baicalin, baicalein, wogonin, wogonoside, and other flavonoids in the plant determines its significance as a valuable medicinal raw material from a pharmaceutical perspective. The antioxidant, anti-inflammatory, antiviral, and other biological activities of these compounds have been extensively investigated in various scientific studies. At the same time, in assessing the pharmaceutical value of *S. baicalensis* raw materials, it is important to consider not only biological activity but also the standardization of active components, improvement of quality control using modern chromatographic methods, and enhancement of the biopharmaceutical properties of flavonoids. Research in these areas may provide a scientific basis for the development of promising pharmaceutical preparations containing biologically active components derived from *Scutellaria baicalensis*.

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