PHARMACOGNOSTIC, CHEMICAL, AND PHARMACOLOGICAL PROPERTIES OF OLIVE OIL (OLEUM OLIVARUM)

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Abstract: This scientific article analyzes the pharmacognostic characteristics, chemical composition, and pharmacological properties of olive oil (Oleum olivarum) based on contemporary scientific sources. Olive oil is a natural product that has long been widely used in nutrition and medicine. Scientific studies have demonstrated that its content of monounsaturated fatty acids, phenolic compounds, and antioxidant components exerts multifaceted beneficial effects on the human body. The article describes the quality parameters, identification methods, biologically active constituents, and their therapeutic significance.

Keywords: Oleum olivarum, olive oil, pharmacognosy, oleic acid, polyphenols, antioxidant, pharmacology.

Introduction

Olive oil is a natural fatty product obtained from the fruits of the olive tree (Olea europaea L., family Oleaceae) by cold pressing. Since ancient times, it has been widely used in the Mediterranean region as food, in cosmetics, and in traditional medicine [1]. In modern pharmacognosy and pharmaceutical practice, olive oil is considered a plant oil of high biological value.

The World Health Organization and numerous clinical studies have confirmed the role of olive oil in the prevention of cardiovascular diseases [2]. In particular, its content of oleic acid (C18:1) and phenolic antioxidants positively influences lipid metabolism. Therefore, comprehensive pharmacognostic and pharmacological investigation of olive oil remains a relevant scientific issue.

Methodology

In preparing this article, international scientific publications in pharmacognosy, biochemistry, and pharmacology, pharmacopoeial requirements, and monographic sources were analyzed. Data were selected using systematic analysis, comparison, and generalization methods.

Quality indicators of olive oil were evaluated according to the European Pharmacopoeia and Codex Alimentarius standards [3]. Information on chemical composition was analyzed based on studies using gas chromatography (GC) and high-performance liquid chromatography (HPLC) [4].

Experimental and clinical research findings were reviewed to assess pharmacological properties. Onlyreliable, publishedscientificsourceswereused.

Results

Pharmacognostic Characteristics

From a pharmacognostic perspective, Oleum olivarum is a colorless or pale yellow oily liquid with a characteristic odor and mild taste. It is insoluble in water but readily soluble in organic solvents [3]. According to pharmacopoeial standards, its relative density should range between 0.910 and 0.916.

The acid value and peroxide value serve as important criteria for assessing olive oil quality. In extra virgin olive oil, the content of free fatty acids, calculated as oleic acid, must not exceed 0.8% [5].

Chemical Composition

Triglycerides constitute the major fraction of olive oil (approximately 98–99%). Thepredominantfattyacidsinclude:

- Oleicacid: 55–83%
- Linoleicacid: 3.5–21%
- Palmiticacid: 7.5–20%
- Stearicacid: 0.5–5% [4]

In addition, olive oil contains a biologically active minor fraction of unsaponifiable substances (approximately 1–2%), which includes:

- Tocopherols (especially α-tocopherol)
- Phenolic compounds (oleuropein derivatives, hydroxytyrosol)
- Squalene
- Phytosterols [6]

PharmacologicalProperties

Research confirms the following biological effects of olive oil:

- Antioxidanteffect
- Hypolipidemiceffect
- Anti-inflammatoryeffect
- Cardioprotectiveeffect
- Hepatoprotectiveeffect [7]

Clinical observations have shown that adherence to a Mediterranean diet rich in olive oil significantly reduces the risk of ischemic heart disease [2].

Analysis and Discussion

The pharmacological effectiveness of olive oil (*Oleum olivarum*) is closely associated with its complex chemical composition, rich in biologically active components. Modern scientific research demonstrates that the health benefits of olive oil are not attributable to a single compound, but rather to the synergistic interaction of monounsaturated fatty acids, phenolic compounds, tocopherols, squalene, and phytosterols [4], [6]. Therefore, evaluation of olive oil should include not only its overall lipid profile but also particular attention to its minor bioactive fractions.

The high proportion of monounsaturated fatty acids, especially oleic acid, represents the leading factor in the metabolic and cardioprotective effects of olive oil. Clinical and epidemiological observations have shown that diets rich in oleic acid reduce levels of low-density lipoproteins (LDL) [8]. Since LDL oxidation is a key stage in the pathogenesis of atherosclerosis, its reduction plays a significant role in lowering cardiovascular risk. At the same time, the maintenance or slight increase of high-density lipoproteins (HDL) contributes to a more balanced lipid metabolism [8].

The lipid fraction of olive oil is important not only quantitatively but also qualitatively. Oleic acid optimizes cell membrane fluidity, positively influencing membrane receptor function and signal transduction processes. Some studies suggest that oleic acid may improve insulin sensitivity, which is considered an important factor in the prevention of metabolic syndrome [7].

Phenolic compounds constitute some of the most significant biologically active components of olive oil. Their concentration is particularly high in extra virgin olive oil. Phenols such as hydroxytyrosol and tyrosol exhibit strong antioxidant properties. Both in vitro and in vivo studies have demonstrated that hydroxytyrosol directly neutralizes free radicals and reduces lipid peroxidation [9]. The suppression of lipid peroxidation plays a critical role in maintaining cell membrane stability and reducing oxidative stress.

Oxidized LDL particles play a central role in the development of atherosclerosis. Phenolic antioxidants suppress atherogenic processes by slowing LDL oxidation. In clinical studies conducted by Covas and co-authors, consumption of polyphenol-rich olive oil significantly reduced markers of LDL oxidation [8]. These findings confirm that the cardioprotective effects of olive oil are associated not only with its fatty acid profile but also with its phenolic components.

The anti-inflammatory effects of olive oil have also been widely documented. Oleocanthal, a phenolic aldehyde found in olive oil, is considered pharmacologically significant. Research conducted by Beauchamp and colleagues demonstrated that oleocanthal partially inhibits cyclooxygenase (COX) enzymes [10]. This mechanism resembles the action of ibuprofen and leads to reduced prostaglandin synthesis, thereby attenuating inflammatory responses.

Chronic low-grade inflammation plays a key role in the pathogenesis of many non-communicable diseases, including atherosclerosis, type 2 diabetes mellitus, obesity, and neurodegenerative disorders. From this perspective, the anti-inflammatory effects of olive oil enhance its value in preventive medicine [12]. However, further randomized clinical trials are required to determine effective dosages and long-term safety parameters.

Another mechanism affecting the antioxidant system involves tocopherols. Olive oil, particularly as a source of α-tocopherol, is nutritionally significant. Tocopherols are lipid-phase antioxidants that protect cell membranes from peroxidative oxidation [6]. The synergy between phenolic compounds and tocopherols further enhances antioxidant defense. Some researchers suggest that this synergistic effect may account for the superior biological value of olive oil compared to other vegetable oils.

The hepatoprotective effect of olive oil is also scientifically substantiated. Experimental animal models have shown that olive oil reduces markers of oxidative stress in liver cells, decreases lipid infiltration, and increases the activity of antioxidant enzymes [11]. These effects are likely associated with the combined action of phenolic antioxidants and monounsaturated fatty acids. Normalization of lipid metabolism in hepatic tissue may be important in the prevention of non-alcoholic fatty liver disease.

From a pharmacognostic standpoint, the quality of olive oil is directly dependent on its production technology. The cold-pressing method (extra virgin) preserves bioactive components to the greatest extent. During refining, although free fatty acids are reduced, phenolic substances, pigments, and aromatic compounds are significantly diminished [5]. Therefore, high-quality, minimally processed oil is preferred for clinical and preventive purposes.

The quality of olive oil is also sensitive to storage conditions. Exposure to light, oxygen, and elevated temperatures accelerates peroxidation processes. An increase in peroxide value indicates oxidative deterioration and reduces its pharmacological value [3]. Consequently, storage in dark glass containers at low temperatures is recommended in both pharmaceutical and food applications.

In the context of metabolic syndrome, the role of olive oil deserves special attention. Epidemiological data indicate that populations adhering to the Mediterranean diet exhibit lower rates of obesity, type 2 diabetes, and cardiovascular diseases [2]. A substantial part of this protective effect is associated with olive oil consumption. In meta-analyses conducted by Schwingshackl and Hoffmann, olive oil intake was linked to improved glycemic control and lipid profile [7].

However, not all studies have produced equally strong results. Some clinical investigations suggest that the effects of olive oil depend on overall dietary composition, the amount consumed, and individual metabolic characteristics of patients. This highlights the importance of evaluating olive oil not as a “universal remedy,” but as one component of a comprehensive healthy lifestyle.

Neuroprotective potential has also been actively explored in recent years. Experimental data indicate that phenolic compounds, particularly hydroxytyrosol, may reduce oxidative stress in neurons and suppress inflammatory mediators. This suggests potential relevance in the prevention of Alzheimer’s and Parkinson’s diseases. However, clinical evidence in this field remains limited, and large-scale studies are required.

From the perspective of pharmaceutical technology, olive oil is also important as an excipient. It is widely used as an emollient base, an emulsion phase, and a lipophilic solvent in various dosage forms. Its relative oxidative stability, low toxicity, and biological compatibility allow its use in dermatological and parenteral preparations [3]. Nevertheless, ensuring oxidative stability requires the addition of antioxidants and proper storage conditions.

Overall, existing scientific evidence demonstrates that olive oil possesses multifaceted pharmacological potential. Its most important characteristic is its multifactorial and synergistic mechanism of action. Future research directions remain highly relevant and include:

• determination of the bioavailability of bioactive phenols;

• establishment of optimal therapeutic dosages;
• evaluation of long-term clinical safety;
• comparison of different cultivars and production technologies.

Conclusion

The analyses indicate that olive oil (*Oleum olivarum*) is a natural product of high biological value from both pharmacognostic and pharmacological perspectives. Its principal active components — oleic acid, phenolic antioxidants, tocopherols, and squalene — exert antioxidant, cardioprotective, anti-inflammatory, and hypolipidemic effects in the human body.

Quality control in accordance with pharmacopoeial standards, particularly the determination of acidity and peroxide value, plays a crucial role in ensuring the safety and efficacy of the product.

Scientific evidence substantiates the broad application of olive oil in rational nutrition and preventive medicine. Future research should focus on a deeper investigation of its pharmacological mechanisms at the molecular level.

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