

THE GENUS *Erica* (Ericaceae): A REVIEW OF PHARMACOLOGICAL STUDIES

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ABSTRACT

The *Erica* genus, belonging to the *Ericaceae* family, has a local distribution and thrives in various Mediterranean regions and Turkey. Currently, many studies have shown that the *Erica* genus has many medical benefits, including the ability to reduce inflammation and pain, fight bacteria, remove stones from the urinary tract, protect cells from damage, stop the production of cholinesterase, and lower cholesterol levels. At present, there is no comprehensive evaluation report that demonstrates the efficacy of plants from the *Erica* genus. Consequently, this review article examines the potential pharmacological activity of *Erica* plants.

KEYWORDS: *Erica*, Pharmacological studies, Anti-inflammatory, Antibacterial, Analgesic, Anti-urolithiatic, Antioxidant, Anti-cholinesterase, Antihyperlipidemic.

INTRODUCTION

People have used medicinal plants as tools to treat acute and chronic diseases since ancient times.^[1] Researchers have identified over 300 plants as having therapeutic potential.^[2] The use of medicinal plants is on the rise globally, and it is the preferred treatment for a variety of ailments because it has the fewest adverse effects.^[3,4] Numerous Mediterranean regions and Turkey are home to the locally distributed *Erica* genus of *Ericaceae*. Most *Erica* species are small shrubs that grow to a height of 20-150 centimeters. However, *E. arborea* and *E. scoparia* are exceptions to this rule, as they can grow to a height of up to 7 meters (23 ft). All are evergreen and possess small, needle-like leaves that measure 2–15 millimeters in length. This plant occasionally places its flowers in the leaf axils and on the terminal spikes, with the flowers facing either outward or downward. In certain species, the seeds are exceedingly diminutive and can endure in the soil for decades.^[5] The *Erica* genus is known to possess anti-inflammatory, antibacterial, analgesic, anti-urolithiatic, antioxidant, anticholinesterase, and anti-hyperlipidemic properties. At present, there is no comprehensive evaluation report that demonstrates the efficacy of plants from the *Erica* genus. Consequently, this review article examines the potential pharmacological activity of *Erica* plants.

TAXONOMIC CLASSIFICATION

Kingdom : Plantae
Order : Ericales

Familia : *Ericaceae*
Subfamilia : *Ericoideae*
Tribus : *Ericaceae*
Genus : *Erica*

PHARMACOLOGICAL STUDIES**Anti-inflammatory**

Physical agents, bacterial, viral, or fungal infections, or a defective immune response typically initiate inflammation and cause damage to living tissue. The primary objective of the inflammatory response is to identify and eliminate harmful agents. Afterwards, its design aims to eliminate damaged tissue components, thereby promoting the healing of the affected tissue, organ, or system.^[6-8] A variety of non-steroidal anti-inflammatory drugs can alleviate pain and inflammation by inhibiting arachidonic acid metabolism by cyclooxygenase enzyme isoforms (COX-1 and/or COX-2), thereby reducing prostaglandin production. Regrettably, administering nonsteroidal anti-inflammatory drugs is associated with numerous adverse effects.^[9] Nevertheless, medicinal plants possess anti-inflammatory therapeutic effects with minimal or no side effects.^[10] Researchers reported that oral administration of *Erica arborea* extract at doses of 100, 300, and 600 mg/kg reduced inflammation in mice in the xylene-induced edematous model.^[11]

Antibacterial

Since their introduction, antibiotics have provided numerous health-related benefits to the human quality of life and are one of our most critical weapons in the fight against bacterial infections. However, the emergence of drug-resistant bacteria and the increased ineffectiveness of commonly used antibiotics against specific diseases have jeopardized these health benefits in recent decades. This is because many commonly used antibiotics lead to toxic reactions. It is crucial to conduct research on new drugs that exhibit reduced resistance.^[12] Natural source medicines significantly influence the prevention and treatment of human diseases. Traditional medicine is the primary health care system in numerous developing countries. Natural products with higher plant levels may serve as a source of new antimicrobial agents with potentially novel mechanisms of action.^[13] It was said that giving *Erica arborea* extract at concentrations of 12.5, 25, 50, and 100 mg/mL stopped the growth of bacteria like *Escherichia coli*, *Pseudomonas aeruginosa*, *Salmonella gallinarum*, *Bacillus cereus*, *Micrococcus luteus*, and *Staphylococcus aureus*.^[11]

Analgesic

Pain is a prevalent, nonspecific symptom of numerous illnesses. Despite the traditional use of nonsteroidal anti-inflammatory drugs (NSAIDs) and opiates in this condition, these medications have been associated with a variety of adverse reactions, including respiratory depression, kidney damage, gastrointestinal disturbances, and potential dependence. Discovery of novel analgesic drugs derived from natural sources and medicinal plants, with fewer side effects, has garnered growing interest in recent years.^[14] Researchers reported that oral administration of *Erica arborea* extract at doses of 100, 250, and 500 mg/kg reduced stomach constriction in a mouse model of acetic acid-induced stomach constriction.^[11]

Anti-urolithiatic

Urolithiasis is a condition affecting approximately 2-3% of the global population and the urinary tract system. If left untreated, urinary stones can result in severe medical complications, including extreme obstruction, hydronephrosis, infection, and bleeding within the urinary tract.^[15] High-power laser surgery, lithotripsy, and local calculus disruption are frequently used to treat and remove urinary tract stones. However, this procedure carries the risk of acute kidney injury, potentially leading to a decrease in kidney function. Furthermore, it is not uncommon for stones to recur.^[16] There have been reports of numerous composite herbal preparations and medicinal plants being effective in the treatment and prevention of kidney stone recurrence with minimal side effects.^[17] Researchers reported that the administration of *Erica arborea* extract at concentrations of 62.5, 125, and 500 g/mL had an anti-urolithiatic effect by inhibiting the formation of CaOx (calcium oxalate) crystals.^[11]

Antioxidant

Free radicals are molecules that become unstable and attempt to reclaim electrons from other molecules or cells as a result of losing energy.^[18,19] Free radicals, highly reactive in the body, interact with specific body parts and cells composed of protein, fat, DNA, carbohydrates, and RNA through destructive oxidation reactions. This interaction will result in the development of a variety of chronic degenerative diseases, such as aging, cancer, and coronary heart disease.^[20,21] These radicals can compromise the cellular antioxidant defense system, leading to a more extensive extent of cell damage. All biological systems incorporate antioxidant defense mechanisms to eliminate damaged molecules, but these mechanisms may not be sufficient. Therefore, consuming antioxidant foods is crucial to protect cells from the harmful effects of free radicals.^[22] According to reports, *Erica manipuliflora* administration demonstrated strong antioxidant activity in the DPPH model, with an IC₅₀ of 255 mg/mL.^[23]

Anti-cholinesterase

Memory and behavioral disorders are the hallmarks of Alzheimer's disease. Because they elevate acetylcholine levels in the brain, physicians employ acetylcholinesterase (AChE) inhibitors as medications for Alzheimer's disease treatment. In recent years, scientists have developed a significant interest in the discovery of novel AChE inhibitors from plant sources.^[24] Typically, the brain contains AChE, while peripheral tissues contain BChE (*butyrylcholinesterase*).^[25] Reports indicate that a variety of medicinal plant extracts effectively inhibit BChE and AChE.^[26] Numerous *Ericaceae* plants significantly inhibit AChE and BChE.^[27] When administered at concentrations of 25, 50, 100, and 200 g/mL, *Erica manipuliflora* extract significantly inhibits the AChE and BChE enzymes.^[28]

Anti-hyperlipidemic

Hyperlipidemia significantly influences the initiation and progression of atherosclerosis. The primary symptoms of this disorder are elevated plasma concentrations of total cholesterol (TC), triglycerides (TG), low-density lipoprotein cholesterol (LDL-C), and low concentrations of high-density lipoprotein cholesterol (HDL-C).^[29] In the mouse model of hyperlipidemia caused by Triton WR-1339, administration of *Erica multiflora* extract at a dose of 0.25 g/100 g was reported to significantly reduce levels of total cholesterol, triglycerides, and LDL while increasing HDL.^[30]

CONCLUSION

The use of herbal medicines is currently expanding, encompassing pharmacological practices that can aid in disease prevention and treatment. The investigation of plant biopharmaceuticals and nutraceuticals has introduced herbal medicines to the global market. Several *Erica* genus plants exhibit a variety of pharmacological activities, demonstrating their

adaptability. This article discovers the active compounds and newer and more comprehensive pharmacological activities of the *Erica* genus by using basic data on the currently existing plants.

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