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CHEMICAL COMPOSITION AND BIOLOGICAL ACTIVITY OF ESSENTIAL OILS FROM MEDICINAL PLANTS

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Abstract: Essential oils from medicinal plants are complex mixtures of volatile compounds with significant biological activity. This study reviews the chemical composition and antimicrobial potential of essential oils obtained from medicinal plant species. The analysis demonstrates that terpenes, phenolics, aldehydes, and alcohols are major active components responsible for antibacterial and antioxidant effects. The findings support the use of essential oils as promising natural agents in medicine, pharmacology, and food preservation.

Keywords: essential oils, medicinal plants, chemical composition, antimicrobial activity, phytochemistry

Introduction

Medicinal plants have long been used as sources of biologically active compounds. Essential oils are secondary metabolites with characteristic aroma and diverse pharmacological properties. Their composition depends on plant species, climate, extraction method, and geographical origin. Modern phytochemical studies focus on identifying active components and evaluating their biological effects against microorganisms and oxidative stress.

Materials and Methods

Scientific literature on medicinal plant essential oils was analyzed. Data on gas chromatography, mass spectrometry, antimicrobial testing, antioxidant assays, and phytochemical profiling were reviewed. Comparative analysis was used to evaluate relationships between chemical composition and biological activity.

Results

The most frequently identified components included monoterpenes, sesquiterpenes, thymol, carvacrol, eugenol, linalool, and limonene. Essential oils showed inhibitory effects against Gram-positive and Gram-negative bacteria. Antioxidant activity was mainly associated with phenolic compounds. Oils rich in thymol and carvacrol demonstrated stronger antimicrobial effects.

Discussion

The biological activity of essential oils depends on the synergistic interaction of their chemical components. Phenolic monoterpenes disrupt microbial membranes and inhibit cellular metabolism. Antioxidant activity reduces oxidative damage by neutralizing free radicals. However, variability in composition requires standardization before medical application.

Conclusion

Essential oils are valuable natural products with important chemical and biological properties. Their antimicrobial and antioxidant effects make them promising for pharmaceutical and biotechnological use. Further studies are needed to standardize extraction methods and evaluate safety profiles.

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