

Bioactive *Sesamum indicum* L. seed oil from Supercritical CO₂ Extraction: Fatty Acid Profile, Nutritional energy and Antimicrobial Potential

Elifgöl ÇAYIR^{1*}, Tuba ERİM¹, Hatice Banu KESKİNKAYA^{1,2}, Süleyman DOĞU^{2,3}

¹Necmettin Erbakan University, Faculty of Science, Department of Biotechnology, 42090, Konya, Türkiye.

²Necmettin Erbakan University, Medical and Cosmetic Plants Application and Research Center, 42090, Konya, Türkiye.

³Necmettin Erbakan University, Meram Vocational School, Department of Plant and Animal Production, 42090, Konya, Türkiye.

Abstract

This study aimed to evaluate the fatty acid composition, nutritional energy value, and antimicrobial activity of *Sesamum indicum* L. seed oil obtained using supercritical carbon dioxide (SC-CO₂) extraction. Supercritical CO₂ extraction has emerged as a green extraction technology due to its non-toxic nature, low critical temperature and pressure, and the absence of solvent residues in the final product. The seeds were subjected to supercritical carbon dioxide extraction at 420 bar and 47 °C for 120 min. The fatty acid profile of the obtained oil was analyzed using gas chromatography equipped with a flame ionization detector (GC-FID). The nutritional energy value was estimated using standard macronutrient energy conversion factors. Antimicrobial activity was evaluated by the broth microdilution method against selected Gram-positive bacteria (*Staphylococcus aureus* ATCC 43300, *Bacillus cereus* ATCC 11778, and *Sarcina lutea* ATCC 9341) and Gram-negative bacteria (*Escherichia coli* ATCC 25922, *Pseudomonas aeruginosa* ATCC 27853, *Klebsiella pneumoniae* ATCC 70603, and *Salmonella enteritidis* ATCC 13076). The antimicrobial effects were expressed as minimum inhibitory concentration (MIC) values. The analysis revealed that linoleic acid (43.26%), oleic acid (40.24%), and palmitic acid (9.27%) were the predominant fatty acids present in the sesame oil. Overall, unsaturated fatty acids accounted for more than 83% of the total fatty acid content. The calculated nutritional energy value of the oil was approximately 895.14 kcal/100 g (3745.26 kJ/100 g). Antimicrobial evaluation demonstrated notable inhibitory activity, with MIC values of 6.25 mg/mL against *E. coli*, 6.25 mg/mL against *S. lutea*, and 3.12 mg/mL against *B. cereus*. These findings suggest that SC-CO₂ extraction effectively preserves both the nutritional quality and functional bioactivity of *S. indicum* L. seed oil. Overall, SC-CO₂ extraction provides an efficient and environmentally friendly approach for producing *S. indicum* L. seed oil rich in unsaturated fatty acids, with high caloric content and considerable antimicrobial activity. These findings highlight the potential of this technology for developing high-value products for the food, cosmetic, and pharmaceutical industries.

Key Words: *Sesamum indicum* L., supercritical CO₂ extraction, fatty acid composition, nutritional value, MIC.

