

Structured Monoacylglycerols: Synthesis, Anticancer and Antioxidant Evaluation

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Abstract

Lipids are increasingly recognized for their protective roles against a wide spectrum of microbial threats, making them valuable candidates for applications in healthcare, agriculture, cosmetics, and nutrition. As part of our ongoing research into bioactive molecules, we have synthesised phenolic monoacylglycerols (MAGs) inspired by natural compounds. A standout molecule in this study, the naturally occurring 1-[11-(ferulyloxy) undecanoyl]glycerol from a medicinal herb, was synthesized by an enzymatic method from 11-bromo-undecanoic acid and ferulic acid. Inspired by the biological activity of this molecule, a set of similar phenolic MAGs was prepared, characterized, and analysed. Radical-scavenging assays and oxidative onset temperature measurement of soybean oil revealed that these phenolic MAGs possess robust antioxidant properties on par with standards. In addition to their antioxidant potential, cytotoxicity assays showed promising activity against the HeLa and A549 cancer cell lines, suggesting a potential role in anticancer therapeutics. Notably, the derivative containing p coumaric acid exhibited strong antimicrobial activity against both Gram-positive and Gram negative bacteria, with a minimum inhibitory concentration (MIC) of 6.25 $\mu\text{M mL}^{-1}$. Further screening revealed that all synthesized compounds displayed cytotoxic effects on B16 and DU145 cell lines, with sinapic and p-coumaric acid-based derivatives showing enhanced bioactivity. Encouraged by these results, we are now exploring the synthesis of phenolic lipid derivatives incorporating heterocyclic structures, aiming to expand their biological applications and improve their efficacy in future studies.

