ABSTRACT

Lipids are a diverse group of hydrophobic molecules essential for cellular signaling, energy storage, and metabolic regulation. This research focuses on specific types of bioactive lipids, namely fatty acids and their esters, such as fatty acid esters of hydroxy fatty acids (FAHFA), oxylipins, and others involved in their regulation. Bioactive lipids play crucial roles in processes such as inflammation, metabolism, and immune function. FAHFA exhibit anti-inflammatory and insulin-sensitizing effects, while oxylipins help regulate vascular tone and immunity.

Due to their structural complexity and low abundance, accurate analysis of these lipids requires advanced analytical techniques. This thesis focuses on developing and optimizing chromatography and mass spectrometry-based methods for the quantification. Enhancements to LC-MS workflows improved FAHFA detection through optimized extraction and derivatization strategies. A sensitive LC-MS method was also established for quantifying steroid hormones in small tissue samples. Additionally, a GC-MS method enabled detailed profiling of dietary fatty acids, despite reduced sensitivity.

These techniques were applied to reveal higher FAHFA levels in female adipose tissue and uncovered sex hormone–dependent regulatory patterns. The methods were further extended to analyze FAHFAs in edible mushrooms and oxylipins in mast cells.

Key words: Bioactive lipids**,** FAHFA, oxylipins, steroid hormones, metabolism, liquid chromatography, gas chromatography, mass spectrometry.