The aim of this research project is to investigate how frying conditions, particularly high temperatures and exposure to ozone, affect the quality and safety of edible oils. During cooking, especially frying, oils undergo chemical transformations that can lead to the development of undesirable odors and potentially harmful compounds. A key innovative aspect of the project is the comparison between conventional air and ozone, a powerful oxidant that is increasingly used in kitchen hoods to reduce cooking odors.

The project focuses on understanding how different types of fats, including fully saturated, monounsaturated, and polyunsaturated triacylglycerols, as well as plant sterols, degrade under frying-like conditions. Research will be conducted in three stages. The first stage involves the use of model fats to determine how chemical structure influences the formation of odor-active compounds. The second stage examines the thermal and oxidative breakdown of plant sterols, which are naturally present in edible oils, and the formation of new degradation products. The final stage applies these findings to real edible oils, such as sunflower, palm, and rapeseed oils, in order to validate the results in more complex food systems.

To process and interpret the large volume of chemical and sensory data generated, the project uses advanced data analysis methods, including artificial intelligence and machine learning. These techniques make it possible to predict how factors such as temperature, ozone concentration, and oil composition influence odor, flavor, and overall oil stability.

This research topic was chosen in response to the increasing use of ozone in food-related environments and the limited understanding of its impact on oil chemistry during high-temperature cooking. By addressing this knowledge gap, the project aims to provide important insights into the safe and effective use of ozone in culinary applications.

The expected outcomes include identifying how specific oil components degrade during frying, clarifying the role of ozone in these changes, and creating predictive tools to assist the food industry in monitoring and improving oil quality. In the long term, the findings are expected to support the development of healthier, more stable, and more appealing fried food products.