Volatolomics of the oxidative stress at the molecular level using *in vitro* models

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Oxidative stress is a pathological condition that arises when there is an imbalance between reactive oxygen species (ROS) production and cellular detoxification ability. This condition has been linked to various diseases such as asthma and cancer, making it an important area of research for better diagnosis and treatment of inflammatory diseases. In vitro cell cultures have become an essential tool to comprehend the intricate mechanisms of oxidative stress involved in inflammatory reactions. The use of in vitro cell cultures provides an ethical and controlled environment where the effects of oxidative stress can be studied independently of other confounding factors. Volatolomics, the analysis of volatile organic compounds (VOCs) emitted by biological systems, represents a promising approach for the non-invasive, fast, and cost-effective diagnosis of diseases. The objective of this study is to gain a better understanding of oxidative stress at the molecular level by inducing chemical and biological stress on epithelial cells in vitro to mimic in vivo stress and characterize VOCs released during the process. Specifically, A549 cells were subjected to chemical and asthma-like biological stress. The VOCs released were characterized using solid phase micro-extraction (SPME) coupled with comprehensive two-dimensional gas chromatography and time-of-flight mass spectrometry (GC×GC-TOFMS). Following optimization of the conditions, we observed an increase in cell proliferation and VOC production in response to exposure to hydrogen peroxide (H_2O_2) and inflammatory sputum. Some of the identified biomarkers have previously been reported as potential indicators for lung diseases, including two that were highlighted as potential asthma biomarkers in a previous study. Furthermore, to determine if there is a unique signature that is cell-dependent, these conditions were applied to three epithelial colorectal cell lines, HT-29, Caco-2, and HCT116. This ongoing study aims to provide a better understanding of the molecular mechanisms involved in oxidative stress.