Validation of a methodology for evaluating longitudinal change of VOCs in breath


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Introduction

Exhaled breath contains thousands of Volatile Organic Compounds (VOCs), which are products of metabolic activity and biomarkers for diseases. These can be from endogenous processes in the body and exogenous sources such as environmental exposures and pharmaceuticals.

Reliable longitudinal evaluation of breath VOCs is an essential step enabling studies into:
- Understanding biological variability
- Enabling disease monitoring
- Measuring the response to therapeutic interventions
- Assessing effects of environmental exposures
- Evaluating pharmacokinetics

This study aims to examine the long-term stability of the breath biopsy platform as well as its ability to detect changes over time relative to biological variability.

To evaluate this, two experiments were conducted:
- Analytical reproducibility: Analysis of a target set of VOCs in breath following ingestion of a peppermint capsule and the resulting "washout curve" for target over 8 hours (Figure 1) collected as 4 concurrent samples per timepoint.
- Biological variability: 8 repeats of the same experiment over a 5-week period in the same individual, sampled at three time points.

Methods

Breath Sampling

The study subject was a 32-year-old, healthy male who standardised diet and exercise for the duration of the study. Breath samples were collected at 16 time points in the initial study. In the longitudinal study, timepoints estimating baseline, biological variability, and long-term stability were performed at two time points. Thereafter the subject ingested one Obbekjaers 200mg peppermint capsule.

BreathCollection

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Figure 1. Design of the washout experiment to evaluate changes in breath VOC profile following ingestion of a peppermint capsule.

Figure 2: The ReCIVA Breath Sampler enables reliable, reproducible collection of breath VOCs and pre-concentration for enhanced sensitivity.

Figure 3. Washout curve following ingestion of a peppermint capsule. Breath samples from repeated collects from one individual over 8 hours (8 timepoints) were analyzed. Four replicate VOC sample tubes were collected and analyzed at each timepoint.

Breath Collection

Pre-ingestion controls

Repeated breath collects over 8 hours

Result: Longitudinal Study Over 5 Weeks

Figure 4. Longitudinal study repeating the washout experiment nine times over five weeks in a single individual. Breath samples from repeated collects from one individual over 8 hours (8 timepoints) were analyzed. Five replicate VOC sample tubes were collected and analyzed at each timepoint.

Conclusions

- The study demonstrates that the Breath Biopsy platform can be used to study longitudinal changes of exhaled VOCs in a reliable and reproducible way.
- The evaluation of a washout curve of peppermint oil components provides a model for the study of absorption, distribution, metabolism and excretion of pharmaceuticals.

References


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