# Novel Real-Time Assessment of Endogenous and Exogenous Volatile Organic Compounds (VOCs) On Breath In Healthy Subjects – Next Generation Biomarker Development for Digestive Health

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## INTRODUCTION

- .Microbial fermentation of carbohydrates produces metabolic by-products including SCFAs, gases and VOCs.
- Measuring metabolic by-products allows for non-invasive biomarker detection in real time from specific regions of interest e.g. small bowel and colon.
- VOCs can be endogenously or exogenously produced allowing differentiation between human and microbial fermentation using baseline and subsequent collections after ingestion of a carbohydrate probe e.g. lactulose.

## METHODS

- 25 healthy volunteers completed a 3hr lactulose breath test providing breath samples at baseline and 45, 90, and 180-minutes post lactulose ingestion.
- Samples were collected using 500ml polyvinylidene fluoride bags (PVDF).
- Analysis was done using selected-ion flow-tube mass spectrometry (SIFT-MS).

## RESULTS

- Targeted analysis of 20 VOCs on breath, including SCFAs, $H_2S$, isoprene and methane was performed.
- These compounds were detected in the parts per billion range, except methane that was measured in parts per million range.
- Significant increases were found in isoprene, propanoic acid and acetic acid post lactulose ingestion.

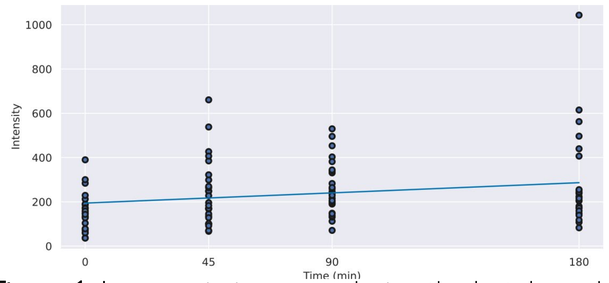


**Figure 1**: Increase in isoprene during the lactulose challenge

| | | | |
|---|---|---|---|
| pentanoic acid | indole | 3-methylbutanoic acid | acetone |
| butanoic acid | isoprene | m-cresol | propanoic acid |
| ethanol | hexanoic acid | 2,3-butanedione | limonene |
| hydrogen sulfide | p-cresol | triethylamine | acetic acid |
| methane | o-cresol | trimethylamine | phenol |

**Figure 2**: The 20 compounds detected on breath using SIFT-MS

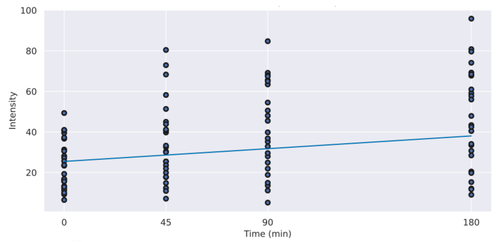


**Figure 3**: Increase in acetic acid post lactulose challenge

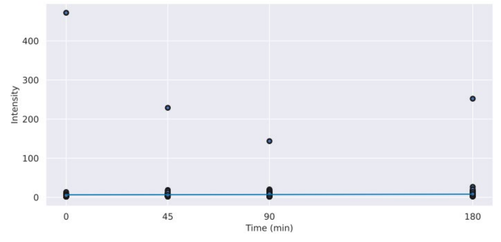


**Figure 4**: Butanoic acid production post lactulose challenge

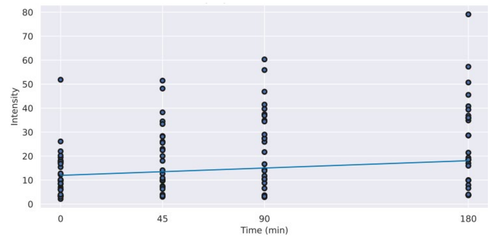


**Figure 5**: Increase in propanoic acid post lactulose challenge

## CONCLUSION

- We have developed a new method for breath VOC collection which can be performed in a non-invasive clinical setting.
- We targeted 20 commonly produced VOCs, all of which were detected during this feasibility study.
- 3 VOCs showed an increase following lactulose ingestion
- In the future, the use of more physiological test meals may allow an increase in signal strength and maximise clinical relevance