

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

A Hobson^{1,2,3}, S Bloor^{1,2,3}, N Nagalingam⁴, A Smolinska⁴, B O'Brien⁴, R Stallard⁴, T Woodland⁴, A Tawfike⁴, M Allsworth⁴, B Boyle⁴

¹Functional Gut Diagnostics, ²The Functional Gut Clinic, ³Anglia Ruskin University, ⁴Owlstone Medical  Anthony@thefunctionalgutclinic.com

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, H₂S, 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.

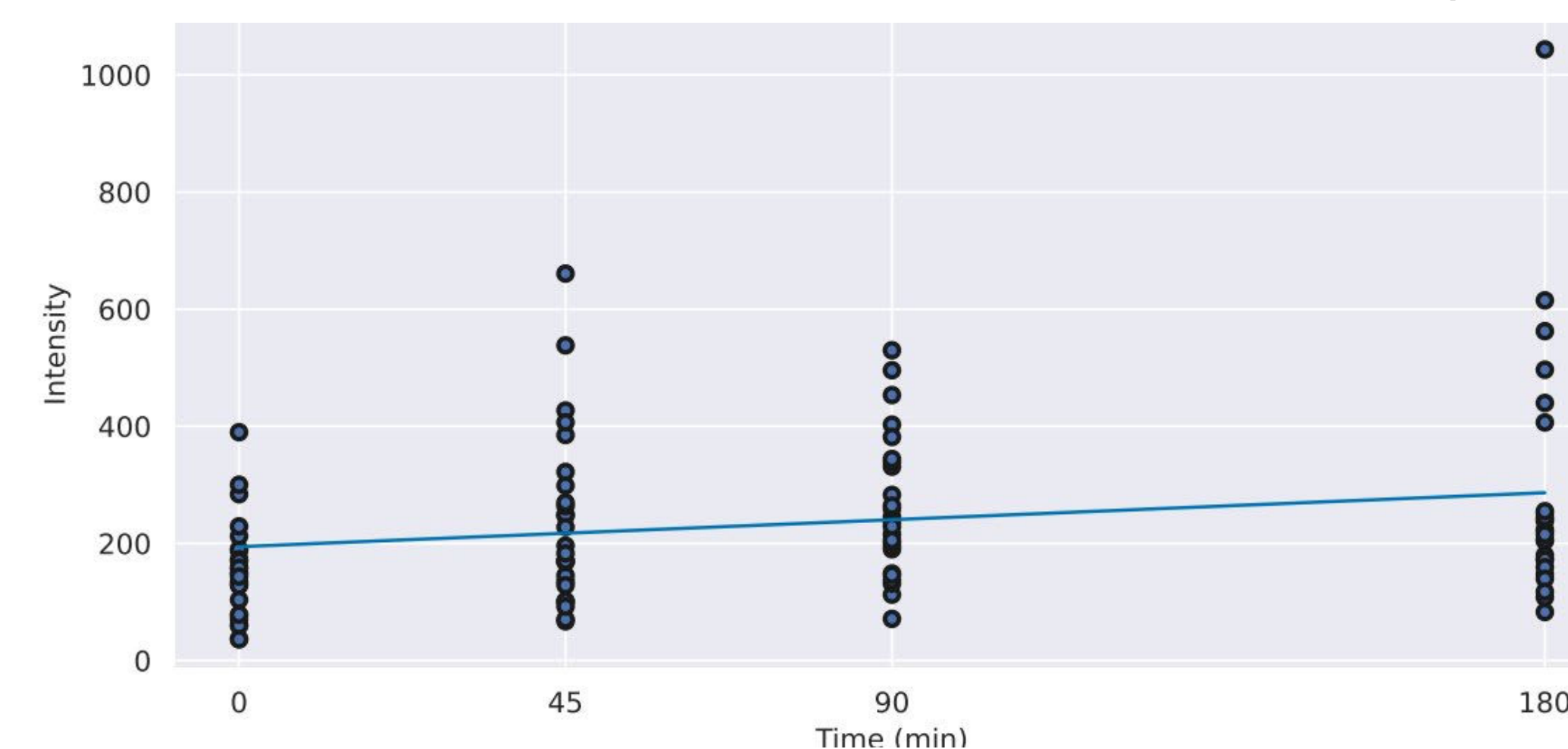


Figure 1: Increase in isoprene during the lactulose challenge

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

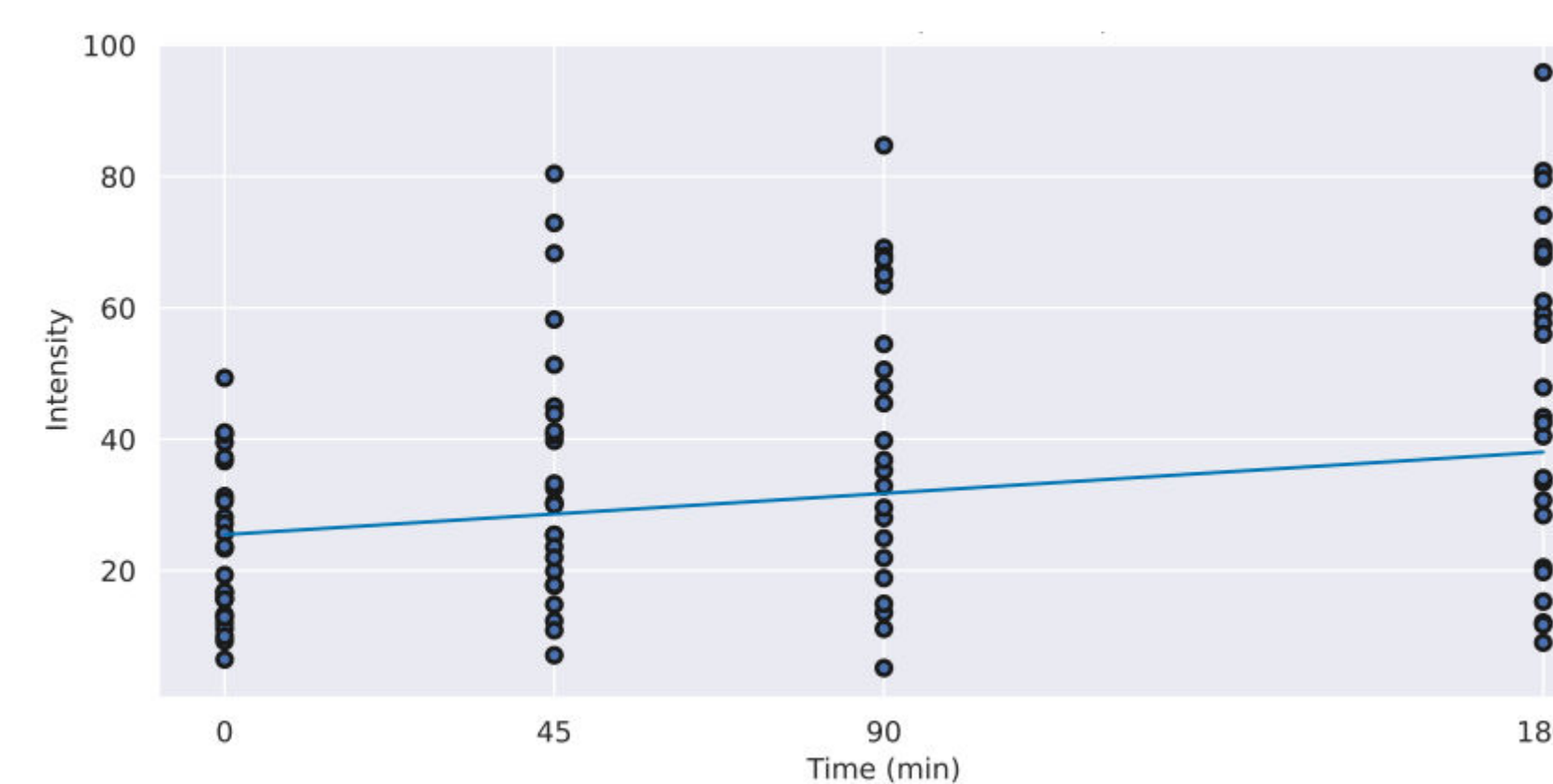


Figure 3: Increase in acetic acid post lactulose challenge

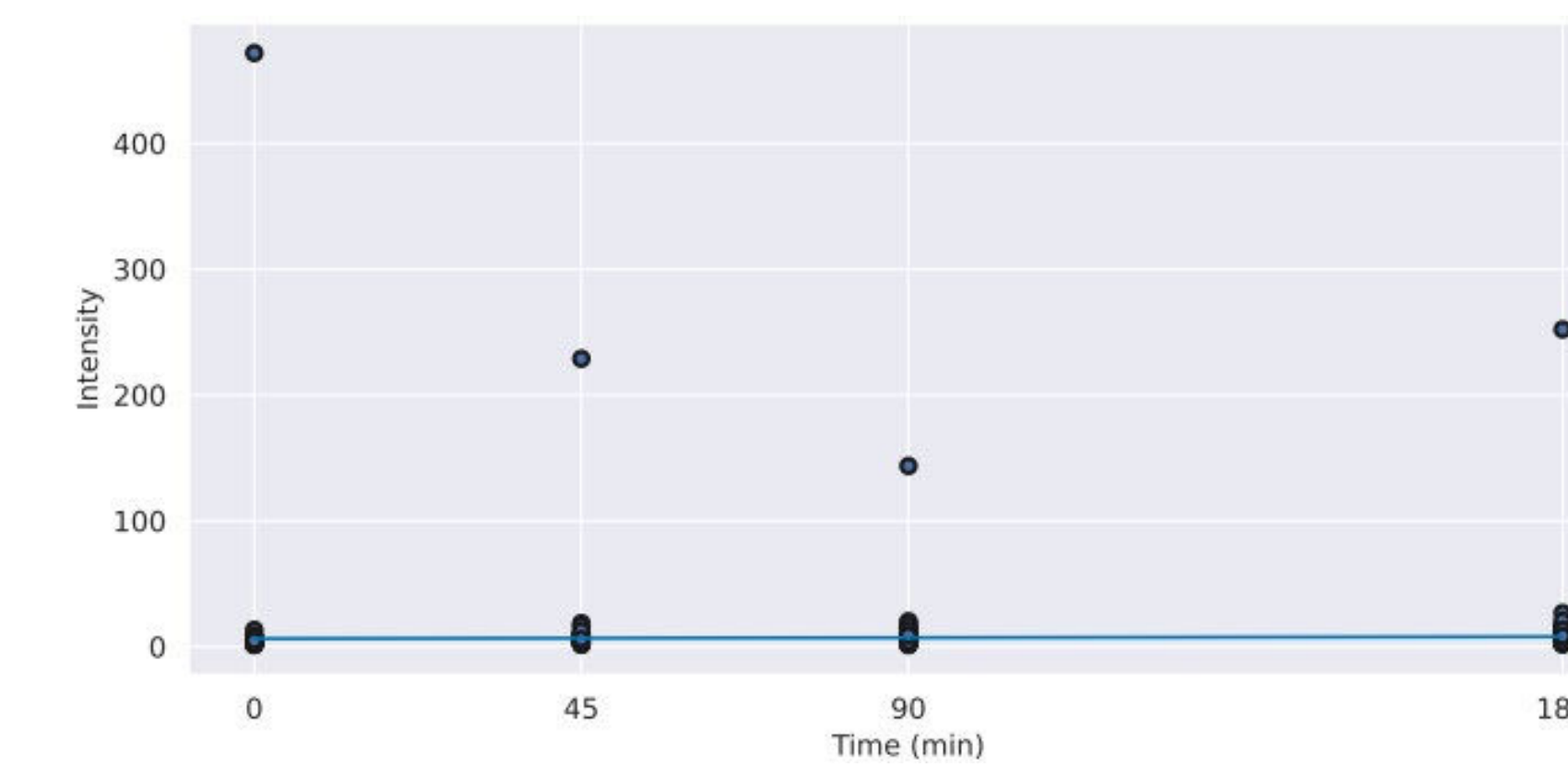


Figure 4: Butanoic acid production post lactulose challenge

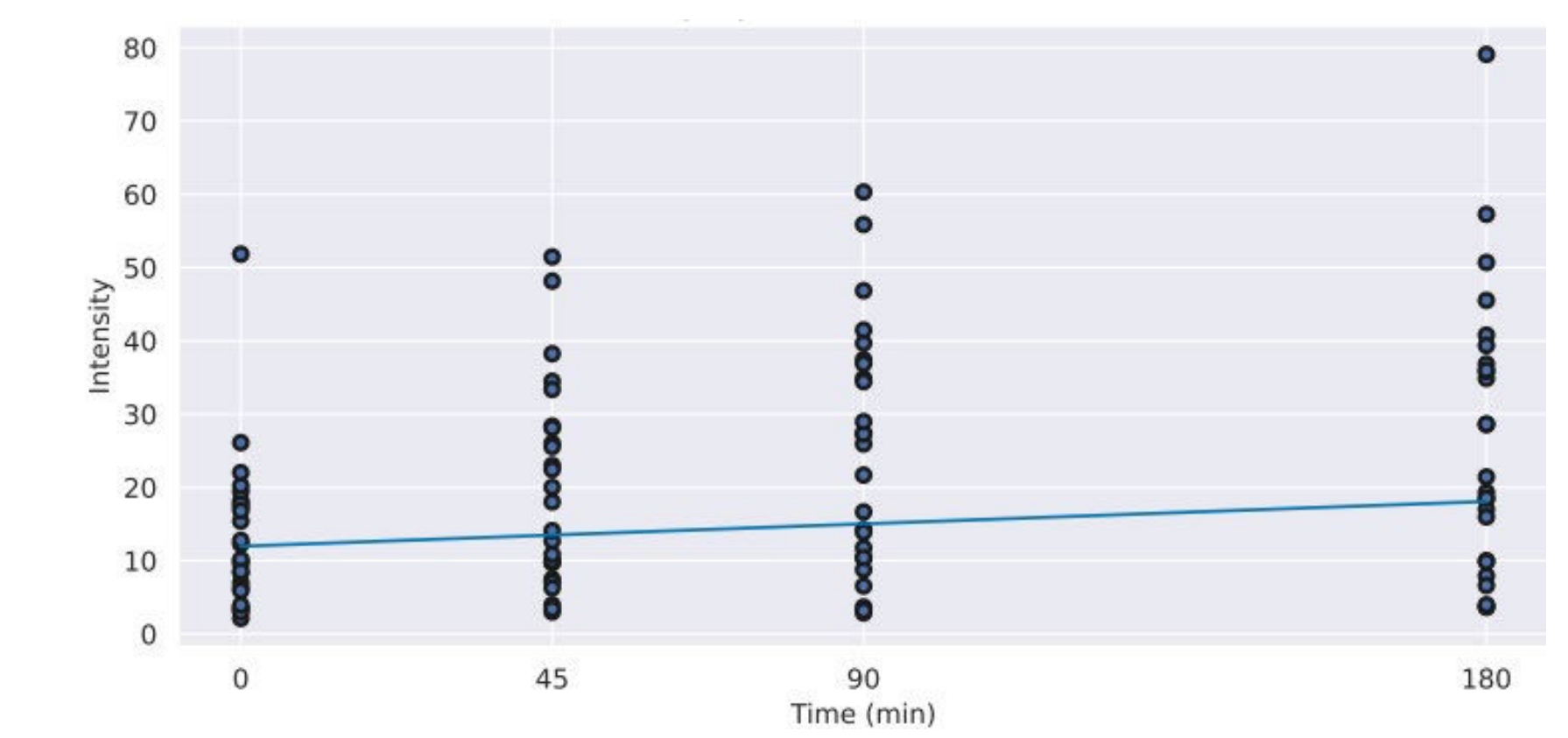


Figure 5: Increase in propanoic acid post lactulose challenge

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

