BREATH® BIOPSY

Gut Microbiome Phenotyping Using Dynamic Breath Analysis

Ahmed T. Murgia A. Banda I. Ahmed Y. Manhota M. Ricciardi F. Sweeney K. Nicholson-Scott L. McConville L. Gandelman O. Allsworth M. Boyle B. Ferrandino G.

Owlstone Medical, United Kingdom

Key Findings

- Several gut-derived, and disease-associated metabolites can be measured in breath either at steady state, and after administration of certain substrates.
- Given ease of use of breath collection, this approach can be used on large cohorts to better establish the effect of these metabolites on diseases.

1. Background and Objectives

- Gut dysbiosis results in excessive production of metabolites that may exacerbate certain diseases, for example gut ethanol production has been associated with NASH.
- Many of these metabolites can be measured non-invasively on breath.
- We investigated the feasibility of quantification of these metabolites in breath with and without substrate intervention.

2. Methods

- For each intervention healthy subjects were enrolled after overnight fasting. Breath was analyzed before and after substrate administration.
- Breath analysis was performed using selected ion flow tube mass spectrometry (SIFT-MS) with direct sampling, or with GC-MS.

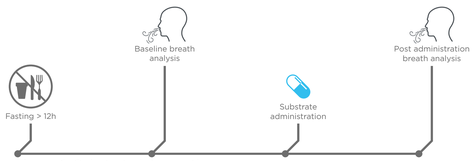


Figure 1. Substrate intervention process.

Table 1. Subject characteristics for glucose intervention.

Total Number	10
Sex (female/male) n	7/3
Age, median [IQR] (years)	29[28-37]
Weight, median [IQR] (Kg)	62[54-70]
BMI, median [IQR] (Kg/m²)	23[22-25]

3. Results

- Fermentation products associated with non-alcoholic fatty liver disease (NAFLD) and gut discomfort show a spike on breath after substrate administration.
- Metabolites generated by amino acid metabolism also show a spike after substrate ingestion.
- Additional metabolites associated with neurodegenerative diseases can be detected.

4. Conclusions

- Many metabolites generated by gut bacteria and associated with different diseases are detectable in breath.
- This non-invasive method can replace the current need for blood collection allowing scaling to large cohort populations.

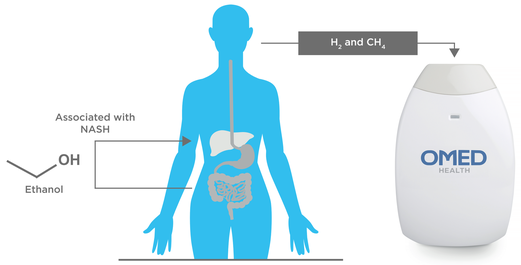
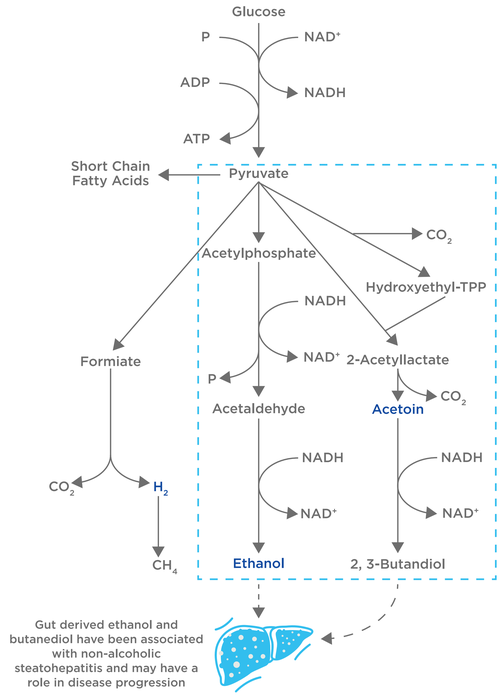
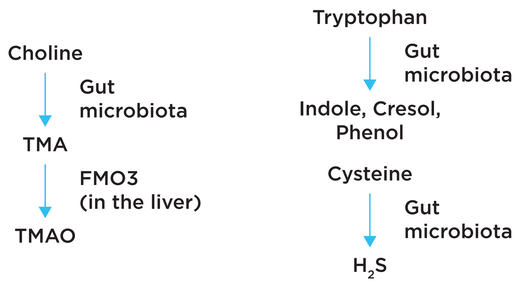


Fig 2. Disease-associated metabolites generated by the gut microbiome are detectable in breath allowing non-invasive at-home self testing. For example, the OMED Health Breath Analyzer is under development for at home-testing of hydrogen and methane to diagnose small intestinal bacterial overgrowth (SIBO).



Administration of Other Substrates



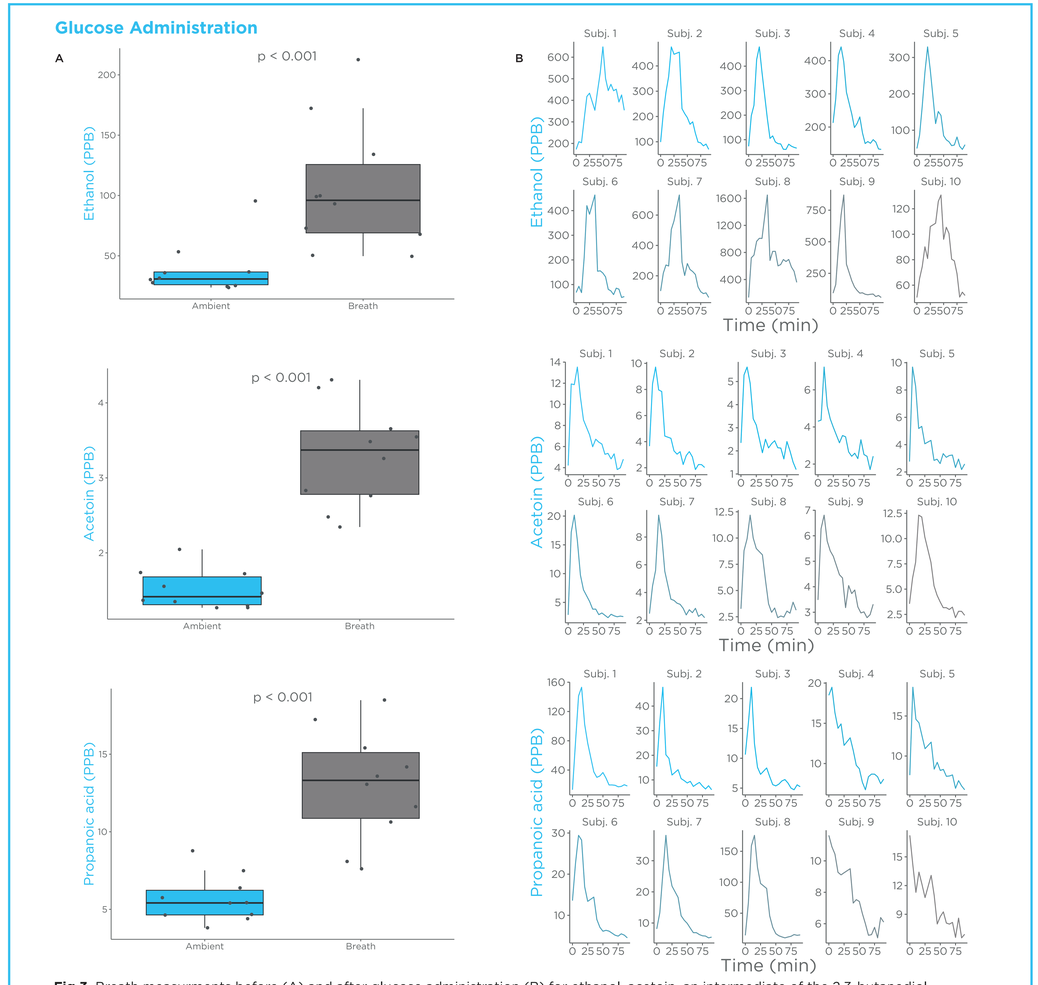


Fig 3. Breath measurments before (A) and after glucose administration (B) for ethanol, acetoin, an intermediate of the 2,3-butanediol fermentation, and propanoic acid.

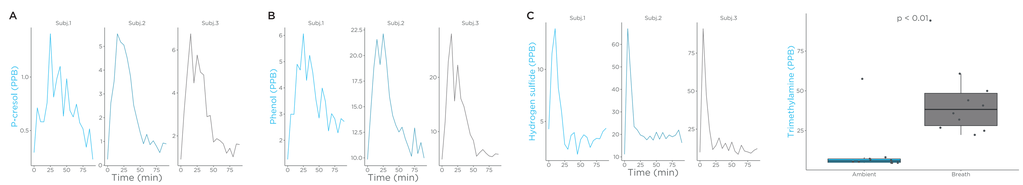


Fig 4. Breath levels of p-cresol (A), phenol (B), and hydrogen sulfide (C) before and at different timepoints after tryptophan and cysteine administration.

Table 2. Summary of gut bacteria-derived metabolites measured in breath.

Phenol	Acetone	Ammonia	Ethanol	Methanol	Propanol	Acetaldehyde	Dimethyl sulfide	Propanoic acid	Methyl mercaptan	Propanol
p-Cresol	Ethyl phenol	Hydrogen sulfide	Acetoin	Methane	Trimethilamine	Indole	Acetic acid	2,3 butanediol	Pentane	1,2 Propandiol