Assessing small intestinal bacterial overgrowth following upper-gastrointestinal surgeries

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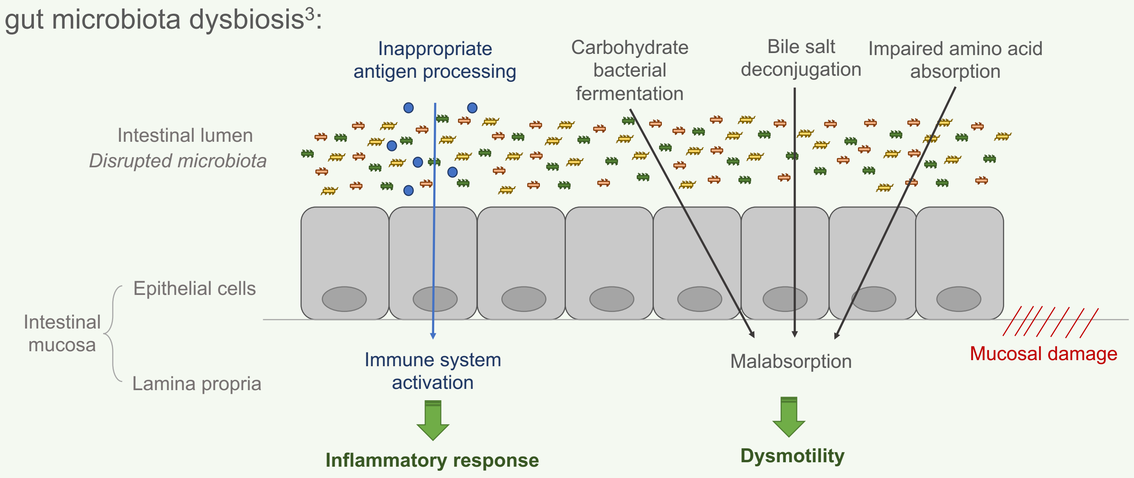
Background

- The gastro-intestinal (GI) tract contains around 1000 distinct bacterial species; roles in maintenance of **immune system** and **metabolism**[1].
- Small intestinal bacterial overgrowth (**SIBO**): increase of bacteria in the gut[2]
- Summary of SIBO-induced gut microbiota dysbiosis[3]:



- Upper-GI **post-operative patients** commonly experience symptoms including anorexia, diarrhoea and dumping, related to SIBO[4].
- Current diagnostic tool for SIBO: **Hydrogen breath test** (HBT), a non-invasive method[6] ➡ **limited** specificity
- Volatile organic compounds (**VOCs**): organic chemicals with a high vapor pressure at room temperature[5].

Project aims

Hypothesis:

SIBO has an impact on the gut microbiome metabolism.

SIBO is highly prevalent in post-operative upper-GI patients

Aims:

1. Determine the prevalence of SIBO in a random population of patients following upper GI surgeries.
2. Acquire data associating SIBO with the breath profile of post-operative patients.
3. Develop a new diagnostic tool to identify SIBO in upper GI post-operative patients.

Materials & Methods

Study population

Inclusion criteria

Previously underwent oesophago-gastric surgery at St Mary's Hospital, >18 years old

Exclusion criteria

Not able to provide informed written consent

Suffered from active infection

Suffered from liver diseases

Breath measurements

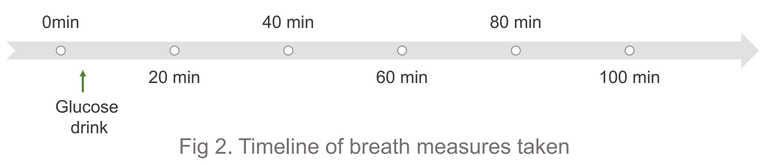


Fig 2. Timeline of breath measures taken

Breath sample collection

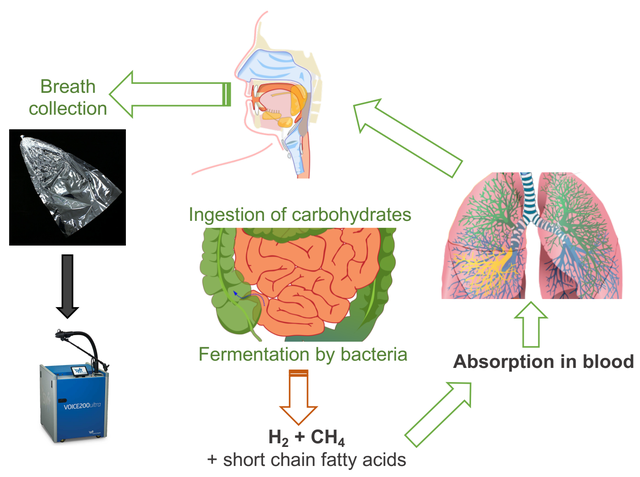


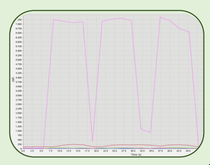
Fig 1. Method of sampling breath and analysis on SIFT-MS

SIFT-MS analysis

Compound	Molecular formula	Molecular weight (g/mol)	Ionisation	Ion (m/z)
Acetone	C_3H_6O	58	H_3O^+	59, 77
			NO^+	88
Acetic acid	$C_2H_4O_2$	60	NO^+	90, 108
Butanal	C_4H_8O	72	NO^+	71
Butyric acid	$C_4H_8O_2$	88	NO^+	118
Ethanol	C_2H_6O	46	H_3O^+	47, 83
Heptanone	$C_7H_{14}O$	114	NO^+	144
Nonanal	$C_9H_{18}O$	142	NO^+	141
Octanone	$C_8H_{16}O$	128	NO^+	158
Pentanal	$C_5H_{10}O$	86	NO^+	85
Pentanoic acid	$C_5H_{10}O_2$	102	H_3O^+	103, 121, 139
Propenal	C_3H_4O	56	H_3O^+	57, 73, 95

Table 1. Targeted VOCs for breath analysis

- Selected VOCs analysed for 60 seconds
- Measurement repeated 3 times
- Mean(y) of peak values noted



Results & Discussion

- The prevalence of SIBO in upper-GI post-operative patients was **66,15%.**
- *VOCs in breath samples showed:*

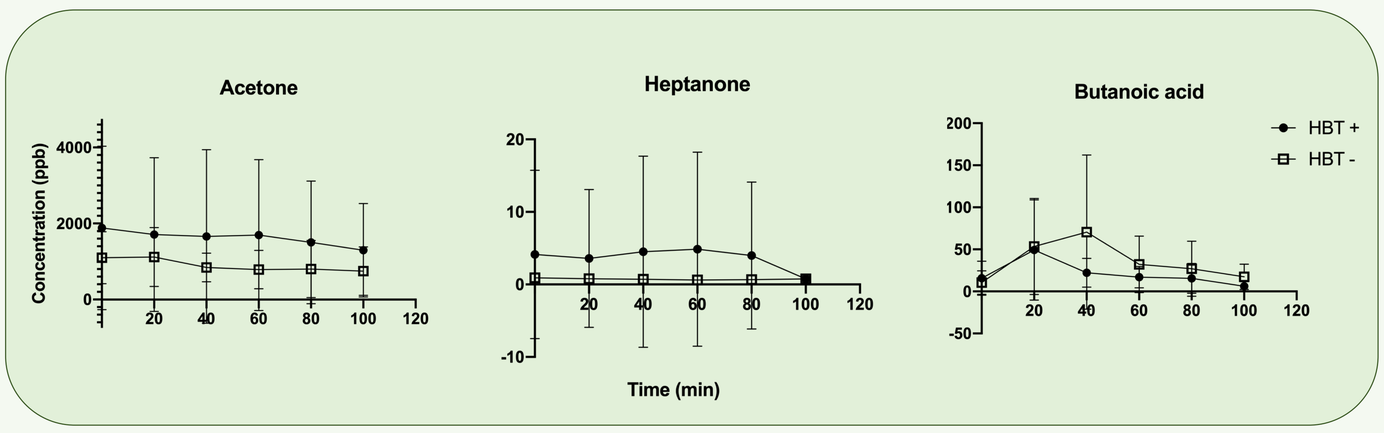


Fig 3. Concentration of acetone (A), heptanone (B) and butanoic acid (C) in parts per billion (ppb) over time, in breath of patients that were either positive (HBT+) or negative for SIBO (HBT-**). Linear mixed model applied for each compound indicated that acetone (m/z 59, 77 & 88), heptanone (m/z 114) and butanoic acid (m/z 118) were significantly different between HBT+ and HBT- patients** (n=30)**.**

Significance was considered at a p-value < 0.05.

- Increase of acetone and heptanone (ketones), and decrease of butanoic acid (short-chain fatty acid, SCFA) are consequences of the disrupted carbohydrate digestion
  - Abnormal bacterial fermentation of non-digestible carbohydrates
  - Abnormal oxidation of FA into ketones for ketosis

- **Future approach:**
- ↑ **sample size** and confirm current results obtained
- investigate products of **FA metabolism**

➡ **Promising feasible and efficient method**

References

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