IOCD 2025 Conference

The 1st International Online Conference on Diseases

09–11 September 2025 | Online

MDPI

Prevalence, pathophysiology, and dietary management of SIBO in the modern lifestyle

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INTRODUCTION & OBJECTIVES

Small intestinal bacterial overgrowth (SIBO) is an abnormally excessive growth of bacteria in the small intestine. SIBO is increasingly recognized in gastroenterology, yet its diagnosis and management remain inconsistent across clinical settings. **Despite high prevalence in symptomatic patients, standard diagnostic thresholds (≥10^3 vs. ≥10^5 CFU/mL) and breath testing remain controversial. Proteobacteria/Firmicutes ratio, particularly values >0.39 is** a promising biomarker correlated with symptoms such as **bloating** and **fecal urgency.** This approach provides a unifying lens through which diagnostic variability may be reduced and **microbial imbalance more precisely addressed.** Additionally, there is evidence on the role of dietary patterns in reshaping the gut microbiota, **proposing targeted nutritional interventions to reduce recurrence rates.**

The recent introduction of **ICD-10 code K82.11** further emphasizes the need for standardized frameworks in epidemiological tracking.

The findings from this study will encourage a **shift from symptom-driven to microbiota-informed care models,** with the potential to enhance clinical decision-making and long-term patient outcomes.

SIBO: CURRENT DIAGNOSTIC EVALUATION

SUSPECTED SIBO

1. Breath test (Non-invasive, feasible, low-cost, & patient-friendly methods)

Glucose hydrogen breath test (GHBT)

- Highly **specific** (78% - 97%)
- **Lower sensitive** (15.7% to 62%) which probably leads to **false negatives**
- May miss distal **SIBO**
- **Cut-off: H_2↑ ≥10–12 ppm** above the baseline value
- Ease repeatable

Lactulose breath Test (LHBT)

- Sufficiently sensitive (31% - 68%)
- **False positives are less specific** (65% - 97.9%)
- **CH_4** measurement
- No distinction is made between **SIBO** and **rapid transit**
- **Cut-off: H_2↑ ≥20 ppm (90 mins), CH_4↑ ≥10 ppm**

Pre-testing preparation

- Stop antibiotics 4 week prior
- Low fasting level of breath hydrogen
- Avoid complex carbohydrates & fiber
- No smoking on test day

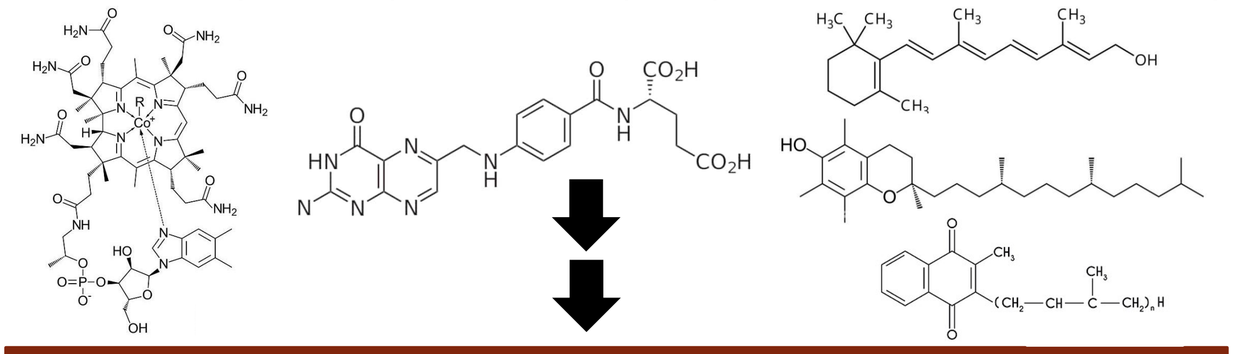
2. Quantitative culture of fluid from the small bowel aspirate

- **Gold** standard for **SIBO** diagnosis
- **Cut-off: ≥10^5 CFU/ml,** though many studies have also reported **≥10^3 CFU/ml.**
- Invasive, pricey, tedious, hard to operate, not widely use in clinical practice
- Limitations: spotty distribution, bacteria contamination, non-culturable bacteria

SIBO should be a suspected diagnosis in patients with **irritable bowel syndrome (IBS)-like symptoms and/or malabsorption syndrome,** with a particular focus on patients with disorders that make them more likely to develop **SIBO**.

3. Supportive laboratory analyses / data

↓ Vitamin B12 (cobalamin) **↑ Vitamin B9 (folate)** **↓ Fat-soluble vitamins (A. D. E, K)**



4. Emerging tools: Molecular techniques

- **16S rRNA gene sequencing** (*in silico* & sequence-based experiments)
- **Metabolomic** patterns in the biological samples collected from patients with **SIBO**
- **Unculturability** *in vitro* (PCR-cloning-sequencing **technique)**
- **Still in its exploratory stage (e.g., gas** sensing capsule)

SIBO PATHOGENESIS

SIBO can negatively impact the host by (1) **bacterial fermentation of carbohydrates,** leading to excess gas and water output, and (2) **bacterial deconjugation of bile acids,** resulting in malabsorption of fat-soluble vitamins. It can also (3) **affect the host through bacterial consumption of macronutrients and micronutrients**, left the host with fewer nutrients for absorption, (4) **flattening of the villi**, which causes poor absorption of carbohydrates, (5) **decreased production of short-chain fatty acids**, and (6) **widening of intestinal permeability** (**Figure 1**).

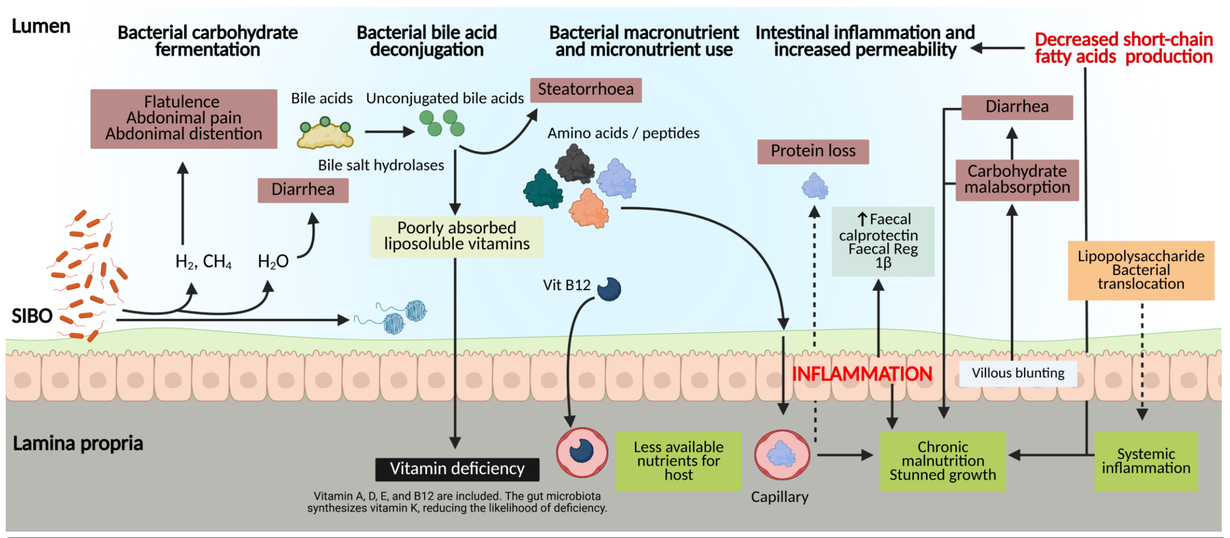


Figure 1: Mechanisms through which SIBO negatively impacts the host. (Avelar Rodriguez et al., 2019). Created with BioRender.com.

DIETARY STRATEGY FOR SIBO

DIETARY MANAGEMENT

Low-Fermentation diets

FODMAP elimination (3 phrases)

1) Restriction
2) Reintroduction
3) Personalization

Target FODMAP groups:
1. Oligosaccharides
2. Mono / Disaccharides
3. Polyols

Benefits:
↓ Gas / osmotic load
↓ Bloating / diarrhea
↑ Quality of life

Long-term risks:
↓ Microbial diversity
↓ Prebiotic intake

Elemental diets

Fully-absorbed liquid diet with no **fiber** or fermentable **carbohydrates**

Bacteria are **starved** of **nutrients** due to **a lack of essential supplies**

Diet post-treatment
- Meal spacing (**≥4-5 hours**)
- Avoid **late-night eating**
- Include: **fiber, EVOO, polyphenols**

CONCLUSION & FUTURE OUTLOOK

SIBO is **prevalent but challenging** to diagnose reliably. While breath tests are considered safe and well-established, **novel molecular approaches show promise for improving future diagnostics.** A **low-fermentation diet** combined with antibiotics effectively minimizes symptoms but should only be used in **the short-term** to avoid **adverse effects on the gut microbiome and nutrition**. **Treatment needs to be tailored to fit the person, taking into account their dietary tolerance, lifestyle, and circumstances, and always backed up by a proper differential diagnosis.**

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ACKNOWLEDGMENTS

The research leading to these results was supported by Proyectos de Generación de Conocimiento 2023 (PID2023-148814OA-C22) supporting the predoctoral industrial grant for A. Perez-Vazquez (DIN2024-013416) in collaboration with Mercantia Desarrollos Alimentarios S.L; by Xunta de Galicia for supporting the pre-doctoral grant of P. Barciela (ED481A-2024-230). The authors also the EU-FORA Fellowship Program (EUBA-EFSA-2023-ENREL-01) that supports the work of F. Chamorro (INNOV2SAFETY-GA13) and S. Seyyedi-Mansour (ALGAESAFE-GA14).