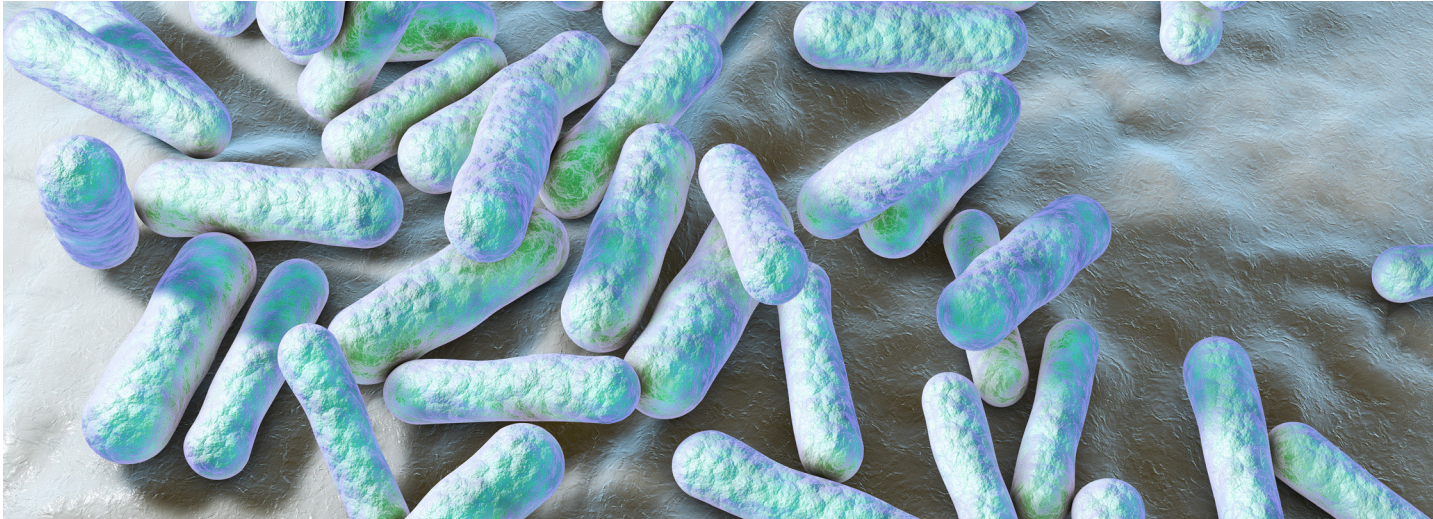# SIBO
Small Intestinal Bacterial Overgrowth

*The **intestine** is home to a living universe - **the microbiome**. Intestinal bacteria fulfill numerous tasks in the human body. They are actively involved in digestion, support the **immune system** and even influence **hormone balance**. However, when microorganisms colonize the relatively germ-poor small intestine, a small intestinal bacterial overgrowth **(SIBO)** develops. Typical SIBO symptoms are flatulence, abdominal cramps, diarrhea, constipation as well as migraine, sleep disorders and depressive moods. In addition, severe vitamin and mineral deficiencies, **intestinal mucosal inflammation** and immune deficiency develop.*

What is SIBO?

SIBO is a qualitative and / or quantitative abnormal bacterial colonization in the small intestine. Compared to the large intestine (10^9 - 10^{12} CFU / ml), a healthy small intestine flora comprises only a very low number of bacteria (< 10^3 CFU / ml). In case of SIBO, the bacterial count in the small intestine is ≥ 10^3 CFU / ml (see Fig. 1). [1]

These bacteria metabolize the ingested carbohydrates. This process produces a whole range of degradation products, such as hydrogen, carbon dioxide and short-chain fatty acids (acetic, lactic and propionic acids), which are responsible for various gastrointestinal complaints.

The following symptoms occur frequently:

- Flatulence
- Abdominal cramps
- Diarrhea
- Constipation

Additional symptoms may includ:

- Depressive moods
- Migraine
- Headache
- General fatigue
- Concentration disorders
- Sleeping disorders

Stomach:
10^2–10^3 KBE/ml

SIBO
≥10^3 KBE/ml

Colon:
10^9–10^{12} KBE/ml
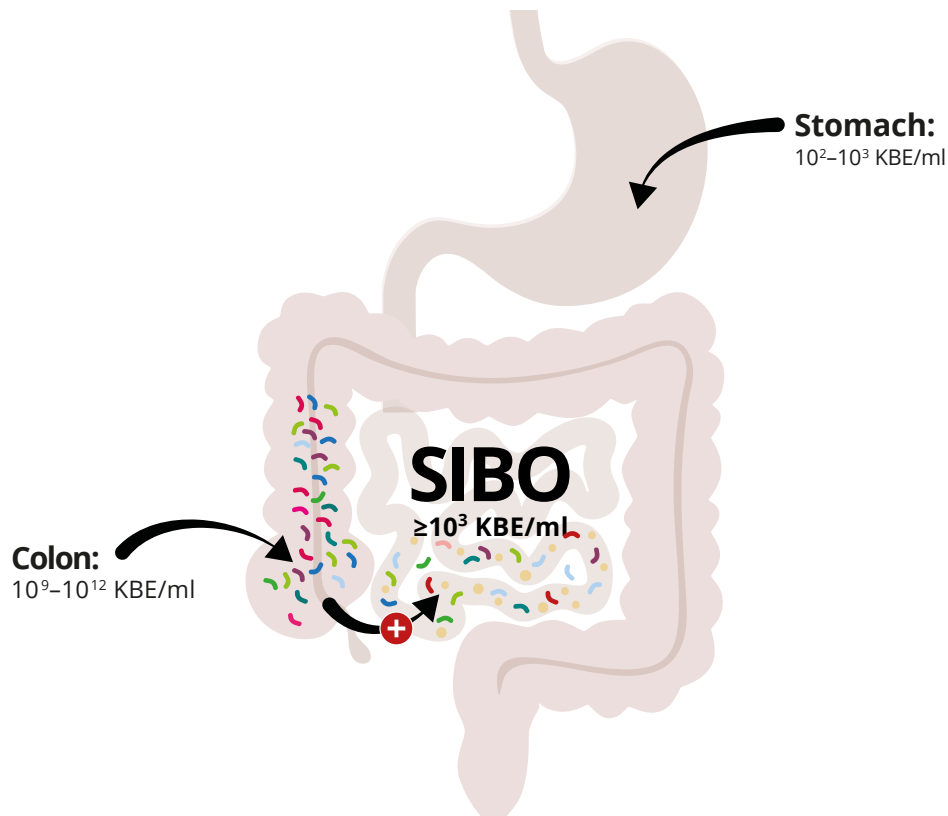
Fig. 1 *Bacterial distribution of the gastrointestinal tract under small intestinal bacterial overgrowth (SIBO) Explanation: CFU per ml = colony forming units / number of bacteria*

Who is affected?

SIBO has no specific symptomatology and was little known until recently. It is still not possible to clearly estimate the exact number of people affected, as the disease has been underdiagnosed. Some studies and meta-analyses provide evidence that SIBO occurs significantly more often in women and in elderly people. Additionally it has been possible to define risk groups and describe causes. Table 1 provides a summary of possible causes and risk factors. [2, 3, 4]

How is SIBO diagnosed?

The non-invasive breath test proves to be particularly reliable, easy to perform and can be offered at a low price. The test procedure detects both SIBO-produced hydrogen and methane concentrations a sensitivity of almost 100%.

After collecting a reference sample, the patient must drink the lactulose solution provided in the test kit to start the test. Subsequently, the hydrogen and methane concentrations are measured at specific time intervals. The patient tested positive for SIBO if the hydrogen and/or methane concentration(s) rise above the normal range within 90 minutes. [1]

Indications

- Flatulence, cramps, diarrhea, constipation

- Depressive moods, migraine, headaches, general exhaustion, concentration disorders, sleep disorders

- Patients with chronic diseases of the gastrointestinal tract

- Patients with known carbohydrate/gluten intolerances and celiac disease.

Mechanical ileus

- Small bowel tumor
- Twisting or obstruction of the intestine
- Obstructive defecation syndrome
- Postoperative side effects

→ Mechanical changes in the physiology of the intestine cause changes in the distribution of microorganisms.

Systemic diseases

- Diabetes mellitus
- Scleroderma
- Amyloidosis
- Metabolic syndrome

→ Chronic diseases involving multiple organs also affect the microbiome.
→ Recent studies show that overweight and obesity promote the development of SIBO.

Motility

- Irritable Bowel Syndrome
- Pseudoobstruction
- Mitochondrial diseases

→ Slowed gastrointestinal peristalsis delays the passage of food and microorganisms through the intestine. This gives bacteria more time to metabolize nutrients, leading to the proliferation and spread of microorganisms.

Medication

- Opiates
- Strong antisecretory agents (such as proton pump inhibitores)

→ E.g. opiates inhibit peristalsis and change the passage time.
→ Proton pump inhibitors block the production of gastric acid. This eliminates the strong antibacterial effect of gastric acid as well as the regulation of bacterial growth in the small intestine..

Malabsorption

- Pancreatic insufficiency
- Cirrhosis of the liver
- Chronic inflammatory bowel disease (IBD), such as Crohn's disease and ulcerative colitis
- Celiac disease, lactose intolerance, fructose- and sorbitol malabsorption

→ Gastric acid, bile acids and digestive enzymes influence the regulation of the microbiome. Together, they control the growth and proliferation of microorganisms in the gut.
→ Undigested food components that are not absorbed due to IBD or other malabsorption disorders provide a perfect substrate for the growth and proliferation of microorganisms.

Immunodeficiency

- sIgA – deficiency
- AIDS

→ A weakened intestinal mucosal immunity is no longer able to regulate bacterial growth and to provide adequate protection against pathogenic microorganisms and their toxic metabolites.

Other causes

- Diverticulosis
- Age

→ Protected niches develop between diverticula and the intestinal mucosa, in which the food pulp can accumulate and microorganisms can thus multiply particularly quickly.
→ Physiological aging processes, such as motility disorders, malabsorption and decreased production of gastric and bile acids, favor the development of SIBO.

Table 1 *Possible causes and diseases that promote SIBO (Source: mod. after G. Losurdo et al. 2020 [2])*

Preanalytic

Time	Measures to be observed
4 weeks ago	✖ No antibiotics
7 days ago	✖ No laxatives ✖ No antacids (such as aluminum or magnesium hydroxides)
48 hrs before	Restrictions - food and drink: ✖ No dietary fiber (E.g.: whole grains, legumes, cabbage). ✖ Only easily digestible foods (E.g.: rice, chicken breast). ✖ No sugar, no sweets ✖ No pro-/prebiotics ✖ No alcohol
12 hrs before	✖ No drinking (only still water if needed) ✖ No food (you must be sober at the start of the test!) ✖ No chewing gum ✖ No toothpaste and no mouthwash (rinse teeth with water only!) ✖ Take only the most important medications (consult with your doctor!)
1 hr before	✖ Do not smoke (even passively) ✖ No physical effort ✖ Do not sleep
During the course of the test	**Please do not drink any water after taking the test solution!** **1 hour after taking the test solution, drinking still water is possible again if needed.**

Further laboratory diagnostics

- Vitamin deficiency (A, D, E, B12, B1, B3)
- Mineral deficiency (Fe, Ca)
- Microbiome composition (e.g., increased bacterial counts of clostridia and eubacteria).
- Changes in bile acid metabolism
- Inflammatory markers in the intestine (calprotectin, α-1-antitrypsin).
- Leaky Gut Markers: Zonulin and histamine
- Immunodiagnostics (slgA, TNF-α)

References

1. **A. Rezaie, M. Buresi, A. Lembo, H. Lin, R. McCallum, S. Rao, M. Schmulson, M. Valdovinos, S. Zakko, M. Pimentel**. Hydrogen amd Methane-Based Breath Testing in Gastrointestinal Disorders: The North American Consensus. The American Journal of GASTROENTEROLOGY. 112:775–784, 2017.

2. **M. Pimentel, R.J. Saad, M. D. Long, Satish S. C. Rao**. ACG Clinical Guideline: Small Intestinal Bacterial Overgrowth. The American Journal of GASTROENTEROLOGY. 2020, 115:165–178.

3. **G. Losurdo, F. S. D'Abramo, G. Indellicati, C. Lillo, E. Ierardi, A. Di Leo**. The Influence of Small Intestinal Bacterial Overgrowth in Digestive and Extra-Intestinal Disorders. International Journal of Molecular Sciences. 2020, 21, 3531.

4. **S. Rao, J. Bhagatwala**. Small Intestinal Bacterial Overgrowth: Clinical Features and Therapeutic Management. Clinical and Translational Gastroenterology. 2019, 10:e00078.

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Do you have any questions? Please call us, we look forward to hearing from you!

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