

IBS – or is it SIBO?

When food is not
your friend.

Sharon Erdrich

MHSc (Hons), NZRN, Dip Nat, Dip
HerbMed, Dip Aroma.

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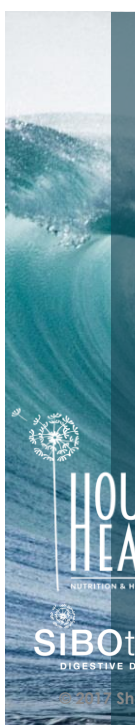


www.SIBOtest.nz

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Conflict of interest & financial disclosures

I own **SiBOtest.nz** - a breath testing service, providing diagnostics for Small Intestinal Bacterial Overgrowth (SIBO) and sugar malabsorption syndromes



1

SEMINAR OUTLINE

SIBO Origins & Manifestations

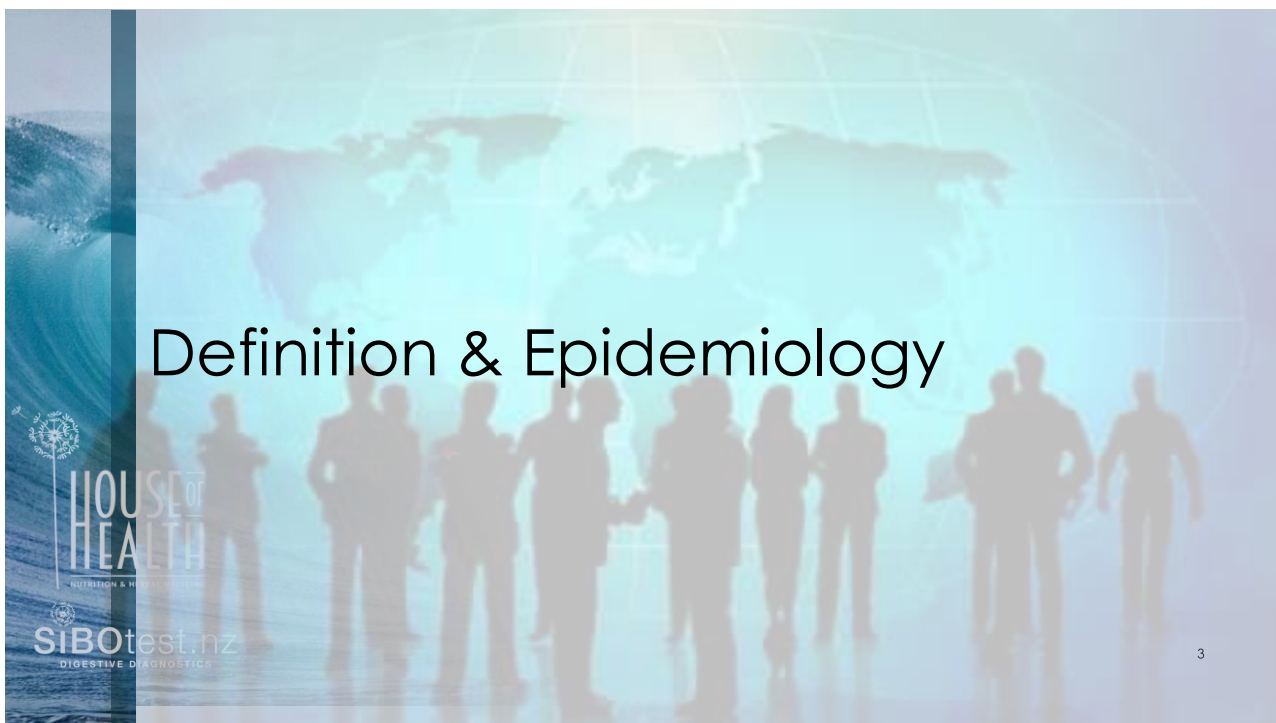
- Definition & Epidemiology
- Origins
- Symptoms
- Associated conditions

SIBO Diagnosis & Management

- Diagnostic options
- Common masqueraders
- Interpretation of breath tests
- Treatment options
- Case studies



2



SIBO – What is that?

- SIBO = Small Intestinal Bacterial Overgrowth
- Formerly called Bacterial Overgrowth of the Small Intestine (BOSI)
- Sometimes referred to as Small Bowel Bacterial Overgrowth (SBBO)
- “an increase in the number and/or alteration in the type of bacteria in the upper gastrointestinal tract”

Sharon Erdrich

World J Gastroenterol 2010; 16(24): 2978-2990

GASTROENTEROLOGY & HEPATOLOGY

The Independent Peer-Reviewed Journal

Gastroenterol Hepatol (N Y). 2007 Feb; 3(2): 112–122.

PMCID: PMC3099351

Small Intestinal Bacterial Overgrowth

A Comprehensive Review

Andrew C. Dukowicz, MD, Brian E. Lacy, PhD, MD,[✉] and Gary M. Levine, MD

Definition

Go to: 

SIBO is defined as a bacterial population in the small intestine exceeding 10^5 – 10^6 organisms/mL.^{1,2} Normally, less than 10^3 organisms/mL are found in the upper small intestine, and the majority of these are Gram-positive organisms.³ In addition to the absolute number of organisms, the type of microbial flora present plays an important role in the manifestation of signs and symptoms of overgrowth.⁴ For example, a predominance of bacteria that metabolize bile salts to unconjugated or insoluble compounds may lead to fat malabsorption or bile acid diarrhea. In contrast, microorganisms that preferentially metabolize carbohydrates to short-chain fatty acids and gas may produce bloating without diarrhea because the metabolic products can be absorbed. Gram-negative coliforms, such as *Klebsiella* species, may produce toxins that damage the mucosa, interfering with absorptive function and causing secretion, thereby mimicking tropical sprue.

- Recently cut-off of 10-3 has been used

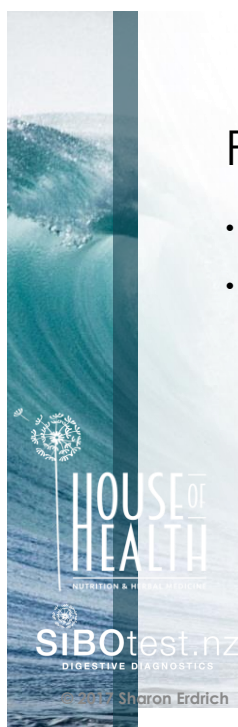
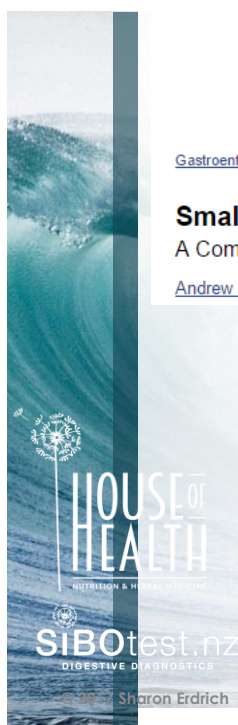
Aliment Pharmacol Ther. 2013 Jun; 37(11): 1103–1111

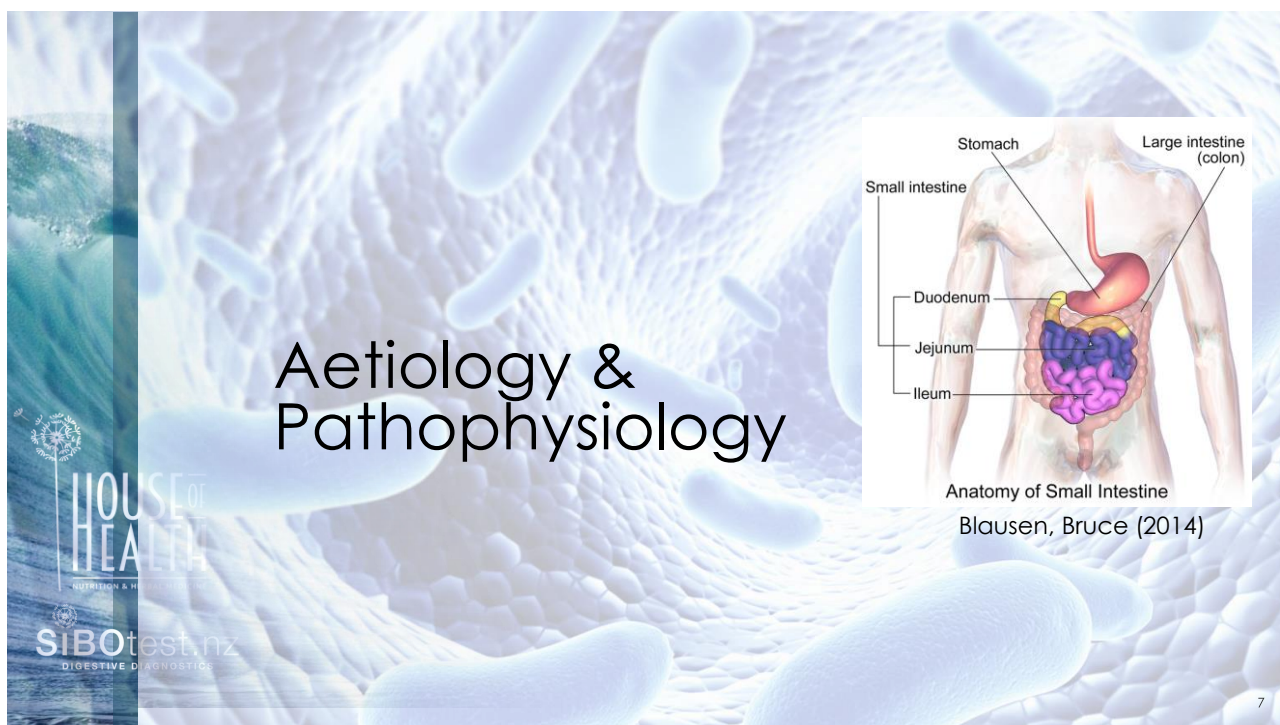
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Prevalence & Epidemiology

- Unknown
- Estimates based on prevalence of Irritable Bowel Syndrome (IBS)
 - 11-14% of the population
 - ~17% in New Zealand
 - the most common gastrointestinal diagnosis in primary care
 - it is thought that up to 50% of people with symptoms of IBS do not consult their GP

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Aetiology & Pathophysiology

Stomach Large intestine (colon)

Small intestine

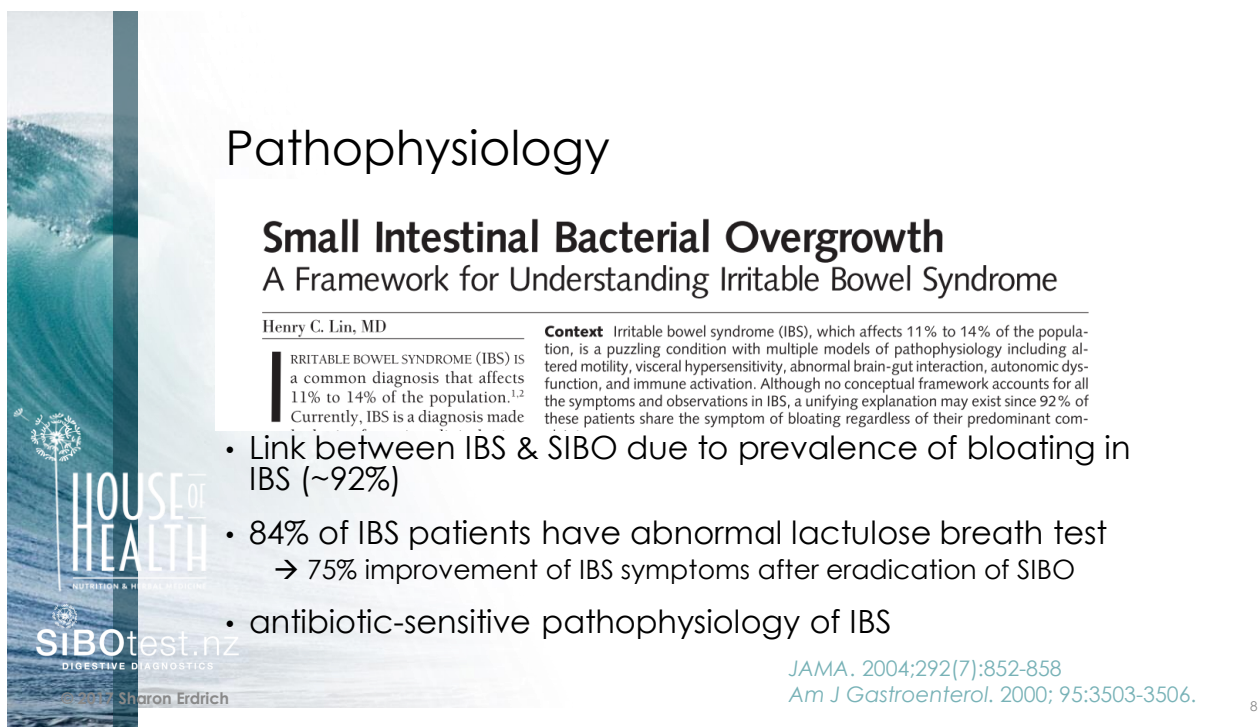
Duodenum

Jejunum

Ileum

Anatomy of Small Intestine
Blausen, Bruce (2014)

7



Pathophysiology

Small Intestinal Bacterial Overgrowth

A Framework for Understanding Irritable Bowel Syndrome

Henry C. Lin, MD

Context Irritable bowel syndrome (IBS), which affects 11% to 14% of the population, is a puzzling condition with multiple models of pathophysiology including altered motility, visceral hypersensitivity, abnormal brain-gut interaction, autonomic dysfunction, and immune activation. Although no conceptual framework accounts for all the symptoms and observations in IBS, a unifying explanation may exist since 92% of these patients share the symptom of bloating regardless of their predominant com-

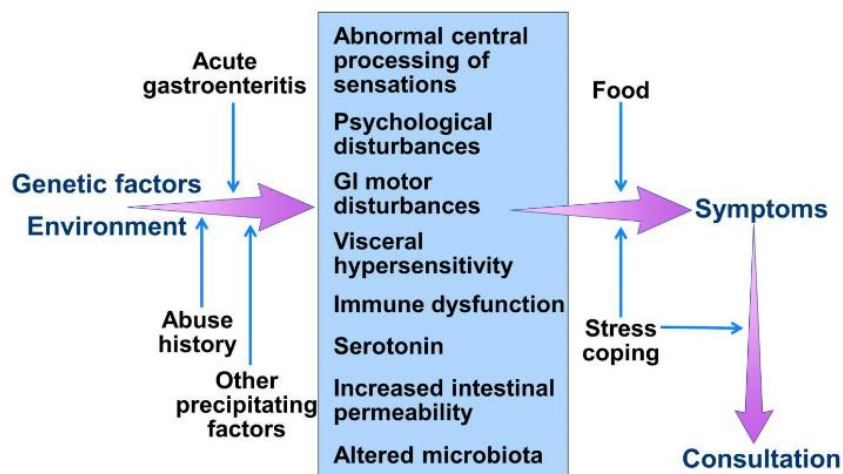
IRRITABLE BOWEL SYNDROME (IBS) IS a common diagnosis that affects 11% to 14% of the population.^{1,2} Currently, IBS is a diagnosis made

- Link between IBS & SIBO due to prevalence of bloating in IBS (~92%)
- 84% of IBS patients have abnormal lactulose breath test
→ 75% improvement of IBS symptoms after eradication of SIBO
- antibiotic-sensitive pathophysiology of IBS

JAMA. 2004;292(7):852-858
Am J Gastroenterol. 2000; 95:3503-3506.

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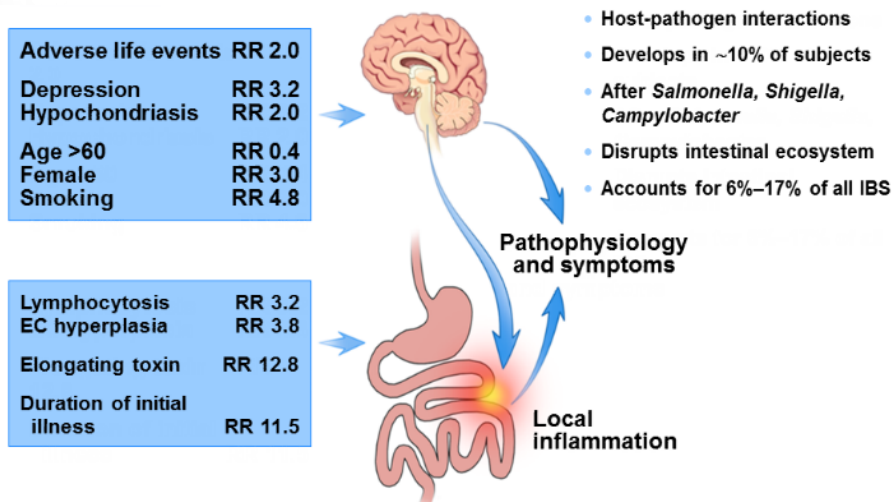
Proposed Pathophysiology of IBS



Simrén, M. Professor, University of Gothenburg

<http://www.mycme.com/irritable-bowel-syndromewhats-new-for-rome-iv/material/4208/16746/> 9

Post-Infectious (IBS)



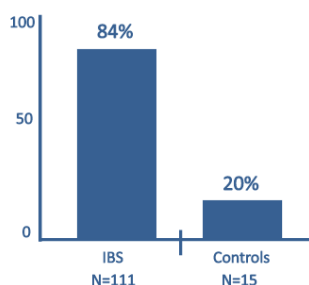
Gastroenterology, 2009;136:1979e88.

Modern Pathology. 2006; 19, 1638–1645

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IBS & Breath Tests

Prevalence of Abnormal * Lactulose Breath Tests in Rome I IBS



*Single peak >20 ppm rise of H₂ by 90 min

Pimentel et al. *Am J Gastro* 2003;98:412

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How Does IBS become SIBO?

- Something goes wrong!
 - Inheritance (?)
 - Natural defences
 - Motility dysfunction
 - Altered anatomy
 - Combination of any of a number of risk factors

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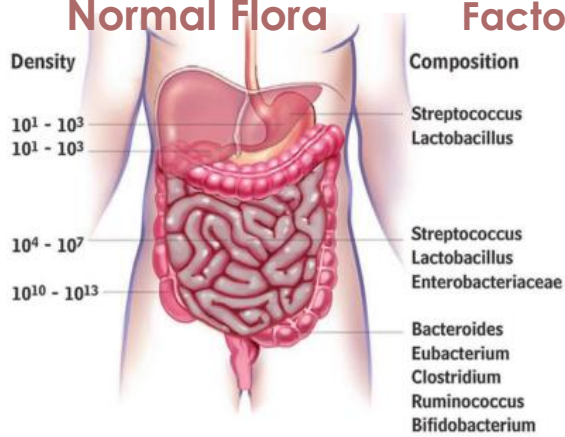
Inheritance



Moskvitch, K. (2014). Bacteria found in healthy placentas. *Nature*. <https://doi.org/10.1038/nature.2014.15274>

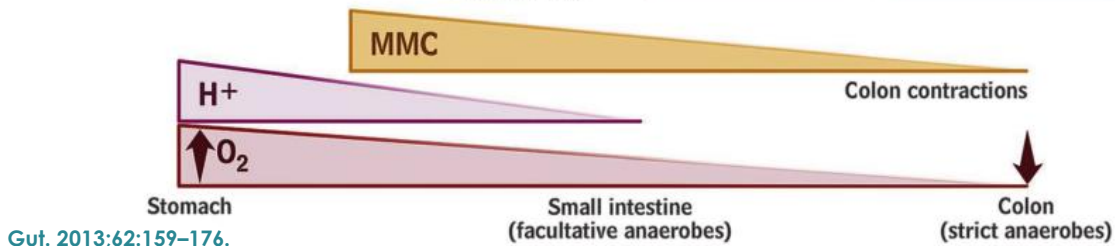
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Normal Flora



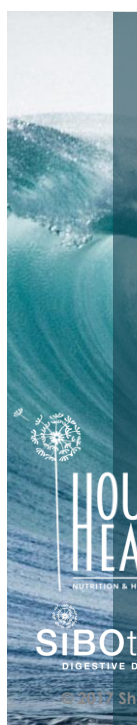
Factors Affecting Gut Microbiota

Intrinsic factors	Extrinsic factors
Gastric acid	Diet, Pre and probiotics
O ₂	PPIs, H2 blockers
Motility	Antibiotics
Mucus	Prokinetics
GI secretions	Laxatives
Antimicrobial peptides	Opioids
Immunity (sIgA)	NSAIDs



Gut. 2013;62:159-176.

14



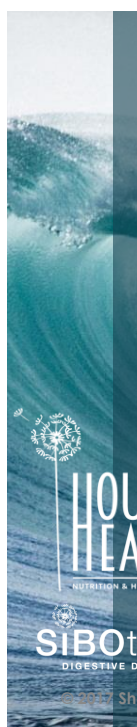
Natural Defences

- Normal GI Function
 - Secretions:
 - Gastric acid
 - Pancreatic enzymes
 - Bile
 - Gut Motility
- Immune function
 - Normal flora
 - Intestinal immunoglobulins
- Normal structure
 - Eg: Intact ileocaecal valve
 - Effects of surgery on normal structure

} Natural
bactericide/
bacteriostatics

World J Gastroenterol. 2010;16(24):2978-2990.
Gastroenterol Hepatol (N Y). 2007 Feb; 3(2): 112-122.

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Natural Defences

- Insufficient gastric acid (Hypochlorhydria)
 - PPIs
 - SIBO occurred in 53% of patients on omeprazole, compared to 17% on cimetidine ($P < 0.05$)
 - H. pylori infection
- Adequate bile secretion
- Digestive enzymes
 - Production may be impaired 2° to brush border damage

Gastroenterol Hepatol (N Y). 2007 Feb; 3(2): 112-122.
FEMS Microbiol Rev, 2005; 29 (4): 625-651

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The Role of PPIs in Loss of Natural Defence

- SIBO is more frequent in patients on long term treatment with PPI c.f. both healthy and IBS controls
 - Prevalence and severity increases with the duration of therapy.
- “Gassy bowel” is more frequent and more severe in PPI-SIBO than in IBS-SIBO.
- Healing of SIBO is more successful in patients on PPI **less than 12 months**



Gastroenterology, 2009; 136: 5, (A71)

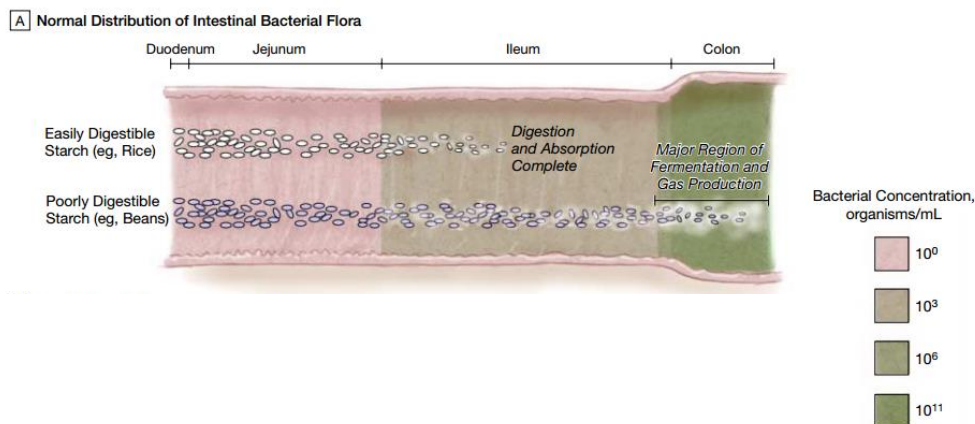
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Biliary Insufficiency and/or Dyskinesia

- Bile
 - major function is as a biological detergent
 - emulsifies and solubilises fats
 - has the ability to affect the phospholipids and proteins of cell membranes and disrupt cellular homeostasis
 - potent antimicrobial properties on bile
 - important role in physicochemical defence system
- Disrupted flow in any liver pathology / bile duct disorder



FEMS Microbiology Reviews., 2005. 29:4 625–651 18



Distribution of Intestinal Bacterial Flora in Normal Gut and in Small Intestinal Bacterial Overgrowth

JAMA. 2004;292(7):852-858.¹⁹

Common Culprits

- The bacteria that are most commonly overgrown are:
 - Anaerobes
 - *Bacteroides* in 39%, *Lactobacillus* in 25%, and *Clostridium* in 20%
 - Aerobes
 - *Strep* in 60%, *E. coli* in 36%, *Staph* in 13%, and *Klebsiella* in 11%.
- In another study
 - *E coli* in 37%, *Enterococcus* species in 32%, *Klebsiella* in 24%, and *Proteus mirabilis* in 6.5%.

Am J Gastroenterol. 1999;94(5):1327-1331.
Arq Gastroenterol. 2008;45(3):212-218.

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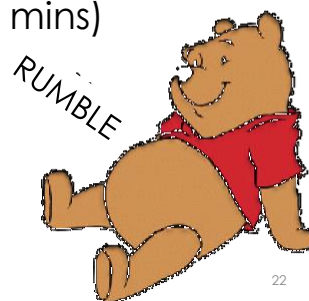
Motility Disorders

- During fasting migrating motor complex (MMC) sweeps the GI tract clean
 - abnormalities predispose to SIBO
- Gastroparesis
 - May develop secondary to chronic diabetes, connective tissue disorders, a prior viral infection, and ischaemia
- Impaired gastric peristalsis
 - Stasis of food and bacteria in the upper GI tract.

Gastroenterol Hepatol (N Y). 2007 Feb; 3(2): 112-122.
Best Pract Res Clin Gastroenterol. 2001;15(3):511-521 21

Migrating Motor Complex

- AKA "housekeeping" wave/cleaning wave
- Bursts of electrical, contractile activity
 - Originate from vagus nerve
 - Regulated by release of motilin
- Cyclical - every 75-90 minutes (or 90-120 mins)
- Originates in stomach
 - **MUST** be empty
- Terminates in distal ileum



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Peristalsis vs MMC



© Ehrlein - University of Hohenheim

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MMC Dysfunction

- Clostridium, Giardia, Lyme disease
- Scleroderma
- Diabetes
- Hypothyroid conditions
- "Pseudo-obstruction"
- Medications
 - Opiates
 - Antibiotics
- Stress

Am. J. Gastroenterol.2016. 111, 93-104

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Infectious Gastroenteritis

- Post-(bacterial) infectious IBS is well known
 - (less likely post-viral)
- Mechanisms:
 - profound depletion of the commensal microbiota
 - alterations of pH (more alkaline)
 - Increase in mucosal cytotoxic T lymphocytes & enteroendocrine cells
 - Increase in 5HT production
 - Broad-spectrum antibiotics deplete anaerobes

Gut. 2013 Jan; 62(1): 159–176. 25

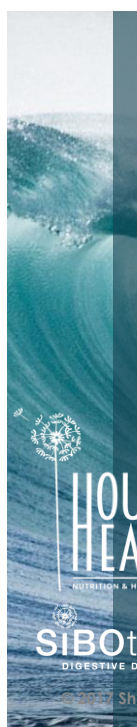
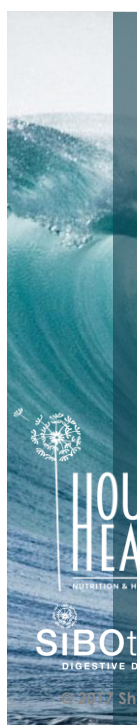
PI-IBS Causes MMC Dysfunction

- Some gram negative bacteria (CESS) secrete cytolethal distending toxin (CDT)
 - These damage small intestinal nerve cells
 - Prevents MMC from working
 - Autoimmune processes may follow
 - Antibodies form to the toxin, which can cause damage to vinculin protein (on nerve cells) → anti-vinculin Abs

CESS: 4 main strains of Gram neg bacteria – all from phylum Proteobacteria

- Campylobacter
- E.coli
- Salmonella
- Shigella

Gut. 2013 Jan; 62(1): 159–176. 26



Anatomical & Physiological Contributors

- Impaired gastric peristalsis
 - stasis of food and bacteria in the upper GI tract.
- Strictures in the SI
 - Crohns Disease
 - Post-radiation
- Ileo-caecal valve resection or dysfunction
- Appendicectomy
 - Removal of natural immunologic barrier to bacterial translocation from colon to small bowel.
 - May result in impaired mucosal immunity.
 - May be associated with recurring SIBO
- Adhesions

Ileum and cecum opened with the ileocaecal orifice



1.Cecic haustra of ascending colon 2. Tenia coli 3.Ileocaecal valve 4.Cecum
5.Ileocaecal orifice 6.Orifice of appendix 7.Appendix 8.Frenulum 9.Semilunar folds

www.4danatomy.com

Am J Gastroenterol. 2008;103(8):2031-2035
Gastroenterol Hepatol (N Y). 2007 Feb; 3(2): 112-2122

Adhesions



This adhesion is between loops of small intestine - typical following abdominal surgery.

<http://library.med.utah.edu/WebPath/GIHTML/GI030.htm>
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Risk Factors for the Development of SIBO

Anatomic

- ▶ Small intestine diverticula
- ▶ Small intestine strictures (radiation, medications, Crohn's disease)
- ▶ Surgically created blind loops
- ▶ Resection of ileocecal valve
- ▶ Fistulas between proximal and distal bowel
- ▶ Gastric resection/Bariatric Surgery

Irritable Bowel Syndrome

- ▶ Multiple factors (eg Post-infectious)

Organ System Dysfunction

- ▶ Gastric resection
- ▶ Cirrhosis
- ▶ Renal failure
- ▶ Pancreatitis
- ▶ Immunodeficiency states
- ▶ Crohn's disease
- ▶ Coeliac disease
- ▶ Malnutrition
- ▶ Distal bowel problems.
- ▶ Reflux ileitis

Other Disorders

- Diabetes
- Hypochlorhydria

Motility Disorders

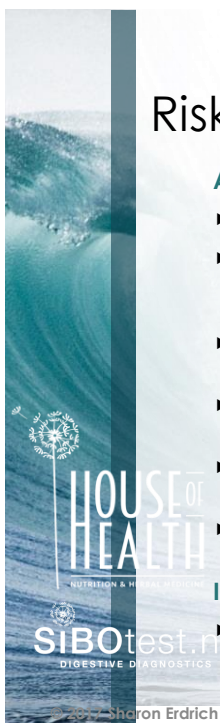
- ▶ Gastroparesis
- ▶ Small bowel dysmotility
- ▶ Chronic intestinal pseudo-obstruction

Medications

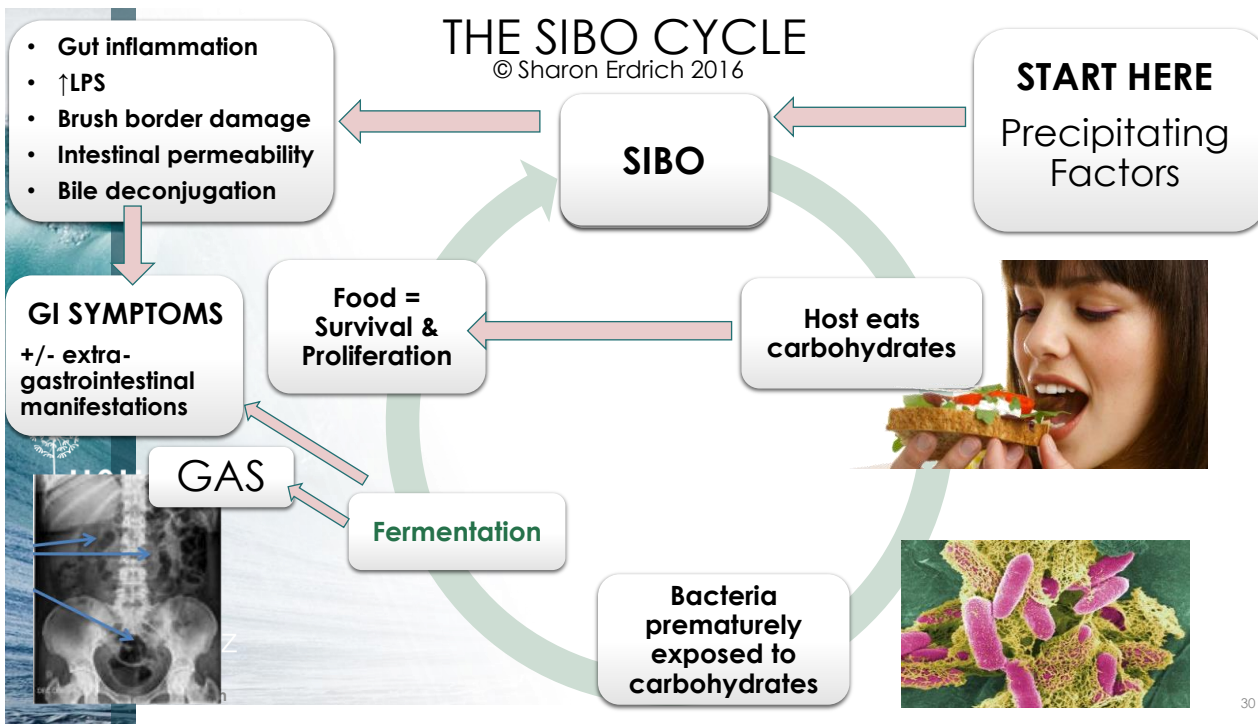
- ▶ Recurrent antibiotics
- ▶ Gastric acid suppression
- ▶ Analgaesics (esp. Codeine, morphine, Tramadol)

Elderly

STRESS



Gastroenterol Hepatol (N Y). 2007 Feb; 3(2): 112-122. 29



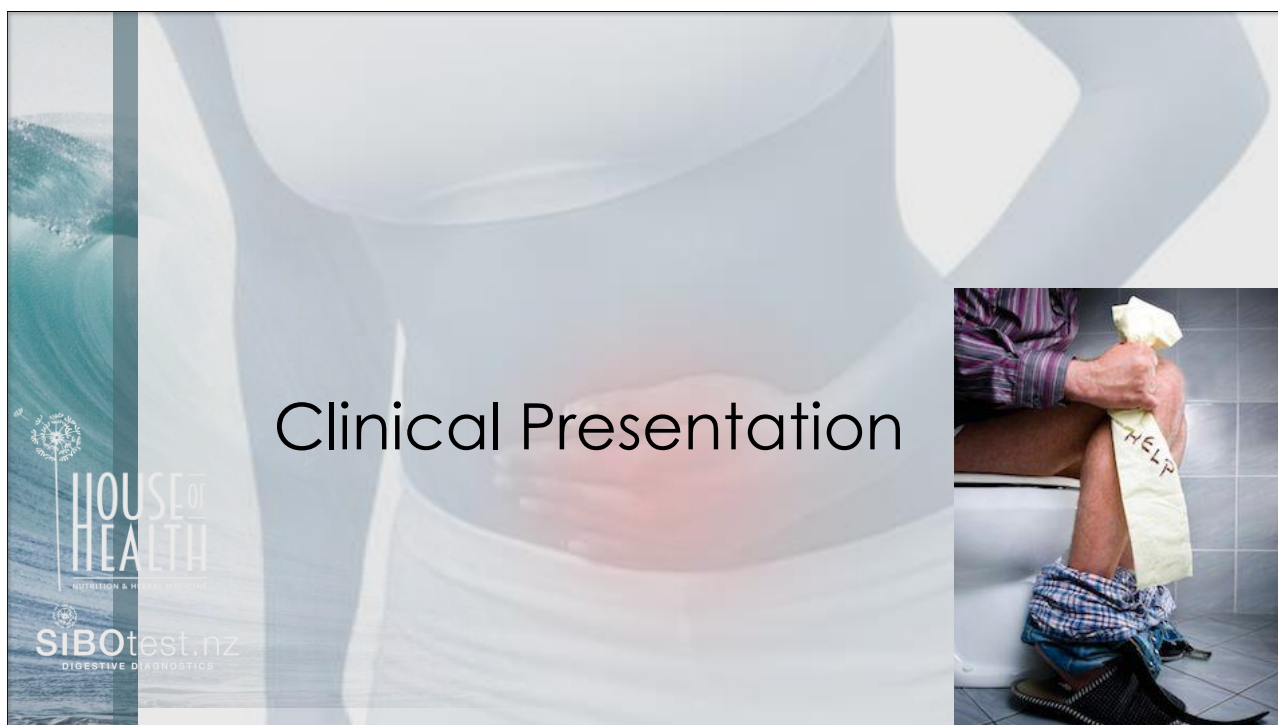
SIBO Produces Toxins

- Microscopic inflammatory changes (especially in the lamina propria) and villous atrophy are found regularly
- Macroscopic changes may also be visible
 - SI mucosal breaks (erosions or ulcers)
- “Bacteria produce various toxic agents that may have surprising systemic effects”
- Ammonia
- Endogenous bacterial peptidoglycans and others.
- Increased serum endotoxins and bacterial compounds stimulating production of (pro)inflammatory cytokines

World J Gastroenterol 2010 June 28; 16(24): 2978-2990,

How Carbohydrate Malabsorption Influences SIBO

- Fructose, lactose, sucrose
 - Usually absorbed in the proximal small intestine
 - Absorption impaired due to
 - Enzyme deficiency (Genetic or pathological)
 - Carbohydrate overload
 - Fuel for opportunistic, commensal bacteria and/or archaea
- Also more complex carbs which may not be fully absorbed before reaching distal bacteria
 - May create osmotic effect (diarrhoea)



Symptom Drivers

Gas

- Bacterial fermentation of carbohydrates
 - Bloating
 - Burping and reflux – upper GI SIBO – rising gas
 - Pain – visceral distention & hypersensitisation
- **Hydrogen** gas → Diarrhoea (osmotic)
- **Methane**. Myostatic → Constipation, Biliary dyskinesia

Absorbed Systemically

- Fatigue, somatic pain, brain fog – systemic gases
- Low grade metabolic acidosis
- May have NO apparent alteration in stool

IT'S BACTERIA NOT BUDWEISER...

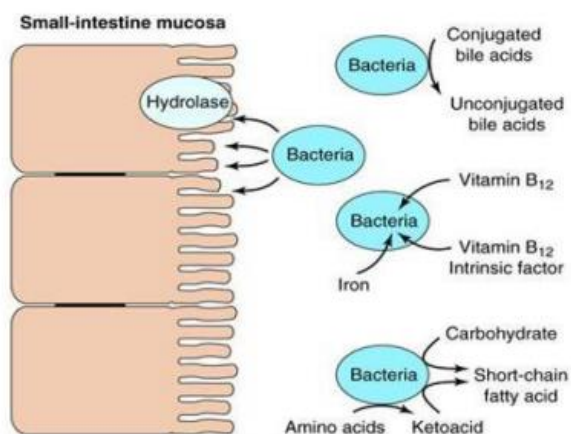
HOUSE OF HEALTH
NUTRITION & HERBAL MEDICINE

SIBOtest.nz
DIGESTIVE DIAGNOSTICS

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Direct Consequences of SIBO

- Inflammation in the lumen
- Brush border damage
 - Malabsorption
 - Hyper-permeability
 - BB Enzyme deficiency



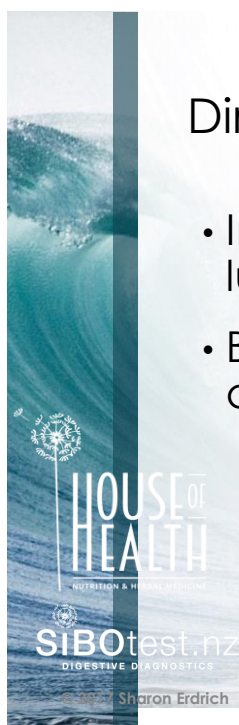
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Clinical Presentation

- Postprandial bloating
- Abdominal distension
- Altered gut motility
- Visceral hypersensitivity
- Abnormal brain-gut interaction
- Autonomic dysfunction,
- Immune activation
- Fatigue
- Brain fog
- Somatic pain
- Iron deficiency
- Vitamin B12 deficiency
- Weight loss
- Weight gain
- Bile salt malabsorption
- Food intolerances +/- confusion

JAMA. 2004;292(7):852-858.

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Clinical Presentation

- Multiple food intolerances " *food not my friend*
 - Carbohydrates &/or fats
 - Leaky gut
 - Calorie-deficit
- Reflux
 - Often associated with early post-prandial bloating
 - May be worse w/ PPIs
- Bile salt malabsorption
 - Common in reflux (aka backwash) ileitis
 - Pain R/LQ
 - Bacteria deconjugate the bile
 - Bile salts & fatty acids thus become non-functional
 - fat soluble vitamin malabsorption

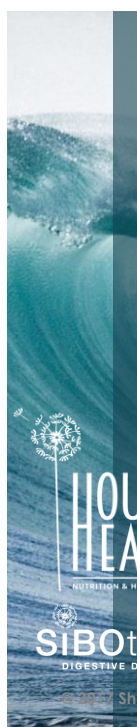
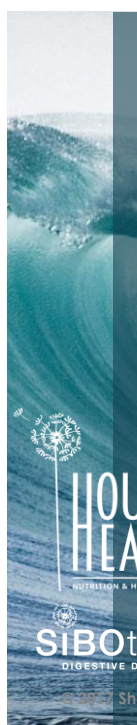
Gut. 2006;55(3):297-303

Curr Gastroenterol Rep. 2010 Aug; 12(4): 249–258.³⁷

Weight Gain, Weight Loss

- Clear that the type of gut flora has a role here.
- In SIBO there are also other mechanisms
 - The type of SIBO – constipation or diarrhoea predominant
 - The location – proximal vs distal
 - PROXIMAL: If severe → damage to brush border → reduced absorptive ability
 - DISTAL: Bacterial ferment carbs that are otherwise not digestible by host → liberate additional energy.

} No studies.
Based on clinical
experience &
that of
colleagues



Alterations in Gut pH

- A variety of microbes in the gut, **including probiotics**, produce lactic acid (L- and D-isomers),
- Elevated production of D-lactic acid is a concern.
- D-lactic acid is broken down much more slowly than L-lactic acid
 - Accumulates in the intestine → absorbed into the blood.
 - Enhanced by LPS administration, intestinal permeability, psychological stress, and osmotic pressure

Medicine (Baltimore) 2013; 92(1):e36-42
 Gut Pathogens 2013, 5:3
 World Journal of Gastroenterology, 16(24), pp.2978–2990

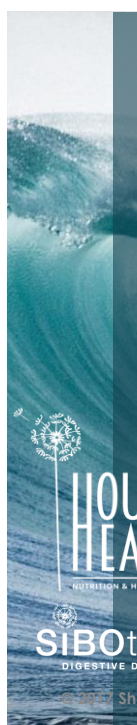
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Alterations in Gut pH

- D-lactic-acidosis occurs due to
 - High carbohydrate intake
 - Carbohydrate malabsorption
 - d-lactate-forming bacteria
 - Reduced motility,
 - Impaired d-lactate metabolism
- I.e: Low grade metabolic acidosis.

Gut Pathogens 2013, 5:3

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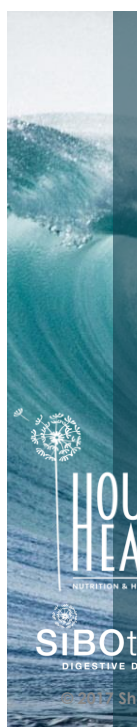


UNDERLYING CAUSES & Risk Factors

- “What is actually wrong” is a small list:
 - Structural, Functional
- Causes of the Underlying Cause (risk factors)
 - Co-morbidities, drugs, lifestyle, surgery, injury



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Session Two

SIBO – Diagnosis & Management

- Common masqueraders
- Diagnostic options
- Interpretation of breath tests
- Treatment protocols
- The role of diet
- Case studies


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Common Masqueraders




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Common Masqueraders (or Clues)

- Gluten sensitivity
 - “I’m better since I went gluten-free and/or dairy-free
 - “...But something’s still not right”
- Candida
 - “I started following an anti-candida diet, and my symptoms improved.
 - But I can’t eat like this forever – every time I start eating any kind of sugar it just comes right back”

 Sharon Erdrich

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Common Misdiagnoses

- Coeliac disease (CD)
 - Blunting of villi seen in severe, proximal SIBO
 - Suspect if not responsive to gluten-free diet
 - OR if apparent gluten intolerance develops
 - CD has been falsely diagnosed when SIBO was the actual pathology.

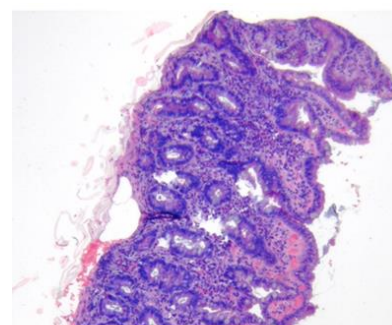


Figure 1A

International Journal of Celiac Disease, 2014; 2.2. 67-69

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Common Misdiagnoses

- Candida
 - SIFO (small intestinal fungal overgrowth)
 - LIFO (large intestinal fungal overgrowth)
 - Treatment may alleviate symptoms, but underlying factors must be addressed or recurrence can occur
 - Candida do not produce hydrogen or methane gas)
 - No evidence that *C. albicans* is involved in the aetiology of IBS
 - Grows best under aerobic conditions & in CO₂-rich environments
 - In anaerobic conditions produce alcohols & aldehydes
 - BUT: may cause biofilm formation

Postgrad Med J (1992) 68, 453 – 454
Pathog Dis, 2016 Jun;74(4):ftw018

Prasad, R, ed. 2017 *Candida albicans: Cellular and molecular biology* (2nd ed). Berlin, Springer-Verlag

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Common Misdiagnoses

- Histamine intolerance
 - Foods such as aged cheeses, eggs, fermented foods, processed meats
 - All high in histamine
- Gut enzyme Diamine oxidase (DAO) is a brush border enzyme
- Lactose intolerance
- Fructose malabsorption
- Other “-ose” malabsorption



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Diagnosis

It is not the food that is the problem. The effects of food give us insights to aid correct identification of the problem



Consultation

- Nutrition/health assessment
 - LISTEN CAREFULLY!
- Bristol Stool Chart.
- Colour Chart - DOCUMENT
- Diet recall – ask about some known trigger foods/what aren't they eating?
- History of nutrient deficiencies?
- Tested for Coeliac disease?
- Evaluate
 - Likelihood of lactose malabsorption, fructose intolerance and/or SIBO ?
- TEST – confirm or rule out diagnosis
- Teach
- TREAT
- Start to challenge
- RETEST



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Show & Tell Time

Bristol Stool Chart

Type 1		Separate hard lumps, like nuts (hard to pass)
Type 2		Sausage-shaped but lumpy
Type 3		Like a sausage but with cracks on its surface
Type 4		Like a sausage or snake, smooth and soft
Type 5		Soft blobs with clear-cut edges (passed easily)
Type 6		Fluffy pieces with ragged edges, a mushy stool
Type 7		Watery, no solid pieces. Entirely Liquid



Source: Wikipedia; licensed under the Creative Commons [\[link\]](https://geekgardencook.files.wordpress.com/2014/01/srm-beer-color-chart.jpg)
<https://geekgardencook.files.wordpress.com/2014/01/srm-beer-color-chart.jpg>



Conditions that may be associated with SIBO

- ▶ Acne
- ▶ Alcohol consumption
- ▶ Anaemia
- ▶ Atrophic gastritis
- ▶ Autism/ASD
- ▶ Coeliac disease
- ▶ Chronic fatigue
- ▶ Cystic fibrosis
- ▶ Diabetes
- ▶ Dyspepsia/reflux/GORD
- ▶ Elderly
- ▶ Erosive oesophagitis
- ▶ Fibromyalgia
- ▶ Fructose malabsorption
- ▶ Gallstones
- ▶ Gastroparesis
- ▶ GERD/GORD
- ▶ H. pylori infection
- ▶ Hypochlorhydria
- ▶ Hypothyroid conditions
- ▶ IBD
- ▶ IBS
- ▶ Lactose intolerance
- ▶ Leaky gut syndrome
- ▶ Liver conditions (incl. NAFLD, Cirrhosis)
- ▶ Gen Malabsorption syndromes
- ▶ Medication use
 - ▶ PPIs, Antibiotics, Opiates
- ▶ Multiple Food Allergies
- ▶ Muscular dystrophy
- ▶ Obesity
- ▶ Pancreatic dysfunction (exocrine)
- ▶ Parasites
- ▶ Prior abdominal surgery
- ▶ Radiotherapy
- ▶ Rosacea
- ▶ Scleroderma
- ▶ Stress
- ▶ Weight loss
- ▶



51

Diagnosis of SIBO

- Considerations
 - Upper GI culture (Jejunal aspirate)
 - Breath testing
- Insight gained from
 - Stool culture
 - Stool PCR
 - Organic acids



52

Diagnosis of SIBO

- Finding of $\geq 1 \times 10^3$ coliform bacteria [i.e. colony-forming units (cfu)] per ml of proximal jejunal aspiration].
 - Invasive
 - Upper SI only can be sampled
 - distal SIBO is thought to be most common
 - Difficulty culturing anaerobes
- Glucose challenge test
 - Problem – distal SIBO will not be detected.

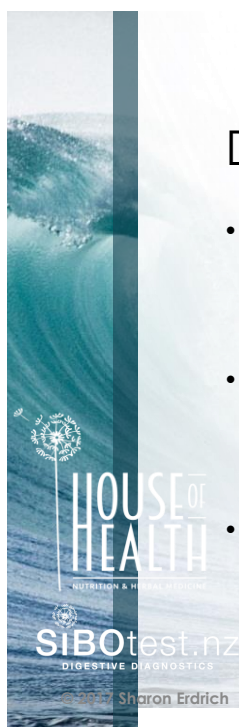


Ther Adv Chronic Dis., 2013, 4(5) 223–231 DOI: 10.1177/ 2040622313496126

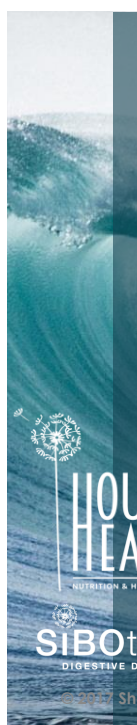
53

Diagnostics for SIBO

- Humans do not make Hydrogen or Methane
 - ONLY produced by bacteria
 - Hence the usefulness of breath testing
- Breath testing technology has advanced
 - Formerly: Glucose challenge, hydrogen-only
 - Can now measure hydrogen & methane
- Good evidence for Lactulose as substrate of choice
 - Not absorbed
 - BUT: may transit to colon rapidly
 - CAUTION: if client is milk **allergic**, lactulose is not an appropriate substrate.



54

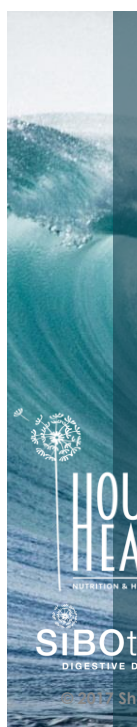


Why is the Gas Important?

- Aids client understanding of symptoms
- Aids targeted treatment
- Gives baseline for comparison
- Hydrogen
 - Main gas produced in most people
 - Previously the only gas considered important, and measurable
- Methane
 - Produced by colonic archae
- Carbon dioxide - Measured as control of sample quality
- Hydrogen sulphide
 - To date not measurable
 - Olfaction is best diagnostic tool
 - Treat as for methane

J Neurogastroenterol Motil, 2010; 16, 2

55



Why is the Gas Important?

Hydrogen

- Visceral sensitiser
- Used by other bacteria to make other gases
 - Methane CH_4
 - Hydrogen sulphide H_2S
- Associated with loose stool (osmotic)
 - 100% correlation to fibromyalgia
 - Associated with chili intolerance (gut)
 - Capsaicin can mediate a painful, burning sensation in the human gut via the transient receptor potential vanilloid-1 (TRPV1)

J Neurogastroenterol Motil, 2010; 16, 2

56

Why is the Gas Important?

Methane

- Previously considered an inactive gas, mainly excreted in flatus, a small amount in breath.
- Recently has been associated with gastrointestinal disorders, mainly:
 - chronic constipation
 - constipation predominant irritable bowel syndrome (IBS),
 - & in metabolic diseases like obesity
 - Biliary dyskinesia
- Gastroparesis assoc. w/methane in 27% in one study
 - symptoms include postprandial fullness, early satiety, abdominal pain, nausea, vomiting and bloating without obstruction

J Neurogastroenterol Motil. 2014; 20(1): 31-40

57

Diagnostics for SIBO

- Stool tests
 - Culture: Good indication of large intestine bacterial population & LIFO
 - CSA: Can show the fat malabsorption that often results from SIBO +/- low grade inflammation

Comprehensive Stool Analysis — Doctors Data (available from FxMed)		
BACTERIOLOGY CULTURE		
Expected/Beneficial flora	Commensal (Imbalanced) flora	Dysbiotic flora
3+ Bacteroides fragilis group	1+ Beta strep, not group A or B	
4+ Bifidobacterium spp.	2+ Citrobacter freundii complex	
NG Escherichia coli	1+ Citrobacter freundii complex, isolate 2	
NG Lactobacillus spp.	2+ Enterobacter cloacae complex	
NG Enterococcus spp.	3+ Gamma hemolytic strep	
	1+ Staphylococcus aureus	
NG Clostridium spp.		
NG = No Growth		

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Diagnostics for SIBO

- Urinary Organic Acid Testing
 - Bacterial overgrowth indicated by levels of hippurate, 4-hydroxybenzoate, and other bacterial metabolites
 - Cannot distinguish the location of overgrowth
 - nor offer the details provided in a breath test
 - Gas produced
 - Location of bacteria (SI vs LI or other location)

Organic Acids Test — Great Plains Lab (available from FxMed)

Intestinal Microbial Overgrowth					
Bacterial Markers					
10	Hippuric	≤ 613	H	622	
11	2-Hydroxyphenylacetic	0.06 - 0.66		0.55	
12	4-Hydroxybenzoic	≤ 1.3		1.0	
13	4-Hydroxyhippuric	0.79 - 17		8.2	
14	DHPPA (Beneficial Bacteria)	≤ 0.38		0.21	

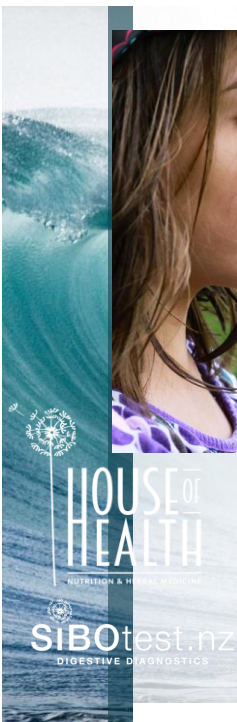
59



Breath Testing



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The Breath Test

1. Test sugar consumed after collecting baseline sample
2. If present, SI bacteria ferment the sugar, producing hydrogen and/or methane gas
3. Gases are absorbed into the blood stream and transported to the lungs
4. Hydrogen, methane & carbon dioxide are measured in the breath

World J Gastroenterol. 2014; June 28; 20(24): 7587-7601

61

Choosing the Substrate

- Breath tests are used to diagnose:
 - SIBO
 - Lactose intolerance
 - Fructose malabsorption
 - Sucrose malabsorption
 - **Must** rule out SIBO first

62

Choosing the Substrate

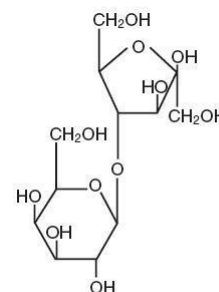
- GLUCOSE is generally preferred (in the literature)
- Has high specificity (100%) for SIBO but just 27% sensitivity
 - was compared to jejunal aspirate
 - ie – only correlates to upper GI SIBO
 - Hence the low sensitivity
- **RECOMMENDATION:**
- Glucose is best for:
 - significant reflux, eructation within 30-60 mins of eating
- Not in dysglycaemia/diabetics
- **MUST** use if dairy ALLERGIC (not intolerant)
 - Dose 1 g / kg up to 100g max dose.

Eur J Gastroenterol Hepatol. 2014 Jul;26(7):753-60

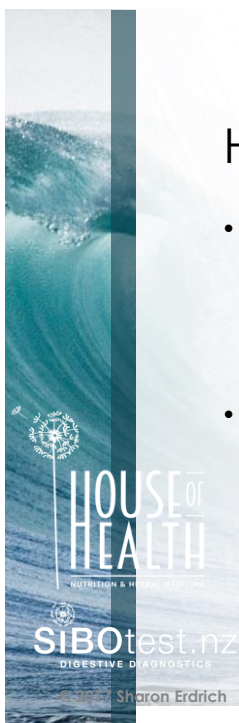
63

Choosing the Substrate

- Lactulose is a synthetic sugar
 - not absorbed by humans
- Rise in breath gases following administration are due to bacterial fermentation
- Challenge test dose 10g lactulose in 250-300mL water



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How the Test is Done

- Prep period 24-48 hours
 - Restricted diet
 - low residue = low fermentable
 - Overnight fast (water only)
- Test period 4 hours
 - Arise one hour prior to testing
 - No smoking or vigorous exercise
 - Baseline breath sample
 - Consume test substrate
 - Repeat breath collections at 20 min intervals
 - 3 hours of sample collection



65

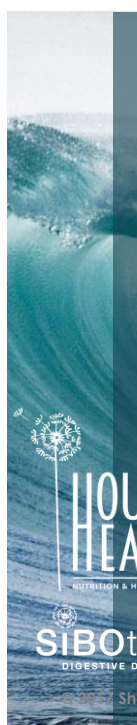


How Samples are Analysed

- 8-day window for sample analysis
- Samples extracted by the Alveolac
- Quintron Breath Tracker
 - Gold standard in breath testing
 - Evaluates
 - Methane
 - Hydrogen
 - Carbon dioxide
 - Uses gas chromatography
 - Corrects automatically based on CO₂ content



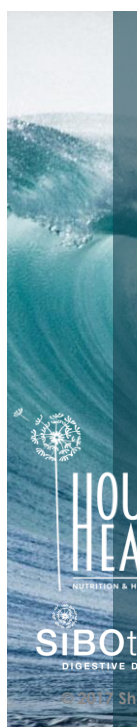
66



Interpreting Results

- First principle
 - ONLY bacteria produce these gases
- Second principle
 - Elevated baselines considered abnormal
 - As long as prep diet was adhered to
- Third principle
 - The rise in gas production must be significant
- Fourth principle
 - Increases after 120 minutes most likely indicate colonic fermentation

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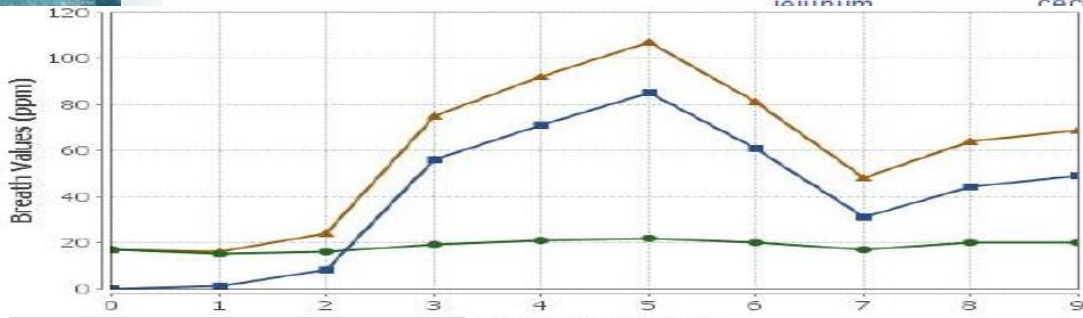
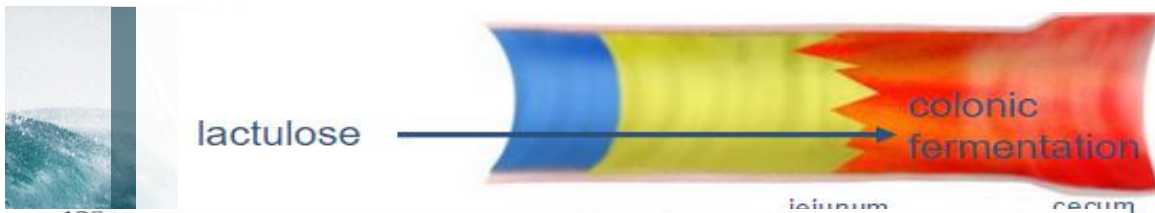
Interpreting Results

- Various criteria in the literature
- Currently:
 - Methane
 - Elevated baseline (>3ppm) OR
 - A rise of 12ppm (c.f. lowest preceding value) within 120 minutes
 - Hydrogen
 - Rise of 20 ppm (c.f. lowest preceding value) within 120 minutes
 - Combined
 - Rise of 15 ppm in methane + hydrogen within 120 minutes

EXPECT: Double peak

- Second peak indicates arrival in the colon

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Sample	Sample Time	ppm H2	ppm CH4	ppm H2 + CH4	% CO2	Correction
Baseline (BL)	09:13	0	17	17	3.3	1.66
#1 - 20 min	09:37	1	15	16	3.7	1.48
#2 - 40 min	09:57	8	16	24	3.4	1.61
#3 - 60 min	10:16	56	19	75	4.0	1.37
#4 - 80 min	10:37	71	21	92	3.7	1.48
#5 - 100 min	10:57	85	22	107	3.5	1.57
#6 - 120 min	11:17	61	20	81	3.6	1.52
#7 - 140 min	11:27	31	17	48	3.9	1.41
#8 - 160 min	11:49	44	20	64	3.5	1.57
#9 - 180 min	12:18	49	20	69	3.6	1.52

69

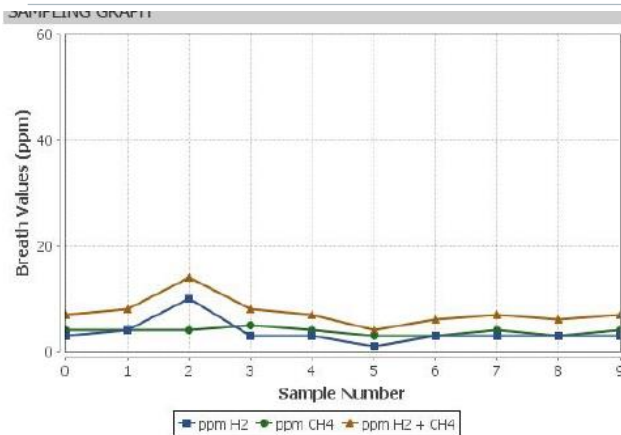
Normal Breath Test..

HOUSE OF HEALTH
NUTRITION & HERBAL MEDICINE

SIBOtest.nz
DIGESTIVE DIAGNOSTICS

Sharon Erdrich

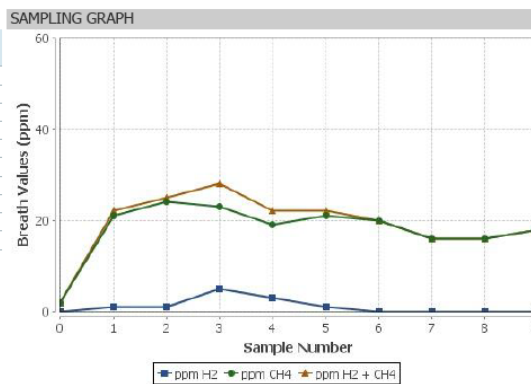
Sample	Sample Time	ppm H2	ppm CH4	ppm H2 + CH4	% CO2	Correction	Symptoms
Baseline (BL)	00:20	3	4	7	3.9	1.41	
#1 - 20 min	00:40	4	4	8	3.8	1.44	
#2 - 40 min	01:00	10	4	14	3.9	1.41	
#3 - 60 min	01:20	3	5	8	3.6	1.52	
#4 - 80 min	01:40	3	4	7	3.9	1.41	
#5 - 100 min	02:00	1	3	4	3.7	1.48	
#6 - 120 min	02:20	3	3	6	3.9	1.41	
#7 - 140 min	02:40	3	4	7	4.0	1.37	
#8 - 160 min	03:00	3	3	6	3.4	1.61	
#9 - 180 min	03:20	3	4	7	4.1	1.34	



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SIBO - Methane

Sample	Sample Time	ppm H2	ppm CH4	ppm H2 + CH4	% CO2	Correction	Symptoms
Baseline (BL)	08:35	0	2	2	3.6	1.52	C
#1 - 20 min	09:00	1	21	22	3.7	1.48	
#2 - 40 min	09:20	1	24	25	3.7	1.48	
#3 - 60 min	09:40	5	23	28	3.4	1.61	
#4 - 80 min	10:00	3	19	22	4.3	1.27	O
#5 - 100 min	10:20	1	21	22	3.9	1.41	
#6 - 120 min	10:40	0	20	20	3.8	1.44	
#7 - 140 min	11:00	0	16	16	3.7	1.48	
#8 - 160 min	11:20	0	16	16	4.2	1.30	
#9 - 180 min	11:40	0	18	18	3.9	1.41	O



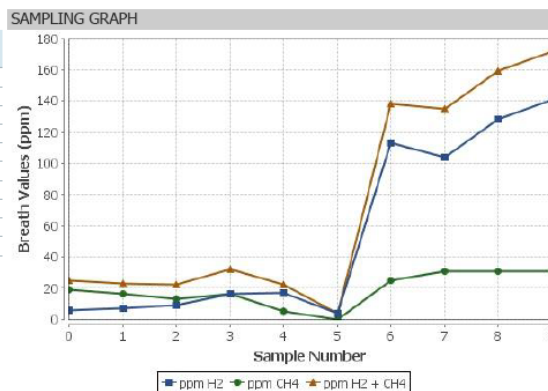
SIBOtest.nz
DIGESTIVE DIAGNOSTICS

Sharon Erdrich

71

Incorrect Sample Collection

Sample	Sample Time	ppm H2	ppm CH4	ppm H2 + CH4	% CO2	Correction	Symptoms
Baseline (BL)	09:40	6	19	25	3.5	1.57	N
#1 - 20 min	10:00	7	16	23	3.7	1.48	N
#2 - 40 min	10:20	9	13	22	3.7	1.48	N
#3 - 60 min	10:40	16	16	32	2.7	2.03	N
#4 - 80 min	11:00	17	5	22	1.2	Too High	N
#5 - 100 min	11:20	4	0	4	0.1	Too High	
#6 - 120 min	11:40	113	25	138	3.1	1.77	O
#7 - 140 min	12:05	104	31	135	2.1	2.61	B
#8 - 160 min	12:20	128	31	159	2.1	2.61	B
#9 - 180 min	12:40	141	31	172	1.4	3.92	B



SIBOtest.nz
DIGESTIVE DIAGNOSTICS

Sharon Erdrich

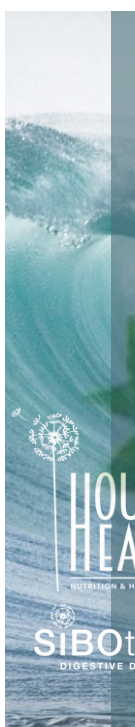
72



Consultation

- Tested for Coeliac disease?
- Tested for lactose and fructose intolerance and SIBO ?
- Nutrition/health assessment – LISTEN CAREFULLY!
- Bristol Stool Chart. Colour Chart - DOCUMENT
- Diet recall – ask about some known trigger foods/what aren't they eating?
- Teach main dietary triggers– to comfort only
- TEST – confirm or rule out diagnosis
- TREAT

73



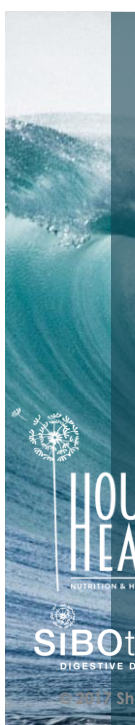
Treatment



74

Treatment

- GOALS:
 - Eliminate/modify underlying causes
 - Induce remission (antimicrobials and diet),
 - Maintain remission
 - pro-motility drugs
 - dietary modifications,
 - repeat or cyclical antimicrobials.



Curr Gastroenterol Rep., 2016;18(2):8. doi: 10.1007/s11894-015-0482-9.

75

Treatment Considerations Checklist

- Hypnotherapy, CBT/Mindfulness
- 5-HT agonists/antagonists
- Antimicrobials
- Motility modulators
- Biofilm disruptors
- Dietary modification
 - Low fermentable/low carb
 - Meal spacing
- Probiotics
- HCl and/or digestive enzymes
- Visceral manipulation (if adhesions suspected)



Nature Rev Gastro & Hepatology., 2013: 10, 13-23

76

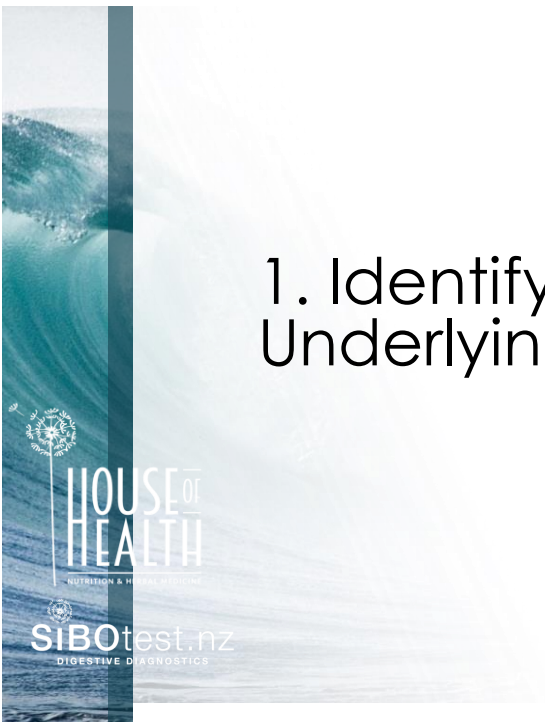
Treatment Objectives

1. Eradication of bacterial overgrowth
2. Biofilm disruption
3. Address underlying factors
4. Motility enhancement
5. Enhance gut integrity
6. Restoration of the microbiome



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1. Identify and Address Underlying Factors





Underlying Factors

- Bacteria
- Natural gut defences
- Biofilms
- Causes and contributors
 - V.IMPORTANT to identify ALL the triggering factor/factors
 - Adhesions
 - Eating patterns
 - Gut motility
 - Medications
 - Liver / bile flow/ breathing patterns

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2. Eradicate Bacterial Overgrowth

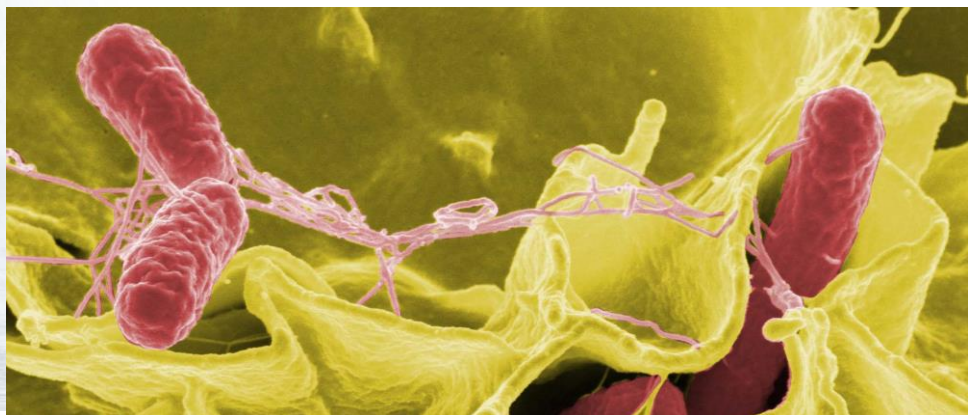


Image: <http://2011.iaem.org/Team:TU-Delft/Human-Practice>

80

ORIGINAL RESEARCH

Herbal Therapy Is Equivalent to Rifaximin for the Treatment of Small Intestinal Bacterial Overgrowth

Victor Chedid, MD, *United States*; Sameer Dhalla, MD, *United States*; John O. Clarke, MD, *United States*; Bani Chander Roland, MD, *United States*; Kerry B. Dunbar, MD, *United States*; Joyce Koh, MD, *United States*; Edmundo Justino, MD, *United States*; Eric Tomakin, RN, *United States*; Gerard E. Mullin, MD, *United States*

- The response rate for normalising breath hydrogen testing in patients with SIBO was 46% for herbal therapies vs 34% for Rifaximin.
- Herbal therapy was used in Rifaximin non-responders with 57.1% response rate

Global Advances in Health and Medicine : Improving Healthcare Outcomes Worldwide, 2014: 3(3), pp.16–24

81



Treating Hydrogenic Bacteria

- Liquid herbs
 - I use for proximal SIBO & paediatrics
 - Oregon grape &/or Barberry
 - Manuka
 - Thyme
 - Koromiko
 - Andrographis OR Cinnamon
- AVOID herbs with (muco)polysaccharides
 - liquorice, marshmallow

International Journal of Herbal Medicine. 2014; 2(2): 132-136

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Treating Hydrogenic Bacteria

- Berberine
 - 400 - 500 mg bd with meals
 - Up to 5 g in split doses, daily
- Neem
 - 300 mg caps tds with meals
- Oregano
 - 300mg bd standardised to 25% carvacrol



(Products available from FxMed)

Phytotherapy Research. 2015; 29(11), 1822–1827
 The Journal of Infectious Diseases. 1987; 155(5), 979–84
 Naturopathic Doctor News and Review. 2013; Jan 9 83

Treating Methanogenic Bacteria

- Start here if predominantly constipated
- Consensus is that these are the hardest group to treat
- Allicin (must be stabilised)
- Atrantil
 - Reduces methane-producing bacteria, which returns the upper GI tract to its normal near-sterile condition
 - Aids in normalising digestive function

Jundishapur J Microbiol. 2015 Aug 25;8(8):e18971

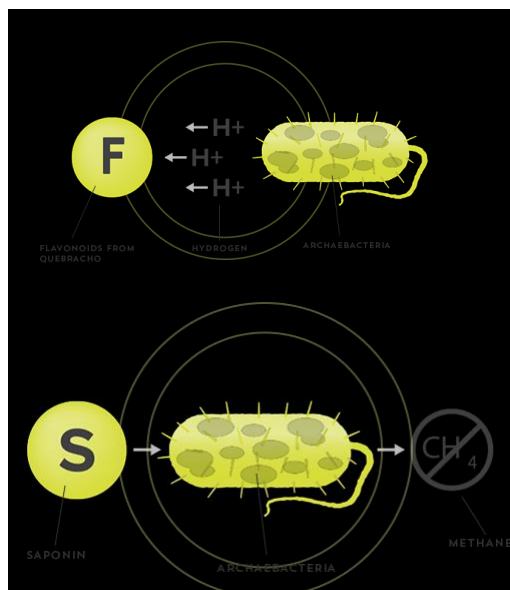
84



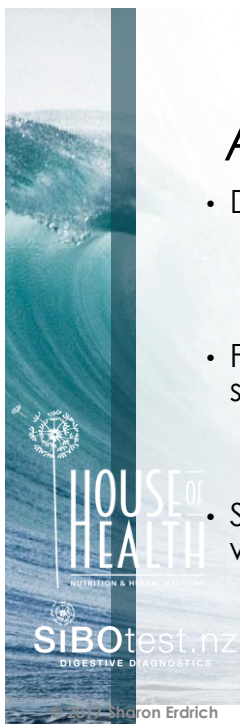


Atrantil

- **M. balsamea Willd extract (peppermint)** coats & calms the SI
 - → allows other ingredients time to work most effectively
- **Quebracho extract (flavonoids)** soak up hydrogen
 - Large molecules, poorly absorbed
 - Has some antimicrobial actions
 - Removes/reduces archaeobacteria's food
- **Conker Tree extract**, reduces methane production.
 - Binds to the reductase enzyme in the weakened archaeobacteria—stopping methane production.



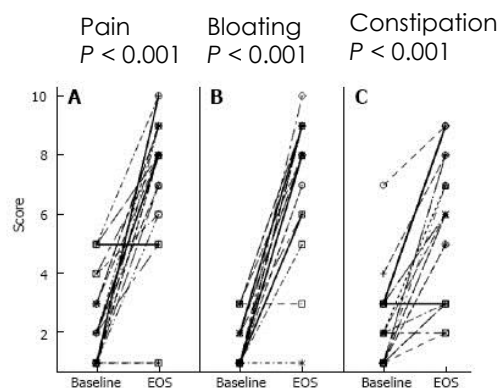
J. Gastroenterology and Hepatology Research – September 21, 2015 pp. 1762-1767. 85



Atrantil

- Double-blind pilot study $n=16$
 - IBS-C

Journal of Gastroenterology and Hepatology Research – September 21, 2015 pp. 1762-1767.
- Followed up with open-label study $n=24$
 - All had failed to find relief from at least four other therapies
- Scores at baseline and at 2 wk
 - Each symbol represents a different, individual patient in the analysis.



Visual Analogue Scores (0 = worst symptoms, 10 = no symptoms)

World J Gastrointest Pharmacol Ther. 2016 Aug 6; 7(3): 463-468. 86

Alicin



Available from House of Health
180mg & 450mg strength & liquid

- Stabilised Alicin
 - 450mg 3-6 per day
 - Split doses, with food
 - 4 weeks
 - 6-8 weeks if high levels of gas produced
- Effective against
 - *S. aureus*,
 - *B. cereus*,
 - *S. pneumoniae*,
 - *P. aeruginosa*,
 - *E. coli*
 - *Klebsiella pneumoniae*.
 - And biofilms

Jundishapur J Microbiol. 2015; Aug 25;8(8):e18971

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Saccharomyces boulardii

- Prevents *C. difficile* recurrences
 - inhibits the effects of *C. diff* toxins A and B in colonic mucosa.
- Competitively inhibits pathogenic bacteria
- Exerts an anti-inflammatory effect
- Bolsters immune function.
- Strengthens tight junctions between enterocytes
- Promotes maturation of the intestinal brush border membrane
- Stimulates production of glycoproteins (including sIgA)
- Promotes production of disaccharidases



(Products available from FxMed)

Children: 250 mg bd
Adults 500mg bd

McFarland, L. V. (2010). *World J Gastroent*, 16(18), 2202-22.
Castagliuolo I, et al. (1999) *Infect Immun*, 67:302-307.
Buck, M (2009) *Pediatr Pharm*. 15(7)



Safety for Special Groups

Pregnancy & Lactation

SAFEST

- Allicin, Ginger (max 2g)
- Saccharomyces boulardii

AVOID

- Berberine, Oregano, Neem, MotilPro

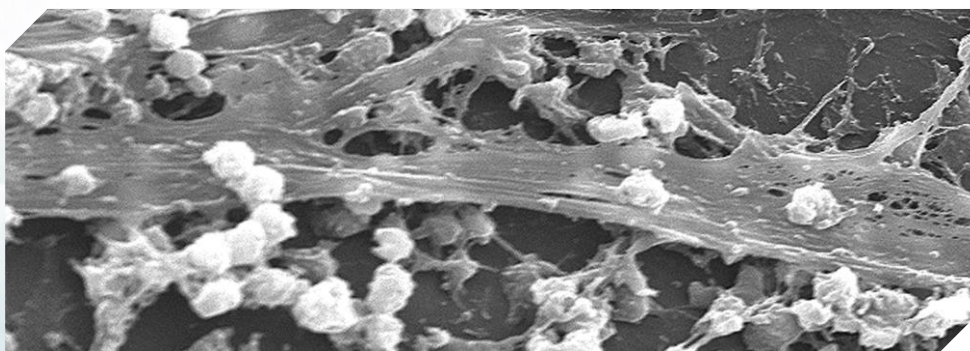
Paediatrics

- Allicin, Berberine
 - ¼ - ½ adult dose
- Saccharomyces boulardii

UNKNOWN

- Oregano, Neem powder/herb, Motilpro
- Neem Powder @ ¼ - ½ adult dose in 7-year-old (THE OIL IS UNSAFE)

Siebecker. 2016; SIBO Symposium⁸⁹



2. Biofilm Disruption

Bacterial species in natural environments usually **live in communities** of microorganisms on the surface of different materials, embedded by a **self-produced matrix**, usually of **polysaccharide** nature, that allows bacteria to adapt and **survive under stress** conditions

World J Gastroenterol. 2014; May 21; 20(19): 5632–5638.

90

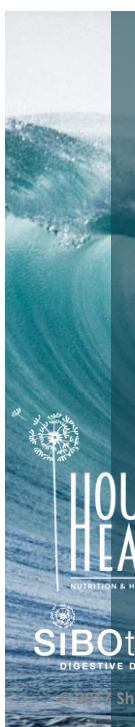


Biofilms

- Formation is a crucial step in the pathogenesis of many subacute & chronic bacterial infections
- Can trap & enzymatically inactivate antimicrobials
- May be present in more than 65 - 80% of all bacterial infections

Antimicrob Agents Chemother. 2001 Apr; 45(4): 999-1007
 Nature Reviews Drug Discovery. 2003 Feb; 114-122 (2)

91

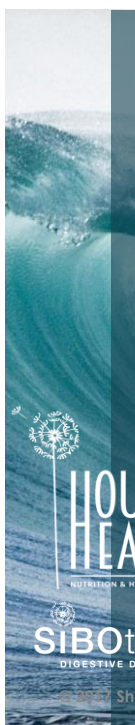


Biofilm Disruptors

- NAC
- Curcumin
- Proteolytic Enzymes
- Garlic/Allicin
- ?Berberine
- CAUTION: Biofilms are also good for us. They line the digestive tract, supporting our commensal organisms

Int J Antimicrob Agents. 2009; Jul;34(1):60-6

92



N-Acetyl Cysteine

- Widely used as a mucolytic
- Inhibits biofilm formation
- Destroys developed biofilm
- Best in an alkaline environment
- Aids restoration of normal gastric barrier
 - Esp in combination with probiotics
- 600 mg twice a day on empty stomach



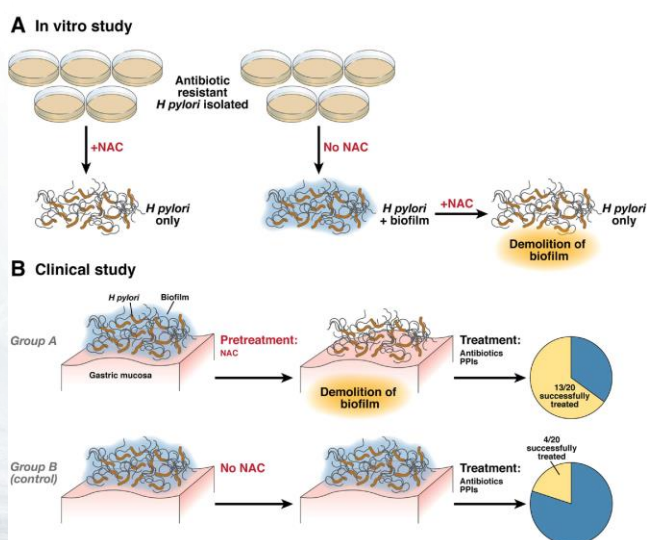
(Product available from FxMed)

Eur Rev for Med and PharmSci. 2014; 18(19), 2942–8
 J Endod. 2012 Jan;38(1):81-5
 J Clin Gastroenterol. 2012 Oct;46 Suppl:S18-26
 Respiratory Medicine. 2016; 117, 190–197.

93



N-Acetyl Cysteine – Biofilm Disruptor



Clinical Gastroenterology and Hepatology 2010 8, 817-820.e3

94



Curcumin

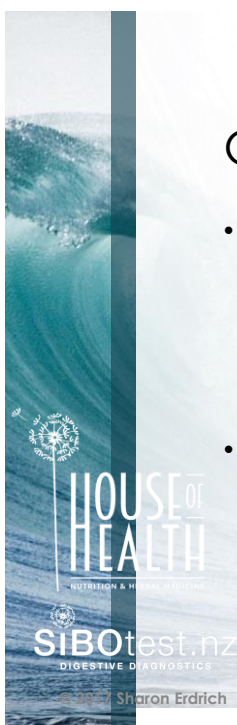
- Has anti-H.pylori activity
- Anti-biofilm activity
- Dose-dependent
- Best in combination (eg w/NAC)
- Clinical evidence is sparse
- Recently shown to prevent LPS-induced intestinal permeability
- Dose: 500mg bd



(Product available from FxMed)

Ann Transl Med. 2016 Dec;4(24):479
 Scientific Reports 2016; 6, Article number: 24797
 Lasers Med Sci. 2014 Mar;29(2):629-35
 Gut Pathogens 2013, 5:3
 World J Gastroenterol. 2014 May 21; 20(19): 5632–5638.

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Garlic Extract (Allicin)

- *A. sativum* L. extracts were efficient to inhibit biofilm structures garlic extracts
 - could reduce 62.72% of biofilm formation
 - Concentration of each extract directly related to the inhibitory effect
- Pure allicin **remarkably inhibited** the attachment of *S. epidermidis*



Jundishapur J Microbiol. 2015 Aug; 8(8): e18971
 J Med Microbiol. 2012 May;61 (Pt 5):662-71.

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Alicin Study

- Stabilised extract of garlic (Active compound)
- Inhibits quorum-sensing
- Inhibits biofilm formation
- Disrupts existing biofilms
 - (Ciprofloxacin did not)



Jundishapur J Microbiol. 2015 Aug 25;8(8):e18971

Int J Mol Sci. 2016 Jul; 17(7): 979

Pol J Microbiol. 2013;62(3):243-51

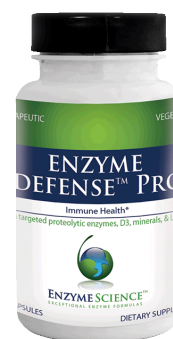
97



Proteolytic Enzymes

- Theoretical applicability
- No (?) *in vivo* evidence
- However, based on
 - proteolytic nature of enzymes
 - Likelihood of biofilms
 - Likelihood of inflammation
 - Deficiency in SIBO

→ must be considered.



(Product available from FxMed)

Future Microbiol. 2013 Jul;8(7):877-86.

Appl Biochem Biotechnol. 2012 Jul;167(6):1778-94.

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3. Motility Enhancement

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Restore Motility

- Meal spacing
- Prokinetics (Motil-Pro)
 - Ginger
 - 5HT
- Visceral work as appropriate
- CNS appraisal (Vagus enervation)
 - Osteopath



(Product available from FxMed)

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Restore Motility

- *“Prokinetics seem to be a logical therapeutic step in SIBO due to motility disorders.*
- *“Several studies tried metoclopramide, cisapride (.. later withdrawn from the market), domperidone, erythromycin, itopride, tegaserod and octreotide*
- *“..limited data suggesting that this treatment would be effective over the long term.*
- *“Cyclic lavages of the small bowel .. can be considered as supportive therapy in cases of relapsing SIBO”*

World Journal of Gastroenterology, 16(24), 2978–2990

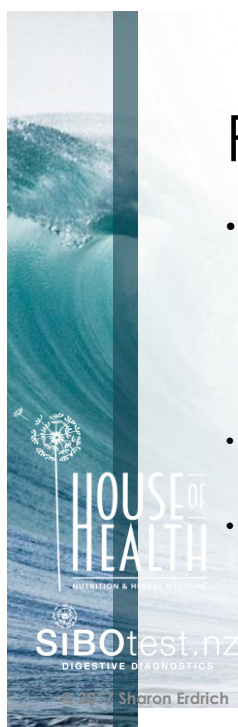
101

Restore Motility

- 5-HT (serotonin)
 - Has a prokinetic and secretory effect
 - some researchers have observed an increase in the number of enterochromaffin cells and in the production of serotonin in the mucosa of the colon and rectum in IBS patients
 - NOT INDICATED FOR DIARRHOEA
- Decarboxylated in the enterochromaffin cells with aid of pyridoxal-5-phosphate
- Ginger
 - Prokinetic, spasmolytic
 - Stimulates gastric emptying and antral contractions in functional dyspepsia

*Revista de Gastroenterología de México (English Edition), 79(2), 96–134
Dig Dis Sci. 2005 Oct;50(10):1889-97.
World J Gastroenterol. 2011 Jan 7; 17(1): 105–110.*

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The Role of Ghrelin

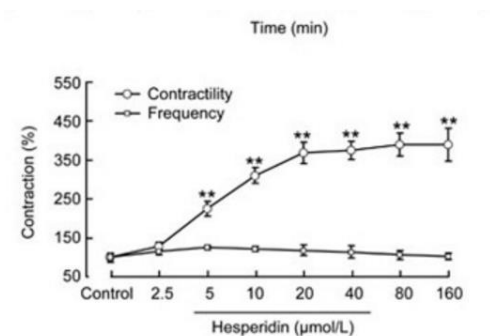
- 28 amino acid gut brain peptide
- Increasing **ghrelin increases appetite**
 - desirable in those who have lost weight or are anorexic due to their condition
- **Also enhances motility**
- Decreased by glucose, fatty acids (medium chain)
- Acts in CNS to increase gastric acid secretion
- Increased by vagus nerve activation



Acta Biochim Biophys Sin. 2009; 41 (3): 188-197 103

Hesperidin

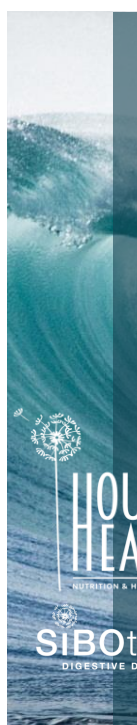
- Rat model of post-operative ileus
 - Delayed gastric emptying and intestinal transit
 - Reversed by oral administration of hesperidin
 - 5–80 mg/kg hesperidin (!)
 - All doses effective
 - Alleviates ileitis
 - Inhibits inflammatory responses
 - Stimulates Ca^{2+} -dependent MLC phosphorylation
 - Both these were in a dose-dependent manner
 - Increases contractility



Effects of hesperidin on ileum contractility

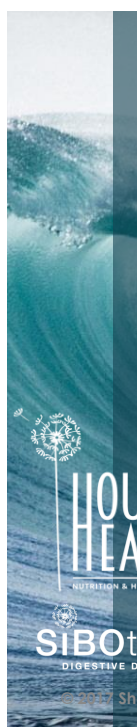


Acta Pharmacol Sin. 2016 Aug; 37(8): 1091-110 104



4. Restore Gut Integrity

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Restoring Gut Integrity

- FIRST: eliminate the problem.
- Some of the usual gut restoratives may aggravate if not 100% healed
- Caution with Glycyrrhiza glabra, Ulmus fulva, Aloe vera, and Althea officinalis
 - Mucopolysaccharides
- Glutamine
 - Dietary sources
- Prebiotics – be careful
 - Inulin, FOS (fructooligosaccharides), GOS (galactooligosaccharides), MOS (maltoligosaccharides) & Arabinogalactan (a common component of gums)
- Thorne EnteroMend



(Product available from FxMed)

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Intestinal Hyperpermeability

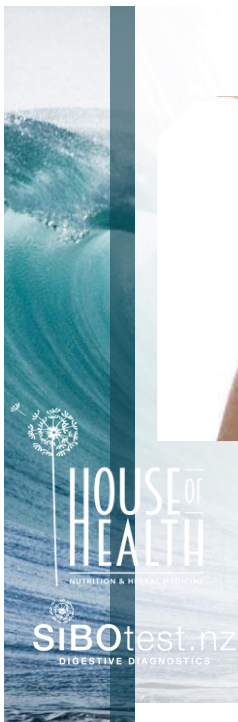
- Normalises 4-6 weeks after successful treatment in 75-100%
- Curcumin and resveratrol (down-regulate NF-K β)
- L-glutamine
- Zinc carnosine
- N-acetyl cysteine
- Saccharomyces boulardii



Naturopathic Doctor News and Review. 2014, Jan 107



5. Restore Gut Flora



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When Should I Give Probiotics?

- Controversial intervention in SIBO
 - Lactobacilli have been cultured in SIBO → concern about adding to the bacterial overload.
 - Esp in decreased motility due to a dysfunctional MMC
- A few probiotic studies have focused directly on SIBO
 - Eradication rate of 47% from *Bacillus clausii* as the only treatment
 - 64% success rate from *Lactobacillus casei Shirota* as the only treatment
 - Clinical improvement of 82% from combo of *L. casei*, *L. plantarum*, *Streptococcus faecalis*, and *Bifidobacter brevis* as the only treatment

• AVOID PREBIOTICS

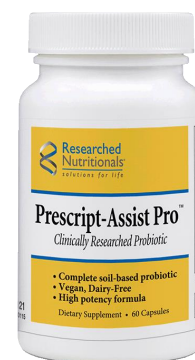
Naturopathic Doctor News and Review. 2014, Jan.

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Probiotics for the Healing Phase

- When 90% better
- AFTER antimicrobial treatment
- **Bring in prebiotics slowly**
- Specific strains
- Soil-based organisms
 - Prescript-Assist Pro



(Product available from FxMed)

Indian J Med Res. 2014 Nov; 140(5): 604–608

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Probiotics – Most Studies on IBS

Table 4 Placebo controlled clinical trials of single or mixed probiotic preparations in IBS

Organism	n	Outcome	Reference
Studies in adult patients			
<i>S faecium</i>	54	↓ Global score	Gade <i>et al</i> ²¹⁶
<i>Lactobacillus acidophilus</i>	18	↓ Global score	Halpern <i>et al</i> ²¹⁷
<i>Lactobacillus plantarum</i> 299V	60	↓ Flatulence	Nobaek <i>et al</i> ²¹⁸
<i>L plantarum</i> 299V	20	↓ Pain, 'all IBS symptoms'	Niedzielin <i>et al</i> ²¹⁹
<i>L plantarum</i> 299V	12	Negative	Sen <i>et al</i> ²²⁰
<i>L plantarum</i> MF1298	16	Deterioration of symptoms	Ligaarden <i>et al</i> ²²¹
<i>L ramnosus</i> GG	25	Negative	O'Sullivan <i>et al</i> ²⁴⁰
<i>L reuterii</i> ATCC 55730	54	Negative	Niv <i>et al</i> ²²³
Studies in paediatric patients			
<i>L ramnosus</i> GG	50	↓ Abdominal distension	Bausserman and Michail ²³⁷
<i>L ramnosus</i> GG	104	↓ Pain	Gawronska <i>et al</i> ²³⁸
<i>L ramnosus</i> GG	141	↓ Pain	Francavilla <i>et al</i> ²¹²
VSL#3® (x8)*	59	↓ Global score	Guandalini <i>et al</i> ²³⁹

*Number of organisms in a mixture.

n, number of randomised subjects.

IBS, irritable bowel syndrome; *L ramnosus*, *Lactobacillus ramnosus*; *L reuterii*, *Lactobacillus reuterii*; *L salivarius*, *Lactobacillus salivarius*; *S faecium*, *Streptococcus faecium*.

Gut 2013;62:159–176. doi:10.1136/gutjnl-2012-302167

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The Role of Diet

REMEMBER: Food is NOT the Problem!



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Principle #1



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Low FODMAP

- Fermentable
- Oligosaccharides (short chain carbs)
 - Fructans, Fructooligosaccharides (FOS), Oligo-galactans, Xylo-oligosaccharides
- Disaccharides (paired sugar molecule)
 - Lactose, maltose
- Monosaccharides (single sugar molecule)
 - Fructose, glucose, galactose, xylose

and






- Polyols.
 - sugar alcohols like xylitol, sorbitol, or maltitol.
- Assumes that there is MALABSORPTION
- GIVES SOME RELIEF of symptoms as bacteria are deprived of food
- BUT bacteria adapt – then symptoms will flare up again.





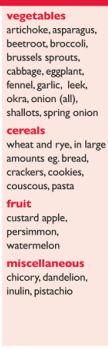


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Low FODMAP

Foods suitable on a low-fodmap diet

fruit	vegetables	grain foods	milk products	other
fruit banana, blueberry, boysenberry, canteloupe, cranberry, durian, grape, grapefruit, honeydew melon, kiwifruit, lemon, lime, mandarin, orange, passionfruit, pawpaw, raspberry, rhubarb, rockmelon, star anise, strawberry, tangelo <small>Note: if fruit is dried, eat in small quantities</small> 	vegetables alfalfa, bamboo shoots, bean shoots, bok choy, carrot, celery, choko, choy sum, endive, ginger, green beans, lettuce, olives, parsnip, potato, pumpkin, red capsicum (bell pepper), silver beet, spinach, squash, swede, sweet potato, taro, tomato, turnip, yam, zucchini herbs basil, chili, coriander, ginger, lemongrass, marjoram, mint, oregano, parsley, rosemary, thyme 	cereals gluten-free bread or cereal products bread 100% spelt; bread rice oats polenta other arrowroot, millet, psyllium, quinoa, sorghum, tapioca 	milk lactose-free milk*, oat milk*, rice milk*, soy milk* <small>*check for additives</small> cheeses hard cheeses, and brie and camembert yoghurt lactose-free varieties ice-cream substitutes gelati, sorbet butter substitutes olive oil 	tofu sweeteners sugar* (sucrose), glucose, artificial sweeteners not ending in '-ol' honey substitutes golden syrup*, maple syrup*, molasses, treacle <small>*small quantities</small> 

Eliminate foods containing fodmaps

excess fructose	lactose	fructans	galactans	polyols
fruit apple, mango, nashi, pear, tinned fruit in natural juice, watermelon sweeteners fructose, high fructose corn syrup large total fructose dose concentrated fruit sources, large serves of fruit, dried fruit, fruit juice honey corn syrup, fruisana 	milk milk from cows, goats or sheep, custard, ice cream, yoghurt cheeses soft, unripened cheeses eg. cottage, cream, mascarpone, ricotta 	vegetables artichoke, asparagus, beetroot, broccoli, brussels sprouts, cabbage, eggplant, fennel, garlic, leek, okra, onion (all), shallots, spring onion cereals wheat and rye, in large amounts eg. bread, crackers, cookies, couscous, pasta fruit custard apple, persimmon, watermelon miscellaneous chicory, dandelion, inulin, pistachio 	legumes baked beans, chickpeas, kidney beans, lentils, soy beans 	fruit apple, apricot, avocado, blackberry, cherry, longan, lychee, nashi, nectarine, peach, pear, plum, prune, watermelon vegetables cauliflower, green capsicum (bell pepper), mushroom, sweet corn sweeteners sorbitol (420) mannitol (421) isomalt (953) maltitol (965) xylitol (967) 

SIBOtest.nz
DIGESTIVE DIAGNOSTICS

Sharon Erdrich

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SIBO-Specific Diet

- Combination of low FODMAP & SCD diet.
 - Removes fermentables and all starches.
- For the most severe cases
- GOAL: Symptom control
 - "Eat to comfort"
- As treatment progresses, reintroduce foods.
- AIM: be on a normal diet before withdrawing antimicrobials.
 - Symptoms should be 90% better
 - RETEST to verify – 2 weeks after cessation of antimicrobials.
- Can be used as stand-alone treatment – expect 18 months (!)

HOUSE OF HEALTH
NUTRITION & HERBAL MEDICINE

SIBOtest.nz
DIGESTIVE DIAGNOSTICS

Sharon Erdrich

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SIBO Specific Diet: Food Guide
Vegetables



SCD "LEGAL" LOW FODMAP	SCD "LEGAL" MODERATE FODMAP	SCD "LEGAL" HIGH FODMAP	SCD "ILLEGAL"
Artichoke Hearts* 1/8 c	Asparagus 1 spear	Asparagus 4 spears	Bean Sprouts
Arugula	Artichoke Hearts* ¼ c	Artichoke	Corn
Bamboo Shoots	Butternut Squash	Avocado	Okra
Beet 2 slices	½ c/60g	Beet 4 slices	Potato: white/all colors
Bok Choy 1 c/85g	Cabbage >1 c/98g	Bok Choy 1½ c/127g	Potato: sweet
Broccoli ½ c/1.6oz	Cabbage: Savoy 3/4 c	Broccoli 1 c	Starch powder: all
Brussels Sprouts 2 ea	Leek ½ ea/42g	Brussels Sprouts 6 ea/ 114g	arrowroot, corn, potato, rice, tapioca
Cabbage 1 c/98g	Parsnip	Cabbage: Savoy 1 c	Seaweeds
Cabbage: Savoy ½ c	Pepper: Chili 40g	Cauliflower	Turpin
Carrot	Peas green 1/2c		

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SIBO-Specific Diet

- May be useful to introduce at the end of treatment
 - Principle:
 - With withdrawal of antimicrobials AND withdrawal of possible food for microbes, eradication may be more complete.
 - After a few weeks – during which time gut healing protocols have been introduced - the diet is gradually expanded
 - Gradual progression to subsequent right-hand columns

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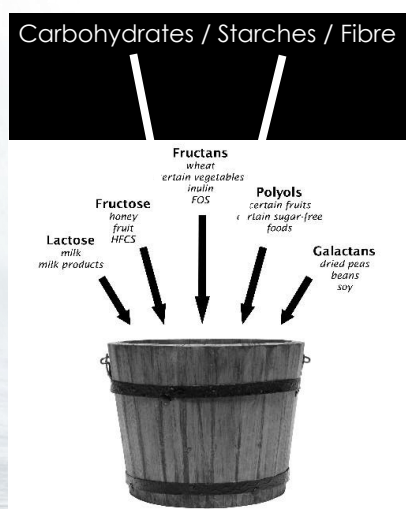
Dietary Tips for the Very Sensitive Ones

- Eat glucose or dextrose with high fructose foods
- Use garlic oil instead of garlic
- Boil and drain high fructan vegetables
- Removing onions from soups and stews is **not** beneficial
 - water soluble therefore already leached out.
- Galactans are water soluble so soak, drain, rinse.
 - Canned lentils and chickpeas are relatively low
- Use lactose free dairy products
- Use carb-focused enzyme pills – avoid mannitol
- To increase fibre use psyllium husk (not flax or chia)
 - Avoid Metamucil (psyllium)– is 100% inulin



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The Bucket Concept



AND

- Frequent feeding
- Inadequate first line of defense
- Dysfunctional MMC
- GI/abdominal surgery
- Compromised gut immunity
- Medications
- Stress
- Etc....



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Gut-Brain Axis



Randomised Clinical Trial

Randomised clinical trial: the efficacy of gut-directed hypnotherapy is similar to that of the low FODMAP diet for the treatment of irritable bowel syndrome

S. L. Peters , C. K. Yao, H. Philpott, G. W. Yelland, J. G. Muir, P. R. Gibson

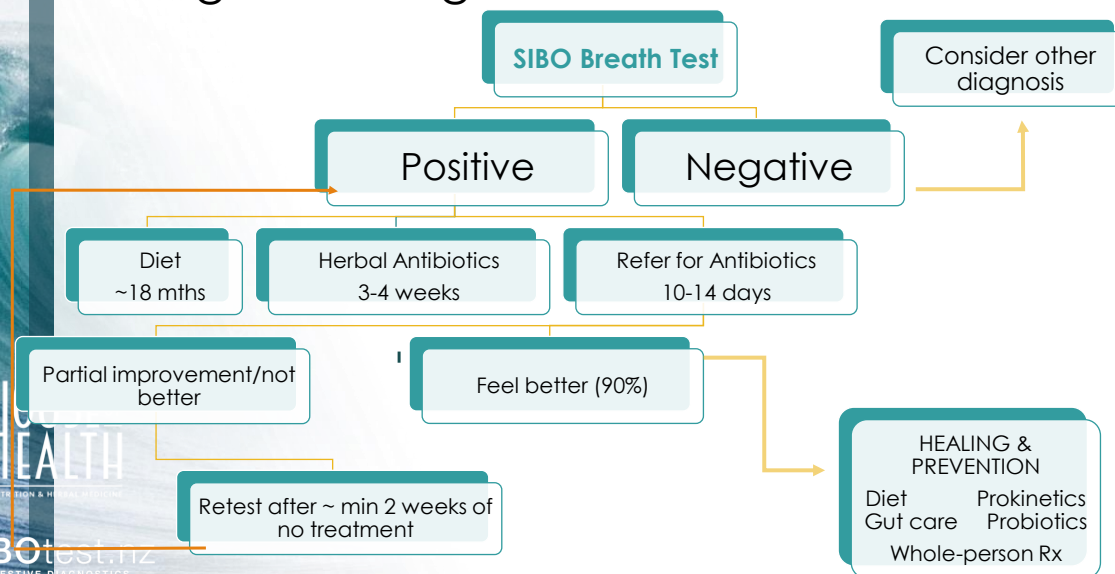
First published: 11 July 2016 [Full publication history](#)

DOI: 10.1111/apt.13706 [View/save citation](#)

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Management Algorithm – SIBO SUSPECTED



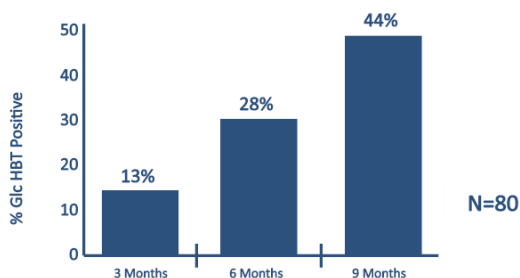
Adapted from Cedars-Sinai & Siebecker/Sandberg-Lewis Protocols

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Will it come Back???

SIBO Recurrence Following Rifaximin



The American Journal of Gastroenterology, 2008, 103; 38

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Maintaining Remission

#1 Maximise MMC function

- Prokinetics
 - Ginger
 - Motilpro
 - 5-HTP
- Meal spacing
 - 4-5 hours apart
- Betaine HCl
- Bitter herbs

The meal spacing is critical. Remember that the MMC can only start on an empty stomach.

Nat Rev Gastroenterol Hepatol. 2012 Mar 27;9(5):271-85

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Have all Underlying Factors been Addressed? HOLISTIC APPROACH

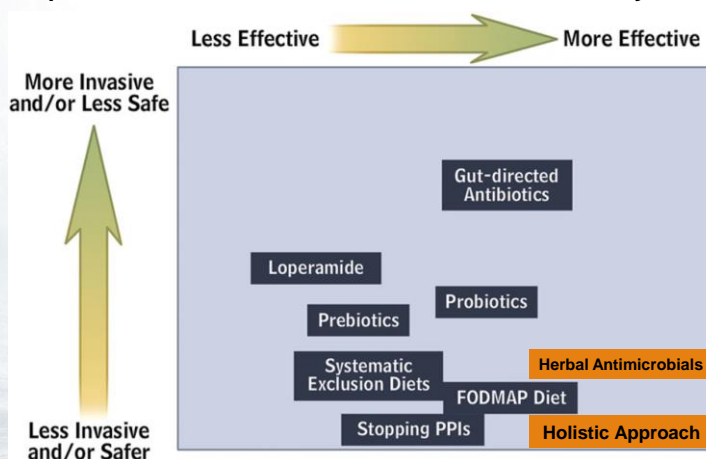
- Bacterial overgrowth → antimicrobials
- Hypochlorhydria (medications) → med cessation, supplemental HCL
- Liver / bile flow → review risk factors
 - Diet
 - Breathing pattern
 - Fatty liver (Fibroscan)
- Biofilms → Disruptors
- Gut motility
 - Meal spacing, CNS, Osteo
 - Adhesions → Visceral osteopath
 - Eating patterns → Meal spacing
- Stress

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Treatment Options: Safety vs Effectiveness

Plot chart of currently available strategies for modifying gut microbiota aiming to demonstrate the relationship between the effectiveness and invasiveness/safety of the proposed approach.

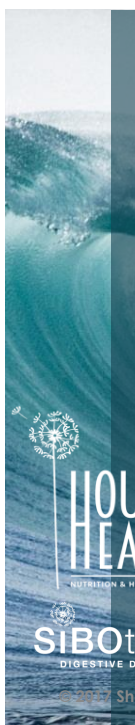


Simrén et al. Gut 2013;62:159-176



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Retest

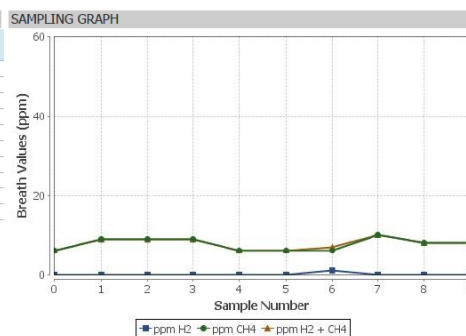
- Why?
- When?
- Confirm eradication
- Change in symptoms
- Complex patients
- Must be not less than 2 weeks after completing any antimicrobials.
 - Longer is probably better, unless relapse is suspected.

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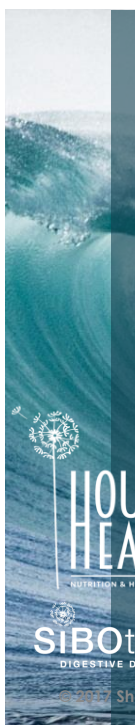
Case #1 Acne & Constipation w/Bloating & R)LQ pain → Negative SIBO Test

Sample	Sample Time	ppm H2	ppm CH4	ppm H2 + CH4	% CO2	Correction	Symptoms
Baseline (BL)	09:30	0	6	6	4.6	1.19	
#1 - 20 min	09:50	0	9	9	4.5	1.22	
#2 - 40 min	10:10	0	9	9	4.1	1.34	
#3 - 60 min	10:30	0	9	9	4.4	1.25	
#4 - 80 min	10:50	0	6	6	4.5	1.22	B
#5 - 100 min	11:10	0	6	6	4.3	1.27	B
#6 - 120 min	11:30	1	6	7	4.3	1.27	B
#7 - 140 min	11:50	0	10	10	3.7	1.48	BO
#8 - 160 min	12:10	0	8	8	4.1	1.34	BO
#9 - 180 min	12:30	0	8	8	4.3	1.27	BO



Except the elevated baseline methane (NB: BSC #1-2 unless has MagLax x4 on alt days)
 Rx Allimed 900mg bd & 450 mg midi.
 Improved, now just 1x mag lax pm
 Felt stressed before Christmas (work-related) – gave stress herbal mix.
 Constipation resolved.
 Then learned the acne came on as her marriage was breaking down...

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Case #2

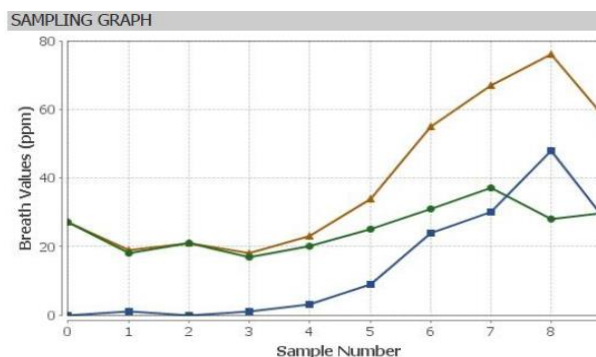
- 35 year old female presented with “sluggish but loose” stools, with gurgling, bloating, weight gain
- BSC Type 4-7. Feeling of incomplete evacuation
- Other symptoms:
 - Almost constant headaches
 - Brain fog
 - Stiff joints
 - Fatigue
 - Anxiety

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Case #2

- ▶ Fibromyalgia score
 - ▶ 18/18 tender points
 - ▶ 52/180 max score
- ▶ Treatment:
 - ▶ Target Hydrogenic species
 - ▶ Berberine 1g bd
 - ▶ Neem
 - ▶ SIBO Specific Diet



Sample	Sample Time	ppm H2	ppm CH4	ppm H2 + CH4	% CO2
Baseline (BL)	09:12	0	27	27	2.4
#1 - 20 min	09:34	1	18	19	4.3
#2 - 40 min	09:54	0	21	21	3.7
#3 - 60 min	10:14	1	17	18	4.5
#4 - 80 min	10:37	3	20	23	4.2
#5 - 100 min	10:55	9	25	34	3.5
#6 - 120 min	11:15	24	31	55	2.8
#7 - 140 min	11:36	30	37	67	2.4
#8 - 160 min	11:56	48	28	76	4.9
#9 - 180 min	12:16	25	30	55	3.3

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Case #2 – 3 weeks later

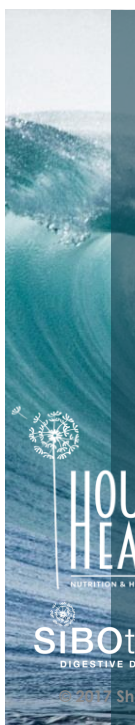
- Much better. Clearer head. Sleeping better
- No headaches since starting treatment (tend to be worse premenstrually, but not this time).
- Deviated from diet a little without symptom aggravation
- Still a bit gassy “tight”.
- Wonders about link to her sore back - notices that this correlates to stomach tension.
- Lost 2-3kg
- General pain has diminished.
 - Fibromyalgia score
 - 15/18 tenderpoints
 - 26/180 max score (e diminished by 50%)

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Case #2

- Plan – further 3 weeks of treatment
- Continue with Neem & Berberine
- Add Allimed (450mg caps), 2 x 1 x 2
- Ref to Osteopath – possible contribution from spinal nerve plexus
- Add white rice, white bread, spelt.

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CASE #3

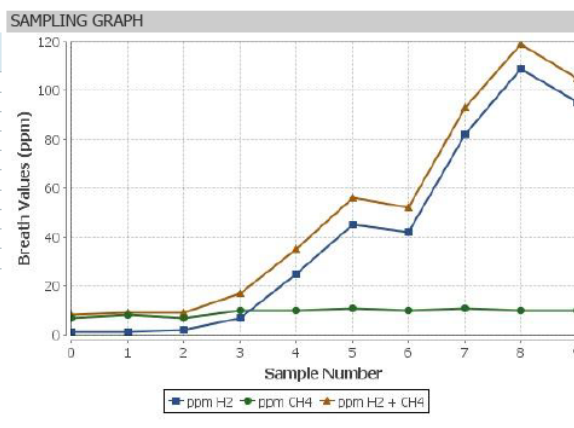
- Ref by Chiro - diffuse body pain, cramps (incl. menstrual).
- Historically had a constipated tendency, but current GI problems started after having Giardia (& treatment for it) 15 months previously.
- BO 2x - watery (BSC #6-7) alt w/ constipation.= (BSC #1-2)
- Gas – bloating & flatulence +++
- Palpitations. Headaches
- Elevated GGT (alcohol intake)
- Thick white coating on her tongue with a minor tremor
- Marked tremor on hands on gravity resistance test.
- Itchy, dry skin on upper arms. Very tender everywhere.
- → Lactulose Breath Test.

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CASE #3

Sample	Sample Time	ppm H2	ppm CH4	ppm H2 + CH4	% CO2	Correction	Symptoms
Baseline (BL)	09:22	1	7	8	5.2	1.05	BO
#1 - 20 min	09:42	1	8	9	5.3	1.03	BO
#2 - 40 min	10:04	2	7	9	5.1	1.07	B
#3 - 60 min	10:24	7	10	17	4.6	1.19	B
#4 - 80 min	10:44	25	10	35	4.9	1.12	BO
#5 - 100 min	11:04	45	11	56	5.2	1.05	B
#6 - 120 min	11:24	42	10	52	5.5	1.00	BO
#7 - 140 min	11:42	82	11	93	5.6	0.99	BO
#8 - 160 min	12:02	109	10	119	5.9	0.94	O
#9 - 180 min	12:24	95	10	105	5.8	0.95	BO



Positive at 80 mins (+24 of hydrogen)
Methane +4
Combined increase 28ppm



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CASE #3

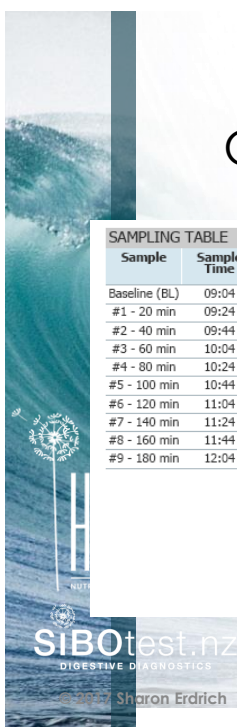
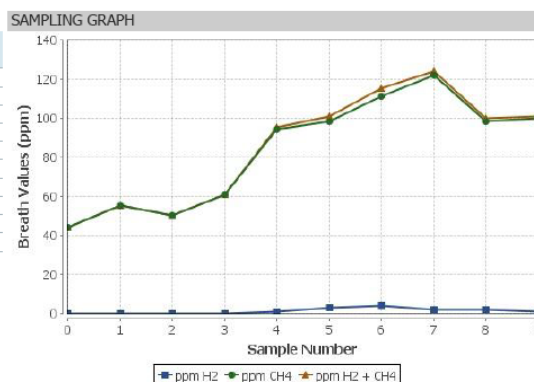
- 3 weeks of Liquid herbs & oregano oil → abdomen “quieter”.
 - Less bloating; diarrhoea has stopped.
 - No palpitation, no period cramps.,
 - headaches settled.
 - Started broad spectrum gut antimicrobial + SB + probiotics
- 3 weeks later
 - Now constipated.
 - Itchy/dry and pain on upper arms has GONE>
 - Repeat broad spectrum gut antimicrobial + SB + probiotics
- 3 weeks later
- Now essentially WELL
- Ongoing issues with GGT elevation – has now stopped consuming alcohol
- Due to financial constraints has not repeated the test.
- We are now supporting liver function – she is doing well.



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CASE # 4 Skin Problems & Constipation

Sample	Sample Time	ppm H2	ppm CH4	ppm H2 + CH4	% CO2	Correction	Symptoms
Baseline (BL)	09:04	0	44	44	4.4	1.25	0
#1 - 20 min	09:24	0	55	55	4.6	1.19	0
#2 - 40 min	09:44	0	50	50	4.3	1.27	
#3 - 60 min	10:04	0	61	61	4.4	1.25	
#4 - 80 min	10:24	1	94	95	4.6	1.19	0
#5 - 100 min	10:44	3	98	101	4.3	1.27	0
#6 - 120 min	11:04	4	111	115	4.5	1.22	
#7 - 140 min	11:24	2	122	124	5.0	1.10	0
#8 - 160 min	11:44	2	98	100	4.5	1.22	
#9 - 180 min	12:04	1	100	101	4.3	1.27	0

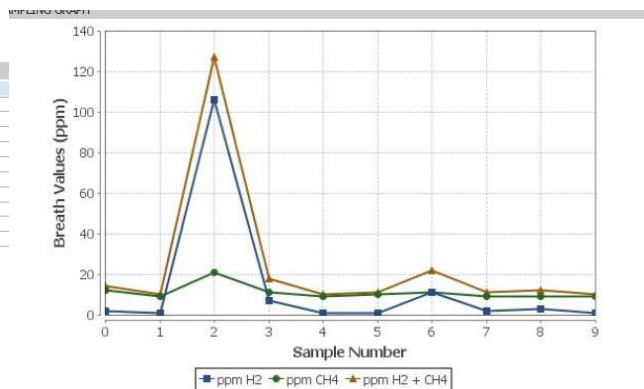


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CASE # 5 – Incorrect collection technique

SAMPLING TABLE

Sample	Sample Time	ppm H2	ppm CH4	ppm H2 + CH4	% CO2
Baseline (BL)	08:20	2	12	14	4.6
#1 - 20 min	08:40	1	9	10	0.2
#2 - 40 min	09:00	106	21	127	3.6
#3 - 60 min	09:20	7	11	18	0.7
#4 - 80 min	09:40	1	9	10	0.2
#5 - 100 min	10:00	1	10	11	0.1
#6 - 120 min	10:20	11	11	22	1.2
#7 - 140 min	10:40	2	9	11	0.2
#8 - 160 min	11:00	3	9	12	0.5
#9 - 180 min	11:20	1	9	10	0.2



8/10 samples were invalid (low CO2) BUT Massive increase from a baseline of 2ppm Hydrogen to 106 ppm at just 40mins, (the only 2 valid samples) with a concomitant small rise in methane.

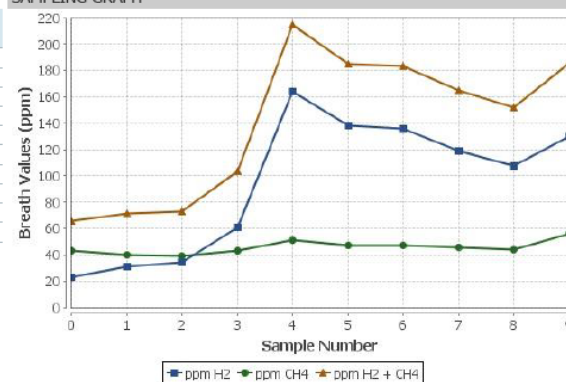
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CASE # 6

SAMPLING TABLE

Sample	Sample Time	ppm H2	ppm CH4	ppm H2 + CH4	% CO2	Correction	Symptoms
Baseline (BL)	07:40	23	43	66	4.1	1.34	O
#1 - 20 min	08:00	31	40	71	4.1	1.34	
#2 - 40 min	08:20	34	39	73	4.3	1.27	
#3 - 60 min	08:40	61	43	104	4.2	1.30	
#4 - 80 min	09:00	164	51	215	4.4	1.25	
#5 - 100 min	09:20	138	47	185	4.3	1.27	
#6 - 120 min	09:40	136	47	183	4.0	1.37	
#7 - 140 min	10:00	119	46	165	4.1	1.34	
#8 - 160 min	10:20	108	44	152	4.0	1.37	
#9 - 180 min	10:40	130	56	186	4.2	1.30	

SAMPLING GRAPH



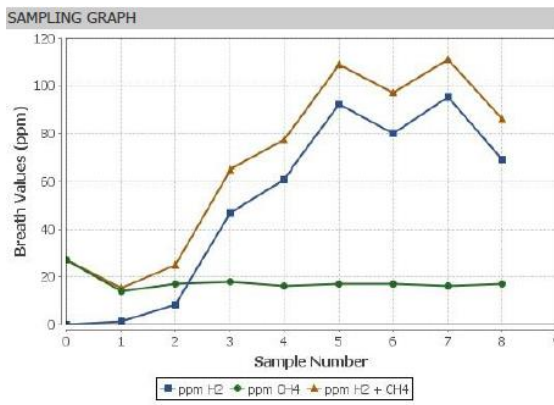
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Case 7

- 40 yo female w/ 7yrs of probs
- Historically constipated - managed w/fibre & diet
 - better if GF, has LF milk
- Gas, Bloating, Gurgling stomach
- Alt constipation, diarrhoea
- SOB - wonders if it's her heart. Feels edgy all the time
- Menses irregular, headaches
- Losing lots of hair
- Difficulty gaining weight
- Super-anxious re food. Was:
 - Low FODMAP, Low Histamine

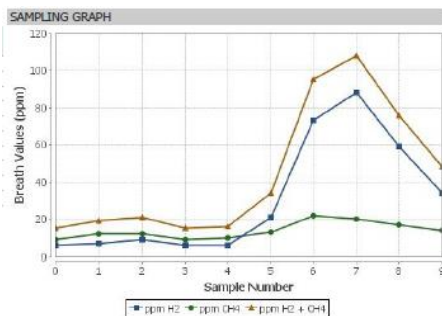
SAMPLING TABLE							
Sample	Sample Time	ppm H2	ppm CH4	ppm H2 + CH4	% CO2	Correction	Syn
Baseline (BL)	09:25	0	27	27	1.8	3.05	
#1 - 20 min	09:52	1	14	15	4.0	1.37	
#2 - 40 min	10:16	8	17	25	3.3	1.66	
#3 - 60 min	10:36	47	18	65	3.6	1.52	
#4 - 80 min	10:56	61	16	77	4.5	1.22	
#5 - 100 min	11:16	92	17	109	4.6	1.19	
#6 - 120 min	11:36	80	17	97	4.3	1.27	
#7 - 140 min	11:57	95	16	111	4.7	1.17	
#8 - 160 min	12:19	69	17	86	4.3	1.27	
#9 - 180 min							



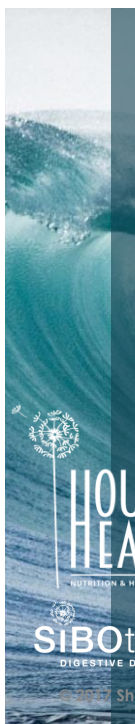
Case 7

- Rx Neem 800mg bd, berberine 1g bd (increased incrementally). Digestive enzymes
 - SIBO-specific diet
 - Sx switched to constipation-predominant
 - Rx Allimed 900mg bd & 450 mg midi.
- One year later: Stool normal (BSC #4, Brown #30) Gained 2kg
- Headaches, dizziness, SOB - gone
 - Histamine intolerance – gone.
 - Still nervous about food – following SCD

SAMPLING TABLE							
Weight: 58.0 kg							
Sample	Sample Time	ppm H2	ppm CH4	ppm H2 + CH4	% CO2	Correction	S
Baseline (BL)	04:20	6	9	15	3.8	1.44	
#1 - 20 min	04:40	7	12	19	3.3	1.66	
#2 - 40 min	05:00	9	12	21	3.7	1.48	
#3 - 60 min	05:20	6	9	15	3.5	1.57	
#4 - 80 min	05:40	6	10	16	3.8	1.44	
#5 - 100 min	06:00	21	13	34	4.1	1.34	
#6 - 120 min	06:20	73	22	95	4.0	1.37	
#7 - 140 min	06:40	88	20	108	4.1	1.34	
#8 - 160 min	07:00	59	17	76	4.1	1.34	
#9 - 180 min	07:20	34	14	48	4.3	1.27	



	Hydrogen	Methane	Combo	Fibro scores
April 2016	+ 92 @ 100mins	Extreme baseline	+94 ppm	42 (8/18)
Mar 2017	+21 @ 100 mins	+4 @ 100mins	+19 ppm	14 (4/18)

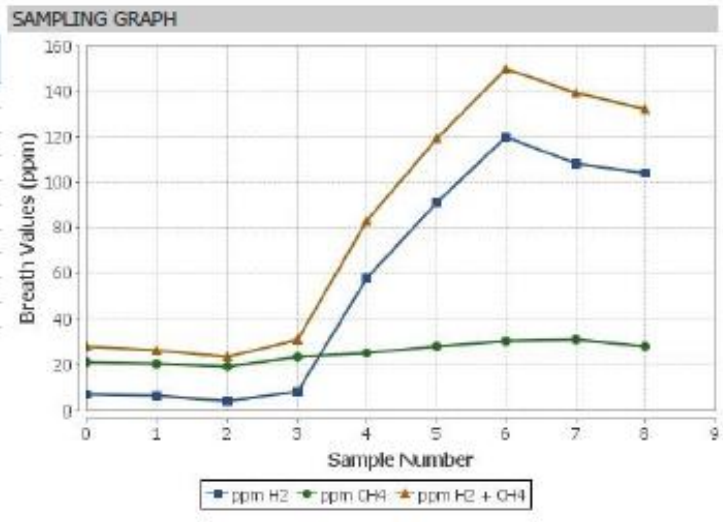


You might see this

Sugar		0	15	30	45	60	75	90	105
Lactulose <small>(25mL syrupy liquid, dissolved)</small>	Minutes:	0940	0955	1010	1045	1100	1115		
	Hydrogen PPM result:	4	7	6	8	29	41		
Date:		09/03/16							
Fructose <small>(35g (small granules) dissolved)</small>	Minutes:	0923	0939	954	1009	1024	1039		
	Hydrogen PPM result:	4	5	6	11	10	9		
Date:		11/3/16							
Lactose 0930 <small>(25g (fine powder) suspended)</small>	Minutes:	0930	0945	1000	1015	1035	1050		
	Hydrogen PPM result:	6	6	7	8	10	9		
Date:		13/3/16							

Hydrogen – only test with lactulose
 + 37ppm at 75 minutes
 Negative lactose & fructose challenges
 - What is the problem here?

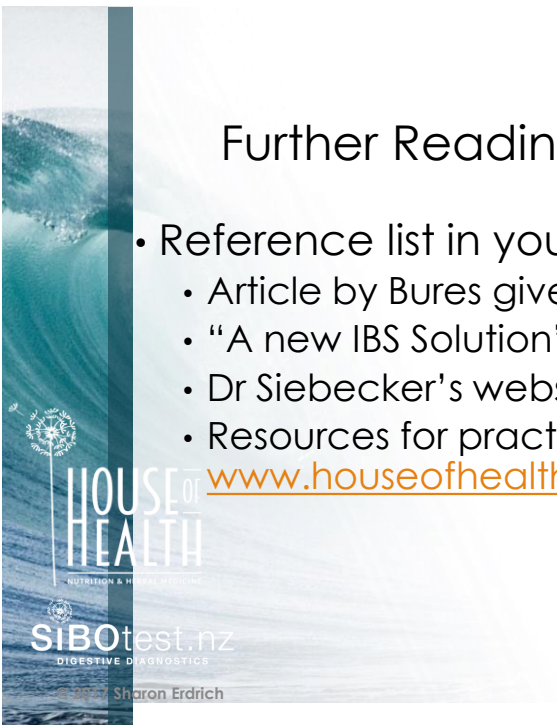
SAMPLING TABLE							
Sample	Sample Time	ppm H2	ppm CH4	ppm H2 + CH4	% CO2	Correction	Symptoms
Baseline (BL)	11:16	7	21	28	3.7	1.48	0
#1 - 20 min	11:36	6	20	26	3.5	1.57	
#2 - 40 min	11:56	4	19	23	3.8	1.44	
#3 - 60 min	12:16	8	23	31	3.4	1.61	0
#4 - 80 min	12:39	58	25	83	3.7	1.48	0
#5 - 100 min	12:56	91	28	119	3.5		
#6 - 120 min	13:16	120	30	150	3.6		
#7 - 140 min	13:36	108	31	139	3.4		
#8 - 160 min	13:56	104	28	132	3.5		
#9 - 180 min				-			



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 Sharon Erdrich

Further Reading

- Reference list in your pack
 - Article by Bures gives a thorough overview
 - “A new IBS Solution” Dr Mark Pimentel
 - Dr Siebecker's website: www.siboinfo.com
 - Resources for practitioners soon to be available via www.houseofhealth.co.nz



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