INTESTINAL GAS
Belching, Bloating, and Flatus:
Helping the Patient Who Has Intestinal Gas

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DDRI
91.2.28
• What do we do with intestinal gas?

• How do we interpret the symptoms?

• When do we look at further testing?

• What do we do with treatment?
The Long History of Bloating & Gas

- Hippocrates: “Gas makes one feel whole”
- Claudius: permitted gas to be passed in Rome
- Emperor Constantine (in the year 315): made passing of gas illegal
Background

- Abdominal bloating is an important, troublesome, and poorly understood clinical problem

- It is highly prevalent and may affect 10%-30% of the population

- Bloating is one of the most common and bothersome complaints in a large proportion of patients with various functional gut disorders

- Bloating imposes enormous economic burden
What are the Gas Related Symptoms?

• **Belching**, or burping, refers to the noisy release of air or gas from the stomach through the mouth; 7% of the general population complain of excessive belching

• **Bloating**, abdominal fullness or distention; 11%-20% general population

• **Flatulence**, is the passage of excessive amounts of intestinal gas, or flatus, through the anus; average, 10-16 times each day
A variety of GI complaints, such as

-belching
-bloating
-abdominal pain
-constipation
-or flatulence
Excessive intestinal gas does occur, it may be due to

- excessive air swallowing

- increased intraluminal production from malabsorbed nutrients

- decreased gas absorption due to obstruction
These gases may be eliminated via
- eructation
- diffusion across the mucosa
- bacterial metabolism
- and passage per anus
COMPOSITION OF INTESTINAL GAS

- N2, O2, CO2, H2, and CH4 account for more than 99% of expelled intestinal gas.
- N2; predominantly gas.
- O2; very low concentrations.
- CO2, H2, and CH4 concentrations; variable.
The gases enter to the gut lumen are

- air swallowing ($N_2$, $O_2$)

- diffusion from the blood ($N_2$, $O_2$, $CO_2$)

- neutralization of bicarbonate ($CO_2$)

- and bacterial metabolism ($H_2$, $CO_2$, $CH_4$, and trace gases)
• Stomach gas contains high concentrations of N\textsubscript{2} and O\textsubscript{2} similar to the atmosphere

• Posture may influence the amount of swallowed air passing from the stomach into the small intestine

• The supine position; gastric air is located above gastric liquid that overlies the GE junction, causing air to pass preferentially into the small intestine
• Flatus contains less O2 and more CH4

• None of the principal gases has an odor

• Minor constituents of flatus, include:
  - sulfur-containing compounds such as: methanethiol, dimethyl sulfide, hydrogen sulfide
    - as well as short-chain fatty acids
  - skatoles, indoles, volatile amines, and ammonia
• The incidence of methane production is increased:
  - colorectal cancer
  - extensive ulcerative colitis
  - and colonic polyps compared with individuals with other diseases of the colon or healthy volunteers
CLINICAL GAS PROBLEMS

ERUCTATION

• Leading to relaxation of the LES, upward movement of the air through the esophagus

• The occasional belch during or after meals expels gas swallowed in the course of ingesting solids or liquids

• It may be voluntary or involuntary

• Excessive belching is often reported in patients with GERD and functional dyspepsia
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Gastric belch (physiologic)</th>
<th>Supragastric belch (aerophagia)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>Few per hour</td>
<td>Up to 20 per minute</td>
</tr>
<tr>
<td>Relation to meal</td>
<td>After ingestion of meals and CO₂-containing beverages</td>
<td>Mostly not meal-related</td>
</tr>
<tr>
<td>Scent/taste</td>
<td>Yes, of food/drinks or acid</td>
<td>No scent/taste</td>
</tr>
<tr>
<td>Audible</td>
<td>Often not</td>
<td>Loud</td>
</tr>
<tr>
<td>Comorbidity</td>
<td>GERD, functional dyspepsia</td>
<td>Anxiety, neurosis</td>
</tr>
</tbody>
</table>
Treatment

• Treatment of chronic eructation consists of breaking the vicious cycle of aerophagia

• These include discontinuation of such:
  - habits as gum chewing
  - smoking
  - drinking carbonated beverages

• Specific treatment of anxiety should be considered if this is a prominent symptom
Maneuvers that can be recommended to reduce air swallowing are:

- chew rather than gulp food
- eat and drink slowly
- avoid chewing gum
- and clench a pencil between the teeth
Flatulence

• The volume of gas passed per rectum varies from about 500 to 1500 mL per day

• Neither age nor sex significantly correlates with flatus frequency

• The frequency of flatus released varies between 10 and 20 times per day in healthy subjects
A number of factors may account for a patient's awareness of bothersome flatus:
- An alteration of intestinal motility or bacteria
- Dietary factors, such as:
  - increased intake of: lactose, fructose, sorbitol
  - or undigestible starches in: fruits, vegetables, carbonated beverages

Products such as:
- pork, upon digestion, may release trace concentrations of malodorous gases
- Psychological factors that may create a heightened sensitivity to normal flatal passage
Lactase Deficiency

- Inability to metabolize lactose in the small intestine (fermentable carbohydrate)
- More common in African Americans, Asians, Puerto Ricans
- More common with advancing age
- Gas after milk, cheese, ice cream
- Often associated with diarrhea and bloating
Diagnosis

• History and physical examination
• New onset flatulence associated with symptoms such as:
  - weight loss
  - diarrhea
  - abdominal pain
  - and distention
  - or anorexia usually deserves a work up for malabsorption
• This may include:
  - stool examination for fat and Giardia
  - lactose tolerance test
  - celiac serology
  - and a small bowel radiograph or upper endoscopy
<table>
<thead>
<tr>
<th>Danger signals requiring work-up in a patient with excessive flatulence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nocturnal abdominal pain (sleep awakening)</td>
</tr>
<tr>
<td>Weight loss</td>
</tr>
<tr>
<td>Blood in the stool</td>
</tr>
<tr>
<td>Severely tender abdomen</td>
</tr>
<tr>
<td>Succussion splash</td>
</tr>
<tr>
<td>Fever</td>
</tr>
<tr>
<td>Vomiting</td>
</tr>
<tr>
<td>Steatorrhea</td>
</tr>
<tr>
<td>New onset diarrhea</td>
</tr>
</tbody>
</table>
Treatment

• Limiting dietary ingestion of known gas-producing foods such as:
  - cabbage
  - onions
  - broccoli
  - brussel sprouts
  - wheat
  - and potatoes
• Simethicon, which causes gas bubbles to break

• The activated charcoal has been supported by some studies and refuted by others

• Beano, an alpha-galactosidase preparation, is often tried by these patients
• If bacterial overgrowth or an altered flora is strongly suspected, a two-week trial of antibiotic treatment may be helpful

• Bismuth subsalicylate reduces the odor arising from hydrogen sulfide as well as other pungent components of flatus
Abdominal bloating and distension

- Bloating; refers to a person's sensation of abdominal fullness

- Distension; used to describe an actual increase in abdominal girth

- However, the relationship between the amount of intestinal gas and symptoms is not straightforward
• Other studies have suggested that gut hyperalgesia occurs in some patients with IBS

• Plain abdominal films and CT have also shown:
  - no evidence of increased gas in patients complaining of gaseous distension

• Discordant data have also been reported
• BMI > 30 kg/m² obesity was significantly associated with bloating

• Some investigators have suggested that patients with IBS or functional bloating may have:
  - impaired transit of intestinal gas

• Lipid perfusion into the duodenum retards gas transit time more in patients with IBS than in normal controls
Pathophysiology of Bloating

Azpiroz F, Gastroenterology 2005
Pathophysiology of Bloating

• The primer to elicit subjective bloating may be any of the other 3 factors

• The sensation may be related to distorted Perception
AMOUNT OF GAS IN THE INTESTINE

• The volume of gas in the intestinal tract, as determined by:
  - body plethysmography
  - or argon washout techniques

• Approximately 200 mL in both the fasting and postprandial states
Ambulatory abdominal inductance plethysmography (AIP)

- Loop of wire forms inductor, the inductance of which is dependent on cross sectional area of loop.
- Small purpose built data logger records data every minute.
- Output frequency is stored on the data logger from which abdominal circumference can be calculated.
- Mercury position tilt switches record posture.
Do Patients With a Bloating Sensation Have Objective Abdominal Distention?

<table>
<thead>
<tr>
<th>Study</th>
<th>Method</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poynard²⁰</td>
<td>Tape measure</td>
<td>No</td>
</tr>
<tr>
<td>Maxton²¹</td>
<td>Tape measure</td>
<td>Yes</td>
</tr>
<tr>
<td>Maxton²¹</td>
<td>Computed tomographic scan</td>
<td>Yes</td>
</tr>
<tr>
<td>Sullivan²²</td>
<td>Tape measure</td>
<td>Yes</td>
</tr>
<tr>
<td>Lea²⁵</td>
<td>Plethysmography</td>
<td>Yes</td>
</tr>
<tr>
<td>Lea²⁶</td>
<td>Plethysmography</td>
<td>Variable&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup>Constipation-predominant yes; diarrhea-predominate no.

*Azpiroz F, Gastroenterology 2005*
Abnormal Perception

• Pts with a normal abdomen with a distorted interpretation of reality, may believe, that their abdomen is distended

• Hypersensitive abdominal wall (i.e. following abdominal wall trauma, or scars)

• Visceral hyperalgesia in pts with functional gut disorders
Intestinal Gas Metabolism

- Air swallowing
- Over production
- Inefficient expulsion

Diagram:
- Eructation
- Swallowing
- Stomach
- Small bowel
- Colon
- Gas diffusion from/to blood
- Chemical reactions
- CO₂ release
- Consumption
- Bacterial metabolism
- Production
- Evacuation
Do Patients With Bloating Produce More Intestinal Gas?

<table>
<thead>
<tr>
<th>Study</th>
<th>Method</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lasser\textsuperscript{67,68}</td>
<td>Washout</td>
<td>No</td>
</tr>
<tr>
<td>Serra\textsuperscript{39}</td>
<td>Washout</td>
<td>No</td>
</tr>
<tr>
<td>Caldarella\textsuperscript{18}</td>
<td>Washout</td>
<td>No</td>
</tr>
<tr>
<td>Chami\textsuperscript{72}</td>
<td>X-ray film</td>
<td>Yes</td>
</tr>
<tr>
<td>Koide\textsuperscript{73}</td>
<td>X-ray film</td>
<td>Yes</td>
</tr>
<tr>
<td>Poynard\textsuperscript{20}</td>
<td>X-ray film</td>
<td>Yes</td>
</tr>
<tr>
<td>Maxton\textsuperscript{21}</td>
<td>Computed tomographic scan</td>
<td>No</td>
</tr>
</tbody>
</table>

Infusion of 2L of gas causes < 2 cm change in abdominal girth

\textit{Azpiroz F, Gastroenterology 2005}
The Gas Challenge Test
Abdominal bloating in IBS

- Bloating is a common and intrusive symptom.
- More common in IBS-C compared with IBS-D.
- More common in females than males.
- Many patients and physicians use the terms bloating and distension synonymously.
- However, the term bloating should be reserved to describe a sensation of abdominal swelling whereas distension used to describe an actual increase in abdominal girth.

Houghton & Whorwell Neurogastroenterol & Motil 2005; 17: 500-11
Relationship to bloating to abdominal distension

- 48% of bloated IBS patients exhibit abdominal distension:
  - 60% IBS-C
  - 40% IBS-D

- Bloating and distension correlates more strongly in IBS-C than IBS-D.

- Bloating and distension may differ pathophysiologically and this appears to be reflected in the bowel habit subtype.

Possible mechanisms: Bloating and Distension

- Psychological (1)
- Weakness of abdominal musculature (2)
- Paradoxical relaxation of anterior abdominal muscles (3)
- Altered visceral sensation – patients with bloating alone more sensitive than those with bloating and distension (4)
- Excessive gas production (5)
- Impaired gut handling of intestinal gas (6)

Gastrointestinal transit in IBS-C

- Often have delayed gastrointestinal transit (1)
- Bloating and abdominal distension more likely to be related in IBS-C (2)
- Suggests distension in this subgroup may be a mechanical problem related to delayed transit.

(1) Cann et al Gut 1983; 24; 405-11; (2) Houghton et al. Gastroenterology 2006 (in press)
• Trapping of gas at the colonic flexures may result in distension, spasm, and subsequent pain

• Instillation of air or barium may reproduce the symptoms

• These syndromes are probably variants of IBS, and anti-constipation therapy is sometimes effective
Protocol

- 27 fasted patients with IBS-C (Rome II) aged 18-68 yrs (28 F, 3 M) were studied.

- 24 age and sex matched healthy volunteers aged 21-58 yrs (28 F, 3M) were also included.

- 24 hour abdominal girth was measured by using the technique of Abdominal Inductance Plethysmography (AIP) (1-2).

- Bloating severity was scored throughout the study (scale 0-5) and retrospectively (scale 0-3) the following day.

- Small and large bowel transit measured within 2 weeks of AIP (3-4)

Bloating and distension - all subjects

Mean bloating score (0-3)  Mean change in girth (cms)

Results expressed as Mean (95% CI)

- IBS-C (n=27)
- HV (n=24)
Transit - all subjects

Colonic transit

Small bowel transit

Results expressed as mean (95% CI)

IBS-C (n=27)
HV (n=24)
Compared with the 95% reference range for healthy volunteers:

- 48% had delayed colonic transit
- 15% had delayed small bowel transit.
Conclusion

Delayed colonic transit is associated with abdominal distension

Drugs that accelerate transit may be of benefit in the management of this difficult problem.
Can Certain Medications Cause Excess Gas?

• There are some prescription medications that:
  - purposefully inhibit digestive enzymes (e.g. acarbose)
  - and others that contain indigestible sugars (lactulose and sorbitol)

• These medications will often cause gas-related symptoms
Evaluation of Intestinal Gas

- History: how long has it been going on?
- Food diary
- If sudden onset or unilateral bloating, think about appendicitis or gallbladder disease
- Consider celiac disease
- Additional testing and imaging: computed tomography, endoscopy, labs, celiac profile
• An x-ray of the abdomen may be performed if blockage of the intestines needs to be excluded

• Sometimes lactose tolerance test should be assessed
What Treatments are Available for the Gas-Related Symptoms?

- Lifestyle modification such as:
  - avoidance of rapid eating
  - chewing gum
  - carbonated beverages
  - and stopping smoking are often recommended but the response is variable

- When simple reassurance and lifestyle modifications are not satisfactory, then psychological treatments such as:
  - relaxation therapy
  - or behavioral therapy are currently the most useful approaches
<table>
<thead>
<tr>
<th>Dairy products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetables</td>
</tr>
<tr>
<td>Onions</td>
</tr>
<tr>
<td>Beans</td>
</tr>
<tr>
<td>Celery</td>
</tr>
<tr>
<td>Carrots</td>
</tr>
<tr>
<td>Brussels sprouts</td>
</tr>
<tr>
<td>Fruits</td>
</tr>
<tr>
<td>Raisins</td>
</tr>
<tr>
<td>Bananas</td>
</tr>
<tr>
<td>Apricots</td>
</tr>
<tr>
<td>Prune juice</td>
</tr>
<tr>
<td>Complex carbohydrates</td>
</tr>
<tr>
<td>Pretzels</td>
</tr>
<tr>
<td>Bagels</td>
</tr>
<tr>
<td>Wheat germ</td>
</tr>
</tbody>
</table>

Table 1. Foods which promote significant gas production.
• Approach to treatment of abdominal distension and gaseousness is similar to that used in IBS

• However, anticholinergic agents should be avoided in these patients because of their potential to exacerbate symptoms

• Simethicone has not been shown to be of benefit

• There is contradictory evidence for the use of activated charcoal
<table>
<thead>
<tr>
<th>Medication class</th>
<th>Examples</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enzyme preparations</td>
<td>β-galactosidase (lactase)</td>
<td>For lactose intolerance; variable effectiveness in lactose intolerant IBS patients</td>
</tr>
<tr>
<td></td>
<td>α-galactosidase</td>
<td>Effective for legume-rich meals in healthy volunteers</td>
</tr>
<tr>
<td></td>
<td>Pancreatic enzymes</td>
<td>Uncertain efficacy for gas and bloating of any cause</td>
</tr>
<tr>
<td>Adsorbents and agents that reduce surface tension</td>
<td>Simethicone</td>
<td>Possible benefits in functional dyspepsia and gas with diarrhoea; uncertain benefits in IBS</td>
</tr>
<tr>
<td></td>
<td>Activated charcoal</td>
<td>Possible benefits in gas production and malodorous flatus; charcoal-lined undergarments are available</td>
</tr>
<tr>
<td></td>
<td>Bismuth subsalicylate</td>
<td>Possible benefits in reducing malodorous flatus</td>
</tr>
<tr>
<td>Treatments to modify gut flora</td>
<td>Antibiotics</td>
<td>Useful for bacterial overgrowth secondary to organic disease; possible benefits in IBS</td>
</tr>
<tr>
<td></td>
<td>Probiotics (Lactobacillus sp., Bifidobacterium sp.)</td>
<td>Possible benefits in IBS</td>
</tr>
<tr>
<td></td>
<td>Prebiotics</td>
<td>Uncertain benefits in IBS</td>
</tr>
<tr>
<td>Prokinetic medications</td>
<td>Tegaserod</td>
<td>Reduces bloating in IBS; removed from market</td>
</tr>
<tr>
<td></td>
<td>Neostigmine</td>
<td>Reduces luminal distention in acute colonic pseudoobstruction; uncertain benefits in bloating</td>
</tr>
</tbody>
</table>
Rifaximin

• In circumstances where the patient may have a little diarrhea; use rifaximin

• Some preliminary experience suggests; resetting the normal bacteria knock out the bad overgrowth bacteria

• A short course (2 weeks) of rifaximin, 400 mg 3 times a day for 14 days
Probiotics

• Add a probiotic, something that potentially may give the bacteria a little bit more of an advantage by changing the natural flora that are causing the problems

• A lot of times it becomes an imbalance between the good and bad bacteria
MODE OF ACTION OF PROBIOTICS

Features of probiotics possibly relevant to treatment of IBS
(i) Mucosal adherence + inhibition of pathogenic bacteria adherence
(ii) Enhanced barrier function of epithelium
(iii) Secretion of bacteriocins
(iv) Acidification of the colon by nutrient fermentation
(v) Immunomodulatory actions
(vi) Alteration in mucosal response to stress
(vii) Inhibition of visceral hypersensitivity

Aliment Pharmacol Ther 2008, 28, 385–396
• Recognize that even in lactose-deficient patients, yogurt is okay

• Recommend; All Bran®; and mix it with yogurt and that seems to be a nice start

• Align® or VSL#3® may have some benefit in these patients
Probiotics & IBS & Bloating

- Kim et al (APT 2003)
- VSL #3
- Dose – $4.5 \times 10^{11}$ daily
- Route – powder
- 25 IBS subjects entered; 24 completed
- Parallel group, DB, placebo-controlled
- Rome criteria; diarrhea predominant
- 2 week run-in; 8 week trial
- Less bloating noted ($p = 0.09$); other Sx not improved
- No change in GI transit time
Table 1  Recent controlled clinical trials of single probiotic preparation in IBS

<table>
<thead>
<tr>
<th>Organism</th>
<th>n</th>
<th>Comments/outcome</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lactobacillus plantarum</td>
<td>60</td>
<td>Improved flatulence and pain</td>
<td>Nobaek et al.54</td>
</tr>
<tr>
<td>L. plantarum</td>
<td>20</td>
<td>↓ Pain in all on probiotic</td>
<td>Niedzielin et al.51</td>
</tr>
<tr>
<td>Lactobacillus GG</td>
<td>25</td>
<td>Negative; trend towards reduced diarrhoea</td>
<td>O'Sullivan and O'Morain53</td>
</tr>
<tr>
<td>L. plantarum</td>
<td>12</td>
<td>Negative</td>
<td>Sen et al.26</td>
</tr>
<tr>
<td>VSL#3</td>
<td>25</td>
<td>↓ Bloating in diarrhoea-predominant IBS</td>
<td>Kim et al.21</td>
</tr>
<tr>
<td>VSL#3</td>
<td>48</td>
<td>↓ Flatulence in IBS with predominant bloating</td>
<td>Kim et al.22</td>
</tr>
<tr>
<td>Four probiotics</td>
<td>103</td>
<td>Improved at 6 months</td>
<td>Kajander et al.23</td>
</tr>
<tr>
<td>L. GG</td>
<td>50</td>
<td>IBS in children; overall negative; reduced distension</td>
<td>Bausserman and Michail27</td>
</tr>
<tr>
<td>Lactobacillus reuterii</td>
<td>54</td>
<td>Negative; trends for improvements in constipation and flatulence</td>
<td>Niv et al.24</td>
</tr>
<tr>
<td>Lactobacillus salivarius,</td>
<td>77</td>
<td>No benefit for the lactobacillus; bifidobacterium improved all cardinal IBS symptoms</td>
<td>O'Mahony et al.8</td>
</tr>
<tr>
<td>Bifidobacterium infantis 35624</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. infantis 35624</td>
<td>362</td>
<td>In a dose of $10^8$ improved all cardinal symptoms; global assessment &gt;20% therapeutic gain over placebo</td>
<td>Whorwell et al.56</td>
</tr>
</tbody>
</table>
Table 2. Large RCT of probiotics in irritable bowel syndrome (IBS)

<table>
<thead>
<tr>
<th>Probiotic dose</th>
<th>Reference</th>
<th>Subjects</th>
<th>Duration of treatment</th>
<th>Outcome significant differences only</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lactobacillus reuteri</strong> $2 \times 10^8$ CFU/day</td>
<td>Niv <em>et al</em>[^82]</td>
<td>54 Rome II criteria IBS</td>
<td>24 weeks</td>
<td>Flatulence decreased</td>
<td></td>
</tr>
<tr>
<td><strong>Lactobacillus rhamnosus</strong> GG $2 \times 10^{10}$ CFU/day</td>
<td>Bausserman and Michail[^85]</td>
<td>64 children (5–21 years)</td>
<td>6 weeks</td>
<td>Less distension</td>
<td></td>
</tr>
<tr>
<td><em>L. rhamnosus</em>* GG &amp; LC705, <em>Bifidobacterium breve</em> Bb99 &amp; <em>Propionibacterium freudenreichii</em> ssp. <em>Shermanii</em> $0.9 \times 10^{10}$ CFU/day</td>
<td>Kajander <em>et al</em>[^83]</td>
<td>103 IBS 37% IBS-D</td>
<td>24 weeks</td>
<td>Improvement in composite score</td>
<td>Only large study in children</td>
</tr>
<tr>
<td><strong>L. rhamnosus</strong> GG &amp; LC705, <em>B. breve</em> Bb99 &amp; <em>Propionibacterium freudenreichii</em> ssp. <em>Shermanii</em> $0.48 \times 10^{10}$ CFU/day</td>
<td>Kajander <em>et al</em>[^83]</td>
<td>86 unselected</td>
<td>20 weeks treatment + 3 weeks follow-up</td>
<td>Composite IBS score decreased</td>
<td>No difference in change in quality of life</td>
</tr>
<tr>
<td><strong>Bifidobacterium infantis</strong> $1 \times 10^6$, $10^6$ &amp; $10^{10}$ CFU/day</td>
<td>Whorwell <em>et al</em>[^86]</td>
<td>362 unselected (58% IBS-D)</td>
<td>4 weeks treatment + 2 weeks follow-up</td>
<td>Decrease in composite symptom score + pain/discomfort with $10^8$ CFU/day dose only</td>
<td>Formulation problem with $10^{10}$ CFU/day dose</td>
</tr>
<tr>
<td><strong>Fermented milk containing Bifidobacterium animalis</strong> $1.25 \times 10^{10}$ CFU/day compared to heat killed yogurt**</td>
<td>Guyonnet <em>et al</em>[^96]</td>
<td>274 IBS-C</td>
<td>6 weeks</td>
<td>Significant difference in ‘responder’ rate at 3 but not 6 weeks</td>
<td>Subgroup with &lt;3 BM/week responded better with ↑BM/week &amp; ↑responder rate</td>
</tr>
</tbody>
</table>

[^82]: Niv *et al* (2008)
[^83]: Kajander *et al* (2008)
[^84]: Whorwell *et al* (2008)
[^85]: Bausserman and Michail (2008)
[^86]: Guyonnet *et al* (2008)
Summary: Intestinal Gas

- Think food, food, food!
- What exacerbates the gas?
- Nondigestible carbohydrates
- Habits that cause air swallowing
- Carbonated beverages
- Food diary for 4-6 weeks
- Trial of probiotics or rifaximin