



Natural Gas: Myths and Facts

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In spite of the fact that “natural gas” is often a major concern for our patients, most physicians continue to avoid dealing with it. Instead, they proceed with investigations to rule out organic disease and once the results prove to be normal, the patients on their way. This article presupposes that an appropriate investigation was carried out to rule out organic pathology. All too often in medicine, with a lack of objective findings, physicians try to minimize symptoms. It is more difficult in this setting, where flatulence and bloating can be socially compromising.

Natural gases

Human bowel gas has five major constituents : nitrogen (N₂); oxygen (O₂); carbon dioxide (CO₂), hydrogen (H₂); and methane (CH₄). There are also traces of other gases, which, although accounting for <0.001% of the total volume, can be very offensive to the human nose (Table 1). N₂ and O₂ are derived from swallowed air. CO₂, H₂, and CH₄ are primarily derived from bacterial fermentation of non-absorbed dietary substrate, most-

Quick Cases

A prominent political figure with a 30-year history of bloating, which was getting progressively worse each workday, was briefly counseled regarding lactose intolerance, stress management and the use of a cork between his teeth to reduce air swallowing.

Using H₂ breath testing, we detected malabsorption of sorbitol, as well as lactose. Substitution of regular mints for the “sugar free” ones, containing 2 g of sorbitol, remedied the situation.

Table 1

Main Gaseous Complaints and Associated Gases

Gaseous Complaints	Gas
Excessive eructation	N ₂ , O ₂
Bloating and abdominal distention	Unknown
Excessive rectal gas	CO ₂ , H ₂ , CH ₄
Noxious flatus	H ₂ S, CH ₃ SH, CH ₃ SCH ₃
H ₂ S: hydrogen sulfide	
CH ₃ SH: methanethiol	
CH ₃ SCH ₃ : dinethylsulfide	

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Table 2
Carbohydrates Malabsorbed by Healthy Subjects

Carbohydrate	Cause of Incomplete Absorption	Main Dietary Sources
Complex Carbohydrates		
Fiber	Lack of B-glucosidase activity	Whole grains, vegetables, fruits
Resistant starch	Naturally resistant to amylase	Fruits, flours, vegetables
Retrograde starch	Crystallization-amylase resistance	Refrigerated wheat products
Oligosaccharide		
Raffinose and stachyose	Lack of a-galactosidase activity*	Legumes and other vegetables
Disaccharides		
Lactose	Low lactase activity	Milk and milk products
Simple Sugars		
Fructose	Slow intestinal transport	See Table 3
Sorbitol		See Table 3

* absent in humans

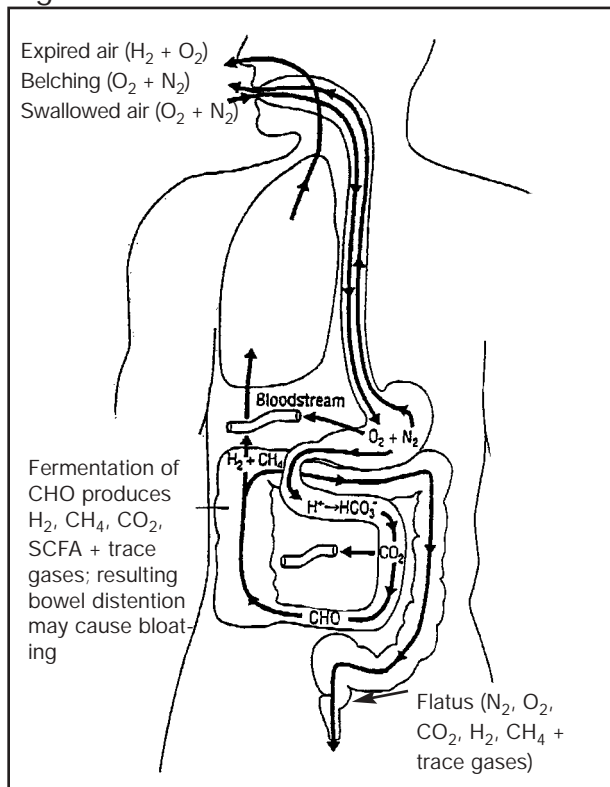
ly carbohydrates. The release of these gases is responsible for most of the gas and bloating discomfort and, by virtue of diffusion across the intestinal mucosa, and then the release of these volatile gases in expired air forms the basis of H₂/CH₄ breath testing (Figure 1).

This noninvasive, inexpensive breath test is the single most useful test for patients with bloating. It involves the measurement of breath H₂ (and possibly CH₄) in end expiratory breath samples after separate challenges with commonly ingested sugars, such as lactose, fructose and sorbitol.

Malabsorption

Elevations of H₂ or CH₄ in the expired air after an appropriate challenge is diagnostic of malabsorption. Accompanying symptoms confirm intolerance to that sugar. This is not an allergy. The five carbon monosaccharide fructose and the five car-

Figure 1 Sources of Gas Production



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bon sugar alcohol sorbitol, which cross the mucosal membrane by facilitated diffusion, are commonly malabsorbed (41.5% to 55.4% for fructose, and 47.2% to 63.0% for sorbitol.) These data are based on 25 g and 5 g challenges respectively administered to 590 patients with functional dyspepsia, representing seven ethnic groups.

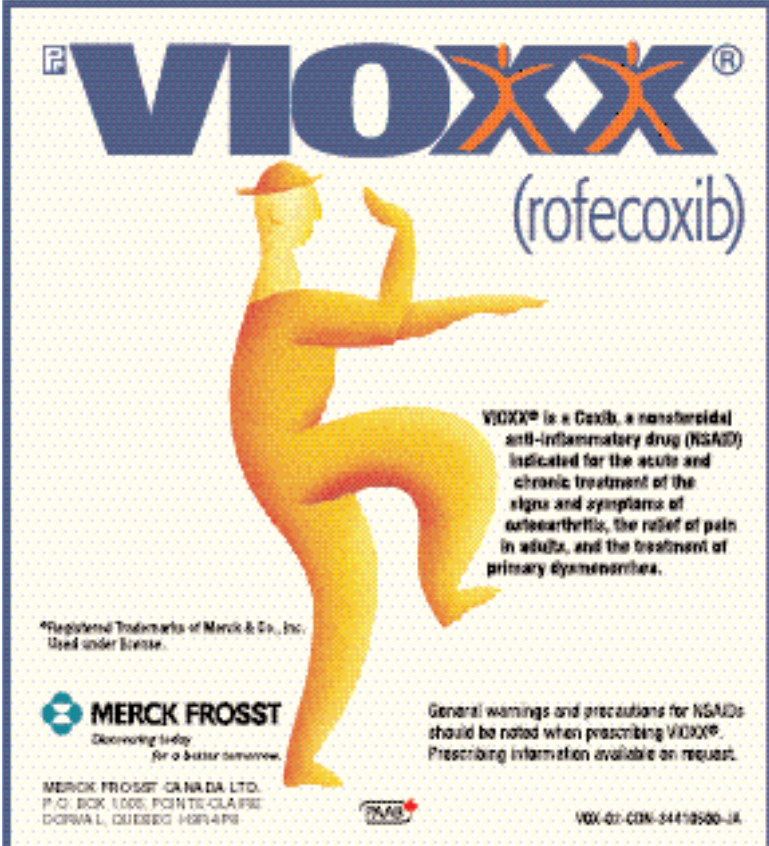
The challenges are determined arbitrarily, based on estimated consumption. In dosages higher than these virtually everyone can become a malabsorber of lactose, fructose and sorbitol. The most widely known entity is lactose malabsorption or intolerance. In contrast to the above mentioned sugars, it is most commonly based on a genetically determined absence of B-galactosidase, an enzyme which breaks down this disaccharide to glucose and galactose. The prevalence of lactose malabsorption ranges from < 15% in people of northern European descent, 60% to 70% in those of semitic or Mediterranean origin, and >90% in Orientals and Norindians. According to our above-mentioned studies, lactose malabsorption was associated with a greater than random prevalence of malabsorption for fructose and sorbitol in patients without evidence of organic pathology. In addition, it has been observed that the simultaneous ingestion of fructose and sorbitol by a malabsorber will lead to more than the additive amount of discomfort. This is due to the interference of each with the absorption of the other. Clearly, other sugars than those discussed may contribute to post-cibal bloating, *i.e.*, mannitol, xylitol, and those derived from complex carbohydrates (Table 2).

Many individuals experience a significant reduction in symptoms with the use of appropriate dietary measures, *i.e.*, avoiding specific sugar offenders (Table 3) or using lactose-reduced dairy products and B-galactosidase preparations.

For patients who do not improve, it has been proposed that proximal bacterial overgrowth may be the problem. This entity can also be diagnosed *via* breath testing after challenges with glucose, lactulose or C¹⁴ xylose.

Irritable bowel syndrome

A recent study concluded that 78% of irritable bowel syndrome (IBS) patients undergoing lactulose breath testing met the criteria for proximal small bowel overgrowth based on an early second H₂ peak. Lactulose, a synthetic sugar which is not absorbed in humans, traverses the length of the gastrointestinal (GI) tract until it encounters the normal colonic flora. The ensuing interaction causes the release of gases including H₂ and/or CH₄ and



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Table 3

Sorbitol and Excess Fructose* Content of Foods and Liquid Medications

	Sorbitol	Excess Fructose
Natural foods (g/100 g edible portion)		
Apple	0.2 - 1.0	2-7
Cherry	1.4 - 2.1	
Peaches	0.2 - 1.3	
Pear	1.2 - 3.5	3-8
Plum	0.3 - 2.8	
Prune	9.4 - 18.8	
Black currant		0-2
Melon		0-3
Beans		0-1
Honey		7
"Dietetic" foods		
Jams	up to 60.0	up to 4.5
Chocolate	up to 33	up to 42.4
Hard nougat		up to 30.3
Gum g/piece	1.3 - 2.2	
Mints g/piece	1.7 - 2.0	
Soft drinks (g/100 ml) (nondietetic)		
Cola drinks		up to 6.0
Lemon/orange		up to 5.6
Liquid medication (sweetened) g/5 ml	2.5-3.5	

is recorded as a peak on the breath test. The timing of this peak is an indirect measure of small bowel or orocecal transit time. Higher than normal concentrations of bacterial colonies proximal to the ileocecal will result in an early peak.

Forty-eight per cent of subjects whose bacterial overgrowth was eradicated no longer met the Rome criteria for IBS. These claims are currently being

investigated.

We suspect that disordered motility may be a factor contributing to "positive" breath tests for proximal small bowel overgrowth. In the case of IBS patients, this may reflect the difficulty they have with the clearing out of retained gas. In our IBS population with positive glucose breath tests 30% to 40% had postinfectious IBS or diabetes.

It appears that hyperglycemia, apart from diabetic autonomic neuropathy, can be associated with dysmotility a forerunner of bacterial overgrowth. Organic conditions associated with bacterial overgrowth must always be excluded (Table 4). A unifying hypothesis with respect to the role of intestinal gas in IBS seems to be emerging. It may not be "too much gas," but impaired transit and evacuation of intestinal gas, which may cause pain and bloating in certain patients.

Other factors

Other points with regard to intestinal gas include:

- 1) Floating stools have more to do with gas than fat content and should not necessarily be considered a sign of steatorrhea.
- 2) Excessive rectal gas (>20 flatus passages/day), means that excessive fermentable substrate is reaching the colonic flora. Radiologic and endoscopic studies are seldom of value in these patients; the only potentially useful studies are breath tests.

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Table 4

Clinical Conditions Associated with Bacterial Overgrowth

SITE	ASSOCIATED CLINICAL CONDITION
Gastric proliferation	Hypochlorhydria or achlorhydria, especially when combined with motor or anatomic disturbances/ Sustained hypochlorhydria induced by omeprazole
Small intestinal stagnation	
Anatomic	Afferent loop of Billroth II partial gastrectomy (rapid transit)* Duodenal-jejunal diverticulosis Surgical blind loop (end-to-side anastomosis) Surgical recirculating loop (end-to-side anastomosis) Obstruction (stricture, adhesion, inflammation, neoplasm)
Motor	Scleroderma Idiopathic intestinal pseudo-obstruction Absent or disordered migrating motor complex Diabetic autonomic neuropathy/hyperglycemia
Abnormal communication between proximal and distal gastrointestinal tract	Gastrocolic or jejunocolic fistula Resection of diseased ileocecal valve Chronic pancreatitis Immunodeficiency syndromes Cirrhosis

*rapid delivery of substrate to normal colonic flora will result in an early H₂ peak. This is a false positive test for proximal overgrowth.

Modified from: Sleisinger and Fordtran, Sixth Edition, Ch. 89, 1998, pp. 1523-34.

- 3) Flexure syndromes arise from the entrapment of gas at the hepatic and splenic areas as well as the junction of the descending and sigmoid colon. This pain, which is often a major problem for the patient, is induced by overstretching of the viscera and may be widely referred. The constipation and anxiety, which are often present, should be dealt with and the patient provided with an appropriate explanation and reassurance once organic pathology is ruled out.
- 4) Magenblase syndrome arises from progressive and excessive accumulation of swallowed air during the day. Symptoms are often relieved by belching.

Treatment

In contrast to the rapid relief of gastroesophageal reflux disease which is achieved with proton pump inhibitors, the treatment of natural gas is seldom as simple and gratifying. For the fortunate, dietary measures, including an elimination diet under the supervision of a specially trained dietician, and B-galactosidase enzyme supplements for the case of lactose intolerance do the trick. Alpha-galactosidase, which is meant to reduce the discomfort experienced after the ingestion of legumes by breaking down oligosaccharides may be helpful but is not indicated

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for reduction of bloating associated with fibre intake (Table 1). The only contraindication for its use is galactosemia.

The efficacy of simethicone, activated charcoal and pancreatic enzymes have been not been proven in controlled trials in this setting. In general, antacids do not benefit these groups of patients while over-the-counter bismuth products may help reduce flatus malodour.

Lifestyle measures, such as avoiding the chewing of gum, chewing food slowly and completely, and inserting a cork between the teeth, are probably more trouble than they are worth.

Control of constipation is certainly a good thing. Tegaserod hydrogen maleate is a newly released 5-HT₄ receptor partial agonist. It is targeted for constipation predominant IBS females. The role of this drug, as well as antibiotics and probiotics, remains to be defined. [CME](#)

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Suggested Readings

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