FOOD INTOLERANCE IN IBS:
FODMAPS AND BEYOND

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For a Digestive Peace of Mind

DISCLOSERS

Consultant: Fody Foods

Sponsored posts: Salix, Campbell soup, Casa de Sante

Published low FODMAP books, app, e-books

OBJECTIVES

- Distinguish between the causes and symptoms of food allergy and food intolerance
- Detail factors involved with food intolerance/malabsorption and GI symptom induction
- List potential IBS food triggers

IBS: ROME IV CRITERIA

Recurrent abdominal pain x 3 month, at least 1 day per week associated with two or more of the following:

- Related to defecation
- Onset associated with a change in the frequency of stool
- Onset associated with a change in the form of stool

Mearin et al. Gastroenterology. May 2016

ROME IV: ALTERATIONS TO NOTE

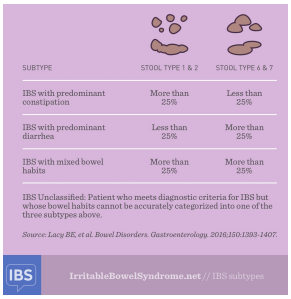
- Motility disturbance: alteration in the movement of food and waste through the GI tract.
- Visceral hypersensitivity: heightened experience of pain in the internal organs.
- Altered mucosal + immune function: changes in the gut's immune defenses.
- Altered gut microbiota: changes in the community of bacteria in the gut
- Altered CNS processing: changes in how the brain sends and receives from the gut.

https://theromefoundation.org/rome-iv/whats-new-for-rome-iv/

4 IBS SUBTYPES

Based on stool type and frequency.

The subtypes have not changed, but Rome IV includes a slightly new way of identifying IBS subtypes. Subtypes are based frequency of loose or very hard stools.



SUBTYPE	STOOL TYPE 1 & 2	STOOL TYPE 6 & 7
IBS with predominant constipation	More than 25%	Less than 25%
IBS with predominant diarrhea	Less than 25%	More than 25%
IBS with mixed bowel habits	More than 25%	More than 25%

IBS Unclassified: Patient who meets diagnostic criteria for IBS but whose bowel habits cannot be accurately categorized into one of the three subtypes above.

Source: Lacy BE, et al. Bowel Disorders. Gastroenterology. 2016;150:1393-1407.

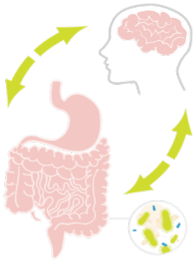
IBS IrritableBowelSyndrome.net // IBS subtypes

IBS: GUT BRAIN AXIS

- Enteric nervous system and CNS derive from same nerves in fetus.
- Stimulation of the bowel can affect areas in the brain producing emotional distress, which in turn can affect bowel functioning.
- Emotional conflict can lead to greater IBS symptoms; treatments directed at emotional distress, like hypnosis or relaxation methods and anti-depressants can reduce symptoms

GUT: BRAIN AXIS

- Vagus nerve is a key route of communication btw gut microbes & brain.
- Gut microbiota regulates neurotransmitters/ brain chemicals such as: serotonin (alters precursors), GABA, dopamine



Dinan, TG, Cryan, JF The Microbiome-Gut-Brain Axis in Health and Disease Gastroenterol Clin N Am 2017;77-89.

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IBS EPIDEMIOLOGY

- IBS impacts about 11% of the population globally w/ range from 10-25%
- Only 30% will consult with a physician about their sx.
- Female predominance; 1.5 to 3 fold higher compared to men
- IBS occurs in all age groups, including children.
- IBS is twice as high in individuals with biological relative with IBS.

Clin Epidemiology 2014:6 71-80

ALLERGY VS. INTOLERANCE

Food allergy: immune mediated reaction

Food intolerance: non-immune, enzymatic defects such as lactose intolerance, transport defects such as fructose, pharmacological such as effects of vasoactive amines or undefined such as NCG/WS.

FOOD-RELATED REACTIONS: ALLERGY, AUTOIMMUNITY, AND INTOLERANCE

Food reaction	Pathogenesis	Clinical Entity	Symptoms
Allergy	IgE, non IgE, occasional IgE	Food allergy, F-PIES, EoE	Respiratory, GI, cardiovascular, skin, anaphylaxis
Autoimmune	Innate and adaptive immunity	Celiac disease (1% population)	GI symptoms, fatigue, low iron osteoporosis, B_{12}, folic acid, weight loss or gain, and more
Food intolerance	Disorder of digestive/absorptive process, toxic or pharmacologic reactions	Lactose intolerance Sucrose-isomaltase deficiency,+ FODMAP Histamine	**GI** Gas, bloat, constipation/diarrhea, pain **Other** Hives, low blood pressure, headaches, pain, diarrhea

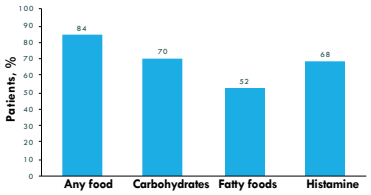
Rosells-Camps A, Ann Fam Enferm Dig. 2013 Apr;105(4):201-6, https://www.aaaai.org/Aaaai/media/MediaLibrary/PDF%20Documents/Libraries/EL-food-allergies-vs-intolerance-patient.pdf

FOOD AND IBS SYMPTOMS

197 IBS patients (Rome III)

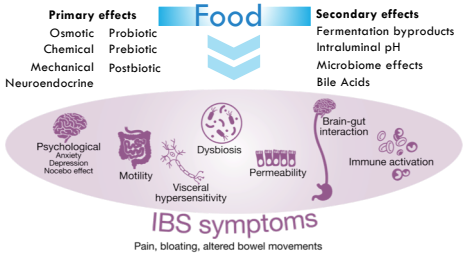
Symptom severity correlates with number of food sensitivities

No impact of IBS subgroup



Bohn L et al. *Am J Gastroenterol.* 2013;108:634.

FOOD AND GI SYMPTOMS

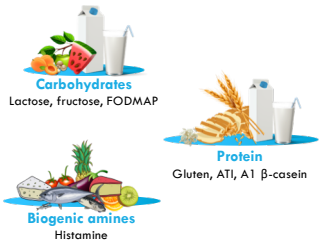


Spencer M et al. *Curr Treat Opin Gastroenterol.* 2014.

FOOD INTOLERANCE

Food intolerance syndromes and non-immune mediated intolerance contribute to GI and extra-intestinal symptoms

Occurs in **15-20%** in Westernized countries



Carbohydrates
Lactose, fructose, FODMAP

Protein
Gluten, ATI, A1 β-casein

Biogenic amines
Histamine

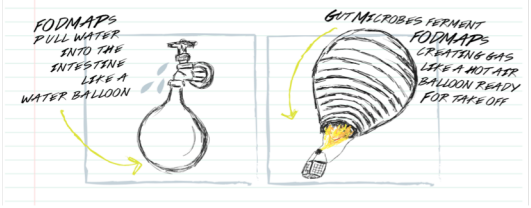
ATIs, amylase trypsin inhibitors.
1. Ortolani C. *Best Pract Res Clin Gastroenterol.* 2005;20(3):467-83; 2. Lomer MCE et al. *Aliment Pharmacol Ther.* 2015;41:261-276.

FODMAP IS AN ACRONYM

Fermentable
Oligosaccharides (fructans and GOS)
Disaccharides (lactose, milk sugar)
Monosaccharides (excess fructose)
And
Polyols (sugar alcohols such as mannitol and sorbitol)

GOS, galacto-oligosaccharides.

FODMAP EFFECTS



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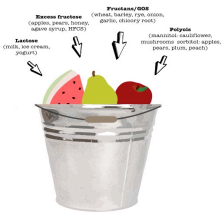
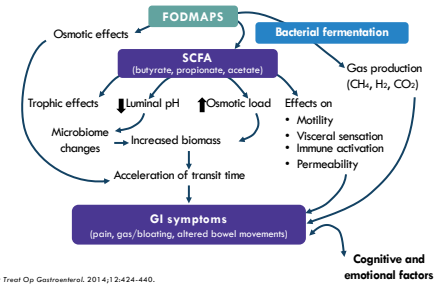
FODMAP EFFECTS ARE CUMULATIVE



POTENTIAL ROLE OF FODMAPS IN IBS SYMPTOMS



Spencer M et al. *Curr Treat Op Gastroenterol.* 2014;12:424-440.

FODMAP SENSITIVITY & SYMPTOMS

Symptoms are triggered **due to response of the enteric nervous system** to the luminal distention likely due to:

- Nature of gut flora (location and type)
- Dysmotility impacting fluid and gas clearance

- Visceral hypersensitivity
- Possibly, intestinal distention induced mast cell degranulation
- Bacterial metabolites as by-product of fermentation of FODMAPs may play a role (histamine/LPS)

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WHY ARE FODMAPS MALABSORBED?

- **Lactose:** Up to 70% of the world population has lactase non persistence, also secondary LI observed in post-infectious IBS & SIBO
- **Fructose:** poor absorption due to it's slow, low-capacity transport mechanism across the epithelium & SIBO; FM occurs in 1in 3 ppl
- **Fructans/ GOS**: humans lack digestive enzymes
- **Polyols**: too large for passive diffusion; absorbed in pores in small intestine.

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MRI STUDY: FODMAPS EFFECT ON SMALL & LARGE INTESTINE CONTENTS

Purpose: Investigate the action of fructose and inulin on the small bowel and colon in healthy subjects using MRI technique.

N=16 healthy subjects (no IBS)
Randomized single-blind crossover study

Murray el al *Am J Gastroenterol* 2014

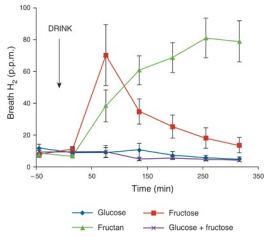
METHODS

Volunteers underwent a baseline fasted scan 45 min before ingestion of the test meals.

Test drinks=500 ml H_20 w/ either 40 g gluc, fructose, inulin or mix of 40 g gluc + 40 g fructose

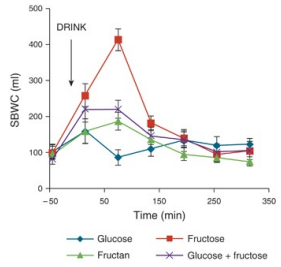
Followed by a scan every hour up to t=3oo min. After each scan, breath hydrogen (H_2) tests were performed using a portable hand-held breath H_2 meter

BREATH HYDROGEN



Murray, et al 2014 Am J Gastro

SMALL BOWEL WATER CONTENT



WHO IS APPROPRIATE FOR THE LFD?

- ☑ No evidence of eating disorder, maladaptive eating or extreme food fears
- ☑ Diet recalls reveal high FODMAP foods
- ☑ Eating exacerbates symptoms
- ☑ Nutritional approach to treatment is desired
- ☑ Celiac serology testing has been completed with adequate gluten intake

LOW FODMAP 3 PHASES

	1 Elimination	2 Determine Sensitivities/ Reintroduction	3 Personalization
Time frame	2-6 weeks	6-8 weeks	As needed for symptom management
Goal	Remove all high FODMAP foods in attempt to provide symptom resolution	Systematically add FODMAP subtypes back into diet to identify food triggers	Add back successfully reintroduced FODMAP foods to expand diet to personal tolerance

SAMPLE OF HIGH-FODMAP FOODS

Excess fructose
Apples, boysenberry, figs, mango, pears, watermelon, asparagus, artichoke, sugar snap peas, high fructose corn syrup, honey, agave

Lactose
Milk, custard, ice cream, yogurt, milk powder, ricotta cheese, cottage cheese

GOS
Legumes, pistachios, cashews

Polyols
Apples, apricots, blackberries, nectarine, peach, pears, cauliflower, mushrooms, sugar alcohol additives[a]

Fructans
Dried fruits, nectarine, persimmon, watermelon, artichoke, **garlic, onion, wheat**, barley, rye, chicory root extract, inulin additives

GOS, galacto-oligosaccharides.
[a]Isomalt, mannitol, sorbitol, maltitol.
1. Shepherd SJ et al. *Clin Gastroenterol Hepatol.* 2008;6:765-771; 2. Shepherd SJ, Gibson PR. *Clin Gastroenterol Hepatol.* 2008:6:765;
3. Eswaran SL, Chey WD. *Gastroenterol Clin N Am.* 2011;40:141.

FODMAP SWAPS

Food	Choose	Lose
Garlic	Garlic infuse oil; Boyajian brand	Garlic flesh, garlic powder or salts
Onion	Shallot or onion infused oil or use chives, asafetida powder or green part of leeks or scallions	Onion, shallot, leek (Fructan in the bulb); onion powder or salts
Legumes	¼ cup canned: rinsed and drained chickpeas or ½ cup canned lentils	Kidney beans or dried beans
Wheat flour	King Arthur GF flour blend, Trader's Joes GF flour, Bob's Red mill 1 for 1 cup GF	Wheat flour
Soybean	Firm tofu, edamame	Soymilk made w/ whole soybean, silken tofu
Milk alternatives	Lactose free milk, hemp, almond, canned coconut milk, rice milk	Cow's milk
Cheese	Most hard/aged cheese	Ricotta/ Cottage

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CONFUSING: CORN

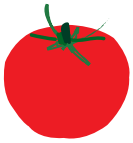
- Corn oil—low FODMAP---no carbs
- Corn starch=OK Starch= long chain carbs. FODMAPs short chain
- Sweet corn (corn on the cob) (oligos, sorbitol); Corn flakes (oligos)
- Corn meal/polenta/tortilla: LF
- Popcorn: LF

DAIRY

- Most cheeses low lactose.
- Lactose is in wet part that is drained off with whey.
- Greek yogurt lower in lactose than traditional.
- Cheeses such as American, Cheddar, feta, Brie, semi-soft goat cheese low enough for low FODMAP diet
- Whipped cream, half and half, cream cheese (2 TB) in small amount well tolerated and low enough in lactose.

TOMATO

- Diced tomatoes (avoid canned w/ onion/garlic)=low
- Sun dried tomatoes: limit to 3 pieces (8 grams)
- Marinara: Choose products made without onion/garlic (Prego Sensitive Recipe, Rao's Sensitive Formula, Fody foods)



SOY

High FODMAP

Soy flour, whole mature soybeans, silken tofu

Low FODMAP

Edamame (1 cup), firm tofu, soy milk made with soy protein (8th Continent ®), soy sauce, soy lecithin

SOURDOUGH BREAD

- ✓FODMAP testing at Monash University has shown sourdough wheat/spelt bread to be lower in FODMAP than regular wheat and spelt breads
- ✓Choose breads leavened with sourdough culture only-as slow leavened—less FODMAPs
- ✓If product contains baker's yeast—rising was accomplished faster – and likely more FODMAPs remain.

LABEL READING TIPS

Highlight of some *High FODMAP* ingredients:

- Agave, honey, HFCS, chicory root, inulin, FOS, fructose, dates, molasses
- Wheat as primary ingredient—unlike GF diet, traces are okay
- Soy flour or whole soybean, other bean flours
- Apple and pear juice
- Natural flavors-can denote onion/garlic in savory USDA regulated foods (meat products/ broth)

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BASIC GUIDELINES FOR THE REINTRODUCTION PHASE

- Test one FODMAP group (lactose, excess fructose etc.) at a time & choose foods that contain only one FODMAP.
- Consume a food amount that represents a normal intake (not excessive amounts).
- Continue to restrict all FODMAPs (maintain a low FODMAP diet) except the food that is being tested until tolerance or intolerance is confirmed.
- Record symptoms experienced for each challenge.
- Use the same food for each of the 3 challenge days.

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DETERMINE SENSITIVITIES WITH THE FOLLOWING FOODS

- **Lactose:** ½ -1 cup milk
- **Fructose:** 1-2 TB. honey or ½ mango
- **Fructans:** 2 slice wheat bread, 1 TB onion, ½ garlic clove
- **GOS:** ½ cup beans
- **Polyols:** ½ cup mushrooms, 1/3 cup cauliflower (mannitol) or 1 peach , 5 blackberries (sorbitol)

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BREAKING IT DOWN

MANNITOL CHALLENGE	
DAY 1	½ cup raw mushrooms
DAY 2	1 cup raw mushrooms
DAY 3	1½ cup raw mushrooms

NOTE: YOU CAN COOK THE MUSHROOMS JUST MEASURE THE PORTION AMOUNT IN RAW FORM.

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WHAT IS A FAILED CHALLENGE?

- A failed challenge should be a noticeable & significant change in symptoms.
- Symptoms may resemble an IBS flare: diarrhea, cramping, return of constipation, bloating.
- = Undesirable outcome.

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WHY REINTRODUCE FODMAPS?

- Research has shown that the low FODMAP diet reduces bifidobacteria and other probiotic gut bacteria (butyrate-producing Clostridium cluster XIVa and mucus-associated Akkermansia muciniphila (Halmos, Gut 2015)
- Stool pH increases slightly on the low FODMAP diet---this may allow pathogenic microbes to grow. (Halmos, Gut 2015)
- The low FODMAP has been shown in 2 studies to increase gut microbial diversity—a good thing. (Halmos Gut 2015, McIntosh Gut 2016)

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NON-RESPONDER

Assess symptoms:

- Bloating & post prandial fullness: r/o SIBO, gastroparesis
- Constipation: assess for slow transit constipation and/or dyssynergic defecation, high colonic stool burden, methane + SIBO
- Diarrhea: parasitic infection, bile acid malabsorption, SIBO
- Other food intolerance/sensitivities: gluten, fat, food chemicals-histamine, milk protein (A1 vs A2)
- Consider probiotics, gut-directed hypnotherapy + other gut-brain directed therapies.

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THE SCIENCE: RCTS EVALUATING THE LOW-FODMAP DIET FOR IBS

7 RCTs compared a low FODMAP diet with various controls in 397 participants

A low FODMAP diet was associated with reduced overall symptoms compared to controls (RR 0.69; 95% CI 0.54, 0.88, I2 25%)

The 3 RCTs that compared low FODMAP diet with rigorous control diets had the least heterogeneity between studies but also the least magnitude of effect

The overall quality of the data was "very low" according to GRADE criteria

- Most studies were high risk of bias
- Heterogeneity between study designs

Dionne JC et al. Presented at DDW 2018. Washington, DC: June 4, 2018; Abstract 1648.

LOW FODMAP VS. TYPICAL AUSTRALIAN DIET

- This RCT compared GI sx. x 3 weeks of low FODMAP diet w/ the *moderate* FODMAP intake of a typical Australian diet
- Crossover interventional study
- 38 participants: 30 IBS & 8 healthy controls
- Almost all food, comprising 3 main meals & 3 snacks daily provided.
- GI symptoms were measured daily during the baseline week and interventional diet periods using a 100 mm visual analogue scale (VAS).

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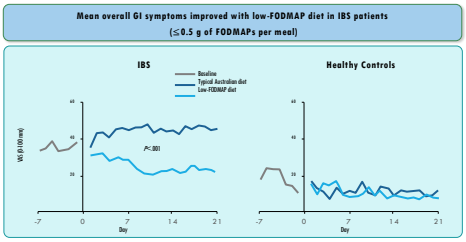
Halmos, E et al Gastroenterology (2014)

LOW FODMAP VS. TYPICAL AUSTRALIAN DIET



Halmos et al. Gastroenterology 2014

RESULTS: FODMAP VS. TRADITIONAL DIET

- Subjects with IBS had lower overall gastrointestinal symptoms scores while on a diet low in FODMAPs, compared with typical Australian diet
- Sx reduced by 50% in 70% of IBS pts. (Noted as good sx control)
- **Symptoms were minimal and unaltered by either diet among controls.**
- Of the 70% of subjects who felt better on the low FODMAP diet, this encompassed subjects across all four subtypes of IBS.

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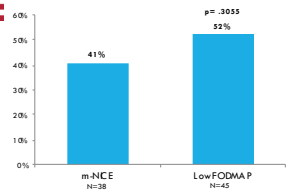
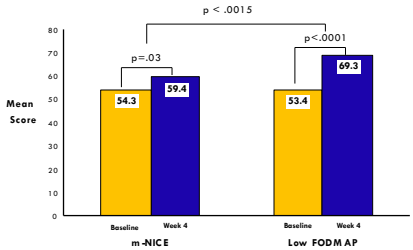
First US, RCT:
Low FODMAP vs. Modified NICE Diets for IBS-D



"In the last week, have you had adequate relief of your GI symptoms?"
Proportion of patients that answered "Yes" for ≥50% of weeks 3 and 4

Eswaran, Chey et al Am J Gastroenterol. 2016 Dec;111(12):1824-1832.
Slide courtesy of U. Michigan; W. Chey

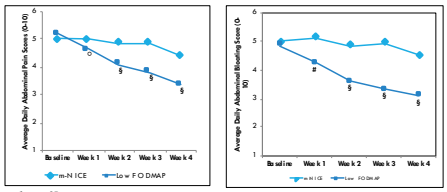
LFD VS. MNICE DIET: IBS-QOL SCORES



Eswaran, Chey et al. Am J Gastroenterol. 2016 Dec;111(12):1824-1832

Slide courtesy of W. Chey/ U. Michigan

Weekly Abdominal Pain & Bloating Scores



* = p ≤.05
◦ = p ≤.01
= p ≤.001
§ = p ≤.0001

P values refer to the change WITHIN group comparing to baseline score

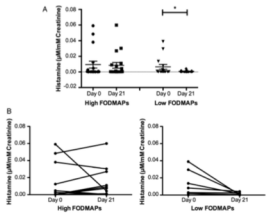
Eswaran, et al, Am J Gastroenterol 2016;111:1824; slide courtesy of U. Michigan/ W. Chey

LFD & THE METABOLOME

- N=37 IBS (19 LFD; 18 HFD) x 3-week diet.
- LFD increased bacterial richness.
- Metabolic profiling of urine differed after the diet ($p<0.01$), with 3 metabolites (histamine, p-hydroxybenzoic acid, azelaic acid)
- Histamine, a measure of immune activation, **was reduced eightfold** in the LFD group ($p<0.05$) and increased in the HFD group in subsets of patients. Strong evidence that histamine is an important signaling molecule linked IBS symptoms.
- P-Hydroxybenzoic & azeliac acid increased on LFD—associated with potential anti-inflammatory effects.

McIntosh K. Gut. 2016

LFD & THE METABOLOME



Eight-fold reduction of urinary histamine in the low vs. high FODMAP group

Histamine is known to be elevated in the intestinal tissues of IBS patients and can sensitize pain-sensing nerves. Several studies suggest that blocking histamine signaling decreases pain sensations in a subset of IBS patients. Lowering FODMAPs in the diet appears to be another means of decreasing histamine signaling.

McIntosh K. Gut. 2016 Mar 14.

LFD & METABOLOME

Do FODMAPs modulate visceral sensitivity due to changes in gut microbiome and gut permeability?

N=12 ; 6 IBS and 6 HC

Fecal samples obtained before & after LFD

Fecal LPS was 2 fold higher in IBS-D patients compared to HC

4 week treatment of LFD resulted in significant improvement of IBS symptoms and normalized fecal LPS to level similar of HC

Zhou SY, Gillilland M 3rd, Wu X, et al. FODMAP diet modulates visceral nociception by lipopolysaccharide-mediated intestinal inflammation and barrier dysfunction. ***J Clin Invest***. 2018;128(1):267-280.

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VISCERAL HYPERSENSITIVITY

In separate study, fecal supernatant from IBS-D patients and HC were administered intra-colonically to naïve rats & visceral hypersensitivity to colonic distention was evaluated 3 hours later.

Behavioral pain studies showed fecal supernatant from IBS-D patients given in colon caused a 3-4 increase in visceral motor response to colonic distention while no visceral motor response occurred in rats receiving fecal supernatant from HC.

DDW 2016 Zhou, SY et al; U. Michigan

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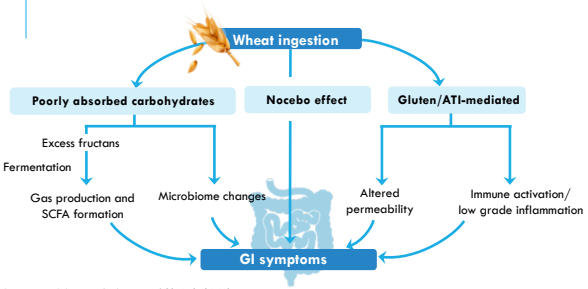
WHEAT INTOLERANCE: FODMAPS & BEYOND



Spencer M et al. *Curr Treat Op Gastroenterol.* 2014;12:424-440.

AMYLASE TRYPSIN INHIBITORS (ATIS)

ATIs

- Pest-resistance molecules in wheat[1]
- Family of 17 proteins constituting 4% of total wheat protein[1]
- Highly resistant to intestinal proteases and heat[1]

Activate innate immunity and may fuel gut inflammation[1,2]

Associated with non-celiac wheat intolerance?[1,2]

- Modern gluten-containing staples (hybridized wheat) have levels of ATIs 100-fold higher than gluten free food[3]
  - Older wheat variants (Emmer, Einkorn) have lower ATI bioactivity
  - GF grains lowest ATIs

1. Schuppan D et al. *Best Pract Res Clin Gastroenterol.* 2015;29:469-476; 2. Junker Y et al. *J Exp Med.* 2012;209(13):2395-2408; 3. Zevallos VF et al. *Gastroenterology.* 2017;152(5):1100-1113.

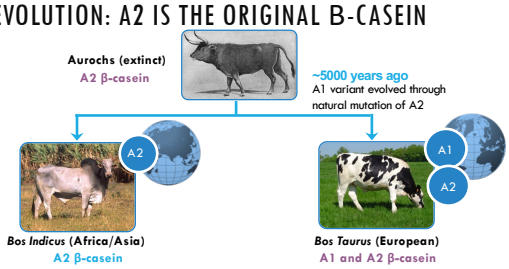
WHAT IF ITS A1 B-CASEIN INTOLERANCE?

Goats, sheep, water buffalo and human breast milk contain **A2-type β-casein protein**

Due to a genetic mutation, cows can produce milk with 3 variations of casein (**A1/A1, A1/A2, A2/A2**)

- Most dairy operations pool all of this milk together so conventional milk is a mix of A1/A2 β-casein proteins
- It is possible to identify cows that produce A2/A2 through a simple genetic test
- Milk produced by these cows is generally considered A1 protein-free

EVOLUTION: A2 IS THE ORIGINAL B-CASEIN

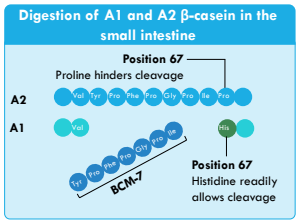


THE RESULT OF A1 B-CASEIN DIGESTION

BCM-7, a peptide fragment and μ-opioid receptor agonist, is formed as a result of the incomplete digestion of A1 β-casein[1]

This does not happen with A2 β-casein, which undergoes complete digestion[1]

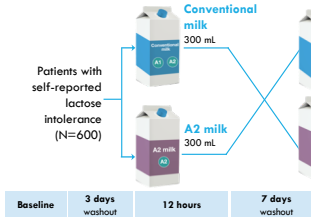
- BCM-7 is degraded by DPPIV[2]
- Activity of DPPIV varies between individuals leading to susceptible groups[2]



BCM-7, β-casomorphin-7; DPPIV, dipeptidyl peptidase IV.
1. Jinsmaa Y, Yoshikawa M. *Peptides*. 1999;20(8):957-962; 2. Kost NV et al. *Peptides*. 2009;30(10):1854-1860.

MILK CONTAINING A2 B-CASEIN REDUCES GI SYMPTOMS OF MILK INTOLERANCE

Randomized, crossover, double-blind trial

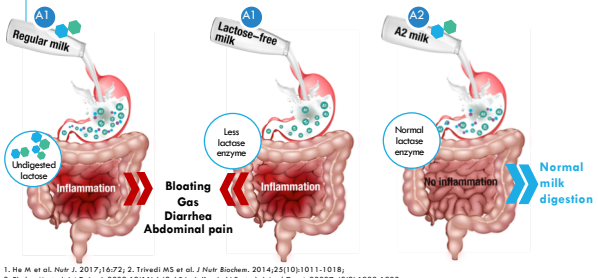


At 12 hours, A2 milk associated with significantly ($P<0.0001$) lower GI symptoms

- Bloating
- Abdominal pain
- Stool frequency
- Stool consistency

He M et al. *Nutr J*. 2017;16:72.

EXPOSURE TO A1 PROTEIN FROM CONVENTIONAL MILK *MAY* COMPROMISE LACTOSE DIGESTION



1. He M et al. *Nutr J*. 2017;16:72; 2. Trivedi MS et al. *J Nutr Biochem*. 2014;25(10):1011-1018;
3. Phelan M et al. *Int Dairy J*. 2009;19(11):643-654; 4. Kaminski S et al. *J Appl Genet*. 20087,48(3):1989-1998.

LACTOSE INTOLERANCE

Lactose malabsorption
- Incomplete digestion of lactose
- May or may not have symptoms

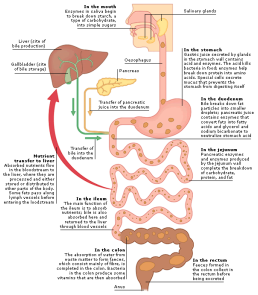
Lactose intolerance
- Symptoms w/ lactose ingestion
- Depends not ONLY on the expression of lactase but also dose of lactose, nature of microbes in the gut, GI motility, SIBO, sensitivity of gut to gas production and fermentation end products (SCFAs)

Lactose malabsorption is the most common genetic disease in the world

~2/3 of the world's population experiences a genetic reduction of lactase synthesis

THE TERM *MALDIGESTION* REFERS TO DEFECTIVE HYDROLYSIS OF NUTRIENTS, WHEREAS *MALABSORPTION* REFERS TO IMPAIRED MUCOSAL ABSORPTION.

Digestion primarily occurs in the duodenum and proximal jejunum



CAUSES OF MALDIGESTION

- **Inactivation of pepsin by achlorhydria;** PPIs, *H. pylori*, autoimmune disease, etc.
- **Improper mixing** (gastric surgery, gastroparesis, neuroendocrine imbalance)
- **Pancreatic insufficiency** (output issue)
- **Inactivation of lipase by low pH** (dumping syndrome)
- **Rapid transit causing malabsorption** (hyperthyroidism)

MECHANISMS OF MALDIGESTION

Mechanism	Malabsorbed Substrate	Causes
Conjugated Bile Acid Deficiency	Fat, fat-soluble vitamins, calcium, magnesium	Liver disease, biliary obstruction, SIBO, ileal disease
Pancreatic insufficiency	Fat, protein, CHO, fat-soluble vitamins, B12	Congenital, chronic pancreatitis, pancreatic tumors, hyperacidity (inactivating pancreatic enzymes)
Reduced mucosal digestion	CHO, protein	Mucosal disease (i.e. Crohn's, Celiac) , brush border enzyme deficiency (i.e. lactase),
Intraluminal consumption of nutrients	B12, macronutrients	SIBO, parasitic infection

WHEN TO SUSPECT MALABSORPTION

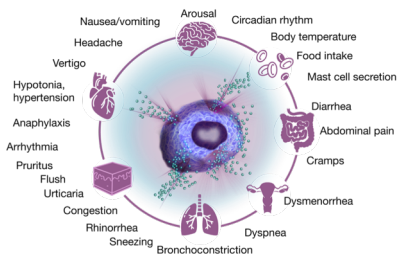
Fats: light-colored, foul smelling stools which are bulky and soft; difficult to flush.
Proteins: fluid retention (edema)
Sugars: explosive diarrhea, flatulence, or bloating
Vitamins/minerals: wasting, malnutrition, low blood pressure, weight-loss, and anemia

HISTAMINE INTOLERANCE

- Histamine: chemical released from our immune cells, in foods, created by gut microbes from amino acid.
- Histamine intolerance results from a disequilibrium of accumulated histamine and the capacity for histamine degradation
- In healthy persons, dietary histamine can be rapidly detoxified by DAO, whereas persons with low amine oxidase activity are at risk of histamine toxicity
- Some drugs can impair DAO activity
- DAO is synthesized by mature apical enterocytes-located on upper intestinal villi
- Mucosal damage (gastroenteritis, SBS) may reduce DAO and lactase activity

DAO, diamine oxidase.
1. Maintz L, Novak J. *Am J Clin Nutr*. 2007;85(5):1185-1196; 2. Enko D et al. *Can J Gastroenterol Hepatol*. 2016;Article IC 4893501.

SUMMARY OF HISTAMINE-MEDIATED SYMPTOMS



Maintz L, Novak N. *Am J Clin Nutr*. 2007;85:1185-1196.

FOODS RICH IN HISTAMINE

Fruits
Citrus fruits, strawberries, kiwifruit, papayas, pineapples, dried fruits

Vegetables
Tomatoes, spinach, eggplants

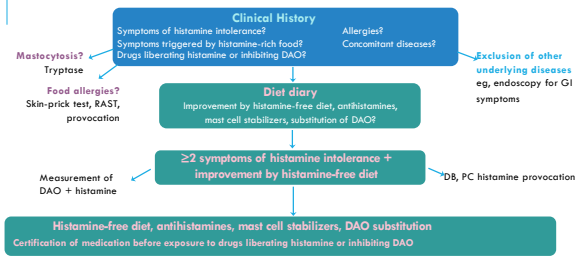
Fish
Mackerel, tuna, sardines, anchovies, herring

Aged cheeses
Cheddar, Gouda, Roquefort, Parmesan

Other
Alcohol, nuts, eggs, cured meats, chocolate, leftover meat or fish

Spencer M et al. *Curr Treat Op Gastroenterol.* 2014;12:424-440.

DIAGNOSTIC PATHWAY FOR HISTAMINE INTOLERANCE



Maintz L, Novak N. *Am J Clin Nutr.* 2007;85:1185-1196.

BALANCED NUTRITION IS KEY FOR GI HEALTH

Include nutrient rich whole food carbohydrates to feed beneficial gut microbes

Healthy fats more omega 3 vs 6 at each meal. Too much can delay stomach emptying & lead to distention

Variety of fiber sources per personal tolerance; slows stomach emptying but can add bulk to stool + potential prebiotic.

Protein rich foods should be ¼ of plate

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FOOD INTOLERANCE: RECAP

Often portion driven

Lactose intolerance: many ppl can tolerate 4 grams per serving of lactose; can use over the counter lactase enzymes to aid digestion.

Histamine: stress management, reduce histamine in diet, mast cell stabilizers and anti-histamines to manage symptoms

FODMAPs: reduce, re-challenge and personalize to least restrictive diet.

Beta-casein: choose goat or sheep milk/cheese; trial A2 milk

Assess level of food fear in IBS and/or maladaptive eating

WHEN HEALTHY EATING GOES TOO FAR.

There is some evidence that people with gastrointestinal disorders who undergo dietary change may be at increased risk for **disordered eating behaviors.**

Orthorexia nervosa: a condition in which people restrict their diet based upon its quality.

This condition is associated with symptoms such as an "obsessive focus on food choice, planning, purchase, preparation, and consumption; food regarded primarily as a source of health rather than pleasure; and exaggerated faith that inclusion or elimination of particular kinds of **food can prevent or cure disease** or affect daily well-being.

Hill P, Muir JG, Gibson PR. Controversies and Recent Developments of the Low-FODMAP Diet. *Gastroenterology & Hepatology*. 2017;13(1):36-45.

ORTHOREXIA

Bratman (1997) coined the term "orthorexia nervosa" to describe people whose extreme diets - intended for health reasons - are in fact leading to malnutrition and/or impairment of daily functioning.

Dunn TM, Bratman S. On orthorexia nervosa: a review of the literature and proposed diagnostic criteria. Eat Behav. 2016;21:11–17.

ORTHOREXIA & FOOD FEARS

When eating leads to guilt & shame…or a false sense of control.

RDNs help individuals work on developing peace with food –not fear.

Reminding individuals that "managing digestive health is about creating a fuller life, not a more limited one".

ARFID

Avoidant/restrictive food intake disorder

ARFID was introduced in the DSM-5 as a diagnosis of eating or feeding disturbance due to lack of interest in eating, avoidance of sensory characteristics of food, and/or fear of adverse eating consequence (eg, choking, vomiting, or digestive distress).

To meet diagnostic criteria, one doesn't have a distorted body image and the food disturbance must lead to one or more of the following: nutritional deficiency, weight loss, psychosocial impairment, or dependence on oral nutritional supplements or tube feedings.

ARFID can't be diagnosed if the eating disturbance is attributable to a concurrent medical or psychiatric condition.

American Psychiatric Association. Diagnostic and statistical manual of mental disorders (DSM-5). USA: American Psychiatric Association; 2013.

ARFID

Preliminary research by Zia and colleagues found that approximately 28% of their functional gastrointestinal disorder (FGID) patient sample met criteria for ARFID.

Interpret with caution as we don't want to be too quick to assign an eating disorder to GI patients given the individuality of one's sensitive gut to potential food triggers and associated behaviors.

ARFID and ED screening tools **not validated in IBS.**

Zia J, Riddle M, DeCou CR et al. Prevalence of Eating Disorders, especially DSM-5's Avoidant Restrictive Food Intake Disorder, in Patients with Functional Gastrointestinal Disorders: A Cross-Sectional Online Survey DDW 2017, Abstract Mo1551

ROLE OF DIETITIAN

Self-guided elimination place individual at nutritional risk.

Dietitians with expertise in food intolerance are essential to help guide individual

Important to rule out serious health conditions and screen for celiac serology test PRIOR to diet change.

Diet is a factor –but stress can exacerbate symptoms. Gut and brain linked via bi-directional pathway, GBA. Stress management should be part of your plan.

Dietitian can and should screen for maladaptive eating or ED prior to instructing patient on elimination diet which could trigger ED behaviors.

RESOURCES

KATE SCARLATA BLOG AND WEBSITE: RECIPES, FREE DOWNLOADS, DIGESTIVE TIPS www.katescarlata.com

CHECK OUT MY YouTube CHANNEL: FOR A DIGESTIVE PEACE OF MIND

Monash University low FODMAP diet app

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#IBELIEVEINYOURSTORY VIDEO

https://www.youtube.com/watch?v=7HQAlraW50s