



BASICS OF THE FODMAP DIET

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OBJECTIVES

Describe sources of FODMAP carbohydrate

Recognize appropriate patient populations for the FODMAP diet

Identify high FODMAP foods which are necessary to restrict when following the FODMAP diet

Identify low FODMAP foods which are allowed when following the FODMAP diet

FODMAP

- Fermentable
- Oligosaccharides
- Disaccharides
- Monosaccharides
- And
- Polyols

POPULATION

- Prevalence of IBS varies between 8% - 20% of the US population depending on diagnostic criteria and population evaluated
- Most studies report a higher prevalence of IBS in women than men
- Average medical expenditure for IBS in the US is estimated to be \$1.35 billion in direct costs and \$205 million in indirect costs
- IBS accounts for almost half of all visits to gastroenterologists

KIDS

- Kids with FGID (functional gastrointestinal disorders) report lower quality of life than healthy controls
 - Increased incidence of school absenteeism
 - Decreased energy
 - Less likely to be physically active
 - Less likely to be involved in school activities
 - Increased feelings of sadness and loneliness

TARGET POPULATION

- Patients diagnosed with functional gastrointestinal diseases (FGIDs) including IBS, abdominal migraine & childhood functional abdominal pain
- Diagnosis by exclusion
 - Celiac disease
 - IBD
 - Food allergies
 - EoE
 - Cancer
 - Gastritis

FODMAP HISTORY

- Sue Shepherd developed the FODMAP diet in 1999 at her Shepherd Works RD practice
- Realized that FODMAP foods were triggers for IBS
- In 2005, the first paper describing FODMAPs was published with Dr. Peter Gibson
- In 2006, the first research trial was a retrospective audit of patients with IBS and fructose malabsorption on a low fructose/fructan diet with 74% of patients reporting symptomatic improvement on this dietary regimen
- Early research continued until 2009 when the FODMAP diet became well known throughout the digestive community

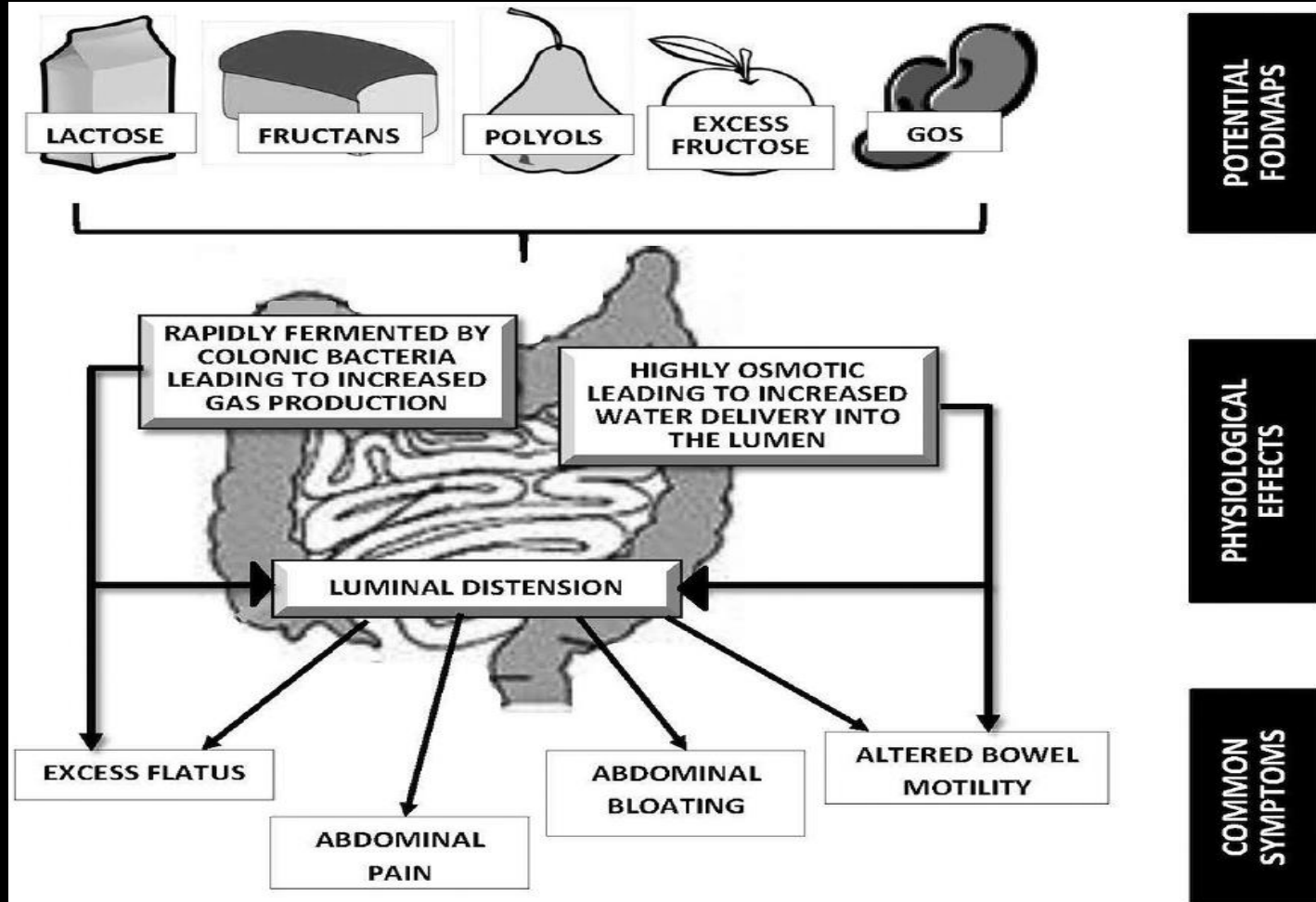
FODMAP CHARACTERISTICS

- Term was coined in 2005 by a group of Australian researchers who theorized that foods containing these forms of carbohydrates worsened the symptoms of IBS and IBD
- Short chain highly osmotic carbohydrates
- Poorly absorbed in the small intestine
- Rapidly fermented by bacteria in the gut

FODMAP MECHANISMS

- Mechanisms that may influence symptoms of FGIDs
- **Fermentation** of short chain carbohydrates
- Nonimmune food sensitivity
- Alterations in gut motility
- **Luminal** fluid shifts
- Highly **osmotic** dietary substances
- Gut hormone changes
- Gut microbiome

PROVOCATION OF IBS SYMPTOMS



FODMAP MECHANISM SUMMARY

- Low FODMAP diet alleviates symptoms by reducing undigested carbohydrates that make it to the colon and feed the colonic bacteria
- Less fermentation results in decreased abdominal pain and bloating and decreased flatulence

OLIGOSACCHARIDES

- **Fructans**
 - Linear structure
 - Wheat major source
 - Small bowel lacks ability to break bonds
 - Not absorbed at all
- **Galactans**
 - Linear structure with galactose
 - Small bowel lacks ability hydrolyze
 - Not absorbed at all

OLIGOSACCHARIDES

Fructan Culprits	Galactan Culprits
Wheat products	Lentils
Rye	Legumes
Onions	Chickpeas
Garlic	Broccoli
Artichokes	Beans
Inulin	Brussels sprouts
FOS* - added as a prebiotic	Soy-based products

DISACCHARIDES

- Lactose is naturally occurring in mammal milk
- Requires enzyme lactase to break down to glucose and galactose
- Malabsorption can be tested
 - Hydrogen breath test
 - Lactose tolerance test
 - Small bowel biopsies with enzyme activity

DISACCHARIDES

- Culprits
- Milk
- Yogurt
- Pudding
- Custard
- Cottage Cheese
- Ice cream

MONOSACCHARIDES

- Fructose
- 1:1 ratio with glucose
- Facilitated diffusion
- Absorption capacity varies from person to person
- Limited transport across jejunum
- Malabsorption
- Test
- Determine if hereditary fructose intolerance (HFI)

MONOSACCHARIDES

- Average daily intake amongst Americans = 55 grams
- Adolescents = 73 grams per day
- Most healthy adults absorb 15 grams
- 40% of adults started having symptoms with 25 grams

VOS ET AL. MEDSCAPE J MED. 2008
RAO ET AL. CLIN GASTROENTEROL HEPATOL 2007
KYAW ET AL. J CLIN GASTROENTEROL. 2011

MONOSACCHARIDES

Culprits	
Agave	Mangos
Apple*	Pears*
Honey	Sugar snap peas
High fructose corn syrup	Watermelon*

* ALSO CONTAIN POLYOLS

POLYOLS

- Sugar alcohols
- No associated active transport system
- Passive diffusion
 - Pore of epithelium
 - Molecule size
 - Molecule size makes diffusion in small bowel difficult which creates a laxative effect
 - Mucosal disease

POLYOLS

- Found in some fruits and vegetables
- Small amounts may be tolerated
- Mushrooms and cauliflower
- Added as humectants in food processing
- Added as sweeteners for use in sugar free gum and mints

POLYOLS

- **Culprits**
- Stone Fruits
 - Apricots
 - Nectarines
 - Cherries
- Sugar alcohol sweeteners
 - Mannitol
 - Sorbitol
 - Xylitol

LOW FODMAP DIET

- **A few points to remember**
 - FODMAP's in the diet do not cause functional GI disorders, but a low FODMAP diet assists in minimizing symptoms
 - Diet restricts FODMAP foods collectively, not individual food items
 - Reduce intake of ALL poorly absorbed short chain carbohydrates

LOW FODMAP DIET IMPLEMENTATION

- Full dietary recall
 - Assess frequency and volume of FODMAP intake
- Symptom history and record
- Adjust diet based on intake
 - If cultural issues, then consider reducing intake of high FODMAP food prior to completely eliminating from diet
- Target most problematic FODMAP containing foods
 - Partial restriction

LOW FODMAP DIET IMPLEMENTATION

- Most problematic per Barrett et al.
 - Oligosaccharides
 - Fructans – wheat, rye, onions, garlic, artichokes
 - Galactans – legumes
 - Disaccharides
 - Lactose – milk
 - Monosaccharides
 - Fructose – honey, apples, pears, watermelon, mango and HFCS
 - Polyols
 - Sorbitol – apples, pears, stone fruit, sugar free gum & mints
 - Mannitol - mushrooms

LOW FODMAP DIET IMPLEMENTATION

- Strict FODMAP elimination diet for 6 – 8 weeks
 - Kids
 - Chumpitazi et al found symptom improvement and lower hydrogen breath testing in 2 days
- If symptoms continue, consider reducing intake of caffeine, alcohol and high-fat foods
- Constipation may be problematic during elimination phase – use chia/flaxseed, oatmeal, rice bran

LOW FODMAP REINTRODUCTION

- Rechallenging/Reintroduction
 - Allows for individualization of diet
 - Avoids over-restriction
- Keeping a symptom log while reintroducing high FODMAP foods is an extremely important part of the process

LOW FODMAP DIET REINTRODUCTION

- Evaluate a single category at a time with a 3-5 day gap between introductions of a new category of FODMAP to assist with determining which FODMAP food is the culprit
- Monash University recommends 1 new food every four days with a 2 week washout period between bothersome foods
- If symptoms occur, then remove the food from the diet
 - **Once symptom free**
 - Decrease serving size in half and re-challenge
 - Try another food from the same FODMAP group

GROUP REINTRODUCTION

1. Polyols
2. Lactose
3. Fructose
4. Fructans
5. Galactans

CHALLENGE GROUP SERVING SIZES

- Lactose: $\frac{1}{2}$ - 1 cup milk
- Fructose: $\frac{1}{2}$ mango or 1 to 2 teaspoons honey
- Fructans: 2 slices wheat bread or 1 garlic clove or 1 cup pasta
- Galactans: $\frac{1}{2}$ cup lentils or chickpeas
- Sugar alcohols (polyols): sorbitol, 2-4 dried apricots; mannitol, $\frac{1}{2}$ cup mushrooms

HIGH FODMAP FOOD

- Per serving

Carbohydrate	Maximum Amount
Lactose	< 4 grams
Mannitol/Sorbitol (Polyols)	< 0.3 grams
Fructans	
Galactooligosaccharides	< 0.3 grams
Fructans	< 0.3 grams
Fructose	> 0.2 grams excess of glucose

BARRIERS/LIMITATIONS

- Strict elimination diets can result in:
 - Weight loss
 - Food aversions
 - Failure to thrive
 - Increased risk of nutrient deficiencies – calcium, vitamin D, fiber, vitamins A & C
 - Increased risk of eating disorders

BARRIERS/LIMITATIONS

- Restriction of prebiotic foods
- Role of small bowel bacterial overgrowth (SIBO)
- Difficult diet for vegetarians
- Cut-off levels of FODMAP content
- FODMAP content of foods in US food supply

RESOURCES

- Applications
 - Monash University
 - Low FODMAP Diet for IBS
- Websites
 - www.suesheperdworks.com.au
 - <http://www.med.monash.edu/cecs/gastro/fodmap/>
 - <http://blog.katescarlata.com/fodmaps-basics/>
 - www.ibsfree.net
 - <http://stanfordhealthcare.org>
 - www.health.arizona.edu

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