Treating Pediatric Constipation with Fiber

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Objectives

- Define constipation
- Define treatments for constipation
- Define dietary fiber
- Review fiber recommendations and intake trends
- Review clinical data on fiber intervention trials in kids (effects on constipation)
Constipation

- 3% of all children
- 25% of visits to pediatric gastroenterology
- $235 million/year, 45% from ED and outpatient for adults and children
- Mean annual cost 2010 (among 15,000 insured patients) was $11,991

Rome III Criteria

One month of >2 symptoms:

1. Two or fewer defecations per week
2. >1 episode per week incontinence after toileting starts
3. History of excessive stool retention
4. History of painful or hard bowel movements
5. Presence of large fecal mass in rectum
6. History of large diameter stools which may obstruct toilet

Rome IV with less distinction between organic and functional

www.romecriteria.org
<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td>Separate hard lumps, like nuts (hard to pass)</td>
</tr>
<tr>
<td>Type 2</td>
<td>Sausage-shaped but lumpy</td>
</tr>
<tr>
<td>Type 3</td>
<td>Like a sausage but cracks on its surface</td>
</tr>
<tr>
<td>Type 4</td>
<td>Like a sausage or snake, smooth and soft</td>
</tr>
<tr>
<td>Type 5</td>
<td>Soft blobs with clear-cut edges (passed easily)</td>
</tr>
<tr>
<td>Type 6</td>
<td>Fluffy pieces with ragged edges, a mushy stool</td>
</tr>
<tr>
<td>Type 7</td>
<td>Watery, no solid pieces, entirely liquid</td>
</tr>
</tbody>
</table>
Constipation
Enteral Therapy

- Modify diet to include more fiber, reduce constipating foods
- Medical foods (foods used as medication)
- Medication
- Behavioral intervention
Institutional Guidelines

- Evidence based guideline for maintenance, 6-12 months of age
- Constipation education, stool diary, dietary review, AND:
  1. Prune juice 2-6oz/day mixed with 2-4 oz form/water OR
  2. Lactulose 1mL/kg daily-BID (max adult dose 60mL/day) OR
  3. Miralax 0.4-1g/kg/day (mix in 4-8oz liquid; max dose 8.5g) OR
  4. Milk of magnesia 2.5-10mL/day/BID-TID
Functional Constipation

- Early intervention for treatment of functional constipation achieved 80% recovery without laxative treatment.

- Delayed intervention for functional constipation, only 32% achieve recovery without laxative therapy.

  JPGN clinical guidelines 2014, functional constipation
END SZTAM
Treatment of Constipation

Key components

- Exercise
- Water
- Fiber/ diet
- Fiber supplements
- Medications/ laxatives
General Fiber Guidelines

- Constipation:
  - Age +5 gm

- Metabolic
  - 10 – 25 gm
Uses For Fiber

- Constipation
- Diarrhea
- Ulcerative colitis
- Obesity in children and adolescents
- Hypercholesterolemia
- Diabetes mellitus/ Pre-diabetes
National Academy of Sciences Institute of Medicine Recommendations

- There is no RDA for fiber for adults or pediatrics
- There are no upper daily limits for fiber for adults or pediatrics
- Adults should consume 20-35 gm fiber per day, the average American adult consumes 12-18 gm fiber per day
- 14 gm fiber / 1000 kcal consumed (J Am Diet Assoc. 2009 Feb;109(2):350.)
Fiber Guidelines for Pediatrics

- Very few studies in pediatric population
- Age + 5 is a reasonable minimal recommendation by the American Association of Pediatrics

(Pediatrics 1995 Nov;96(5 Pt 2):1019-22)
Feeding Infant and Toddler Study (FITS)

- Telephone questionnaires (>3000) repeated in 2002 & 2008

- Results: saturated fat intake was higher than recommended and fiber intake was very low in preschool and toddlers

Clinical Study on Fiber to Treat Constipation

- n=28, mean age 7.25 yr, diagnosed with functional constipation

- Treated for 24 months with medical nutrition therapy recommending increase dietary fiber with wheat bran; Age +5 was initial treatment; wheat bran provided 26% of dietary fiber intake

- 21/28 (75%) who completed study recovered from functional constipation when they continued wheat bran

- JPGN, January 2011, vol 52, issue 1 pg 55-59
### Guidelines for Fiber

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>Male (g/d)</th>
<th>Female (g/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>4-8</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>9-13</td>
<td>31</td>
<td>26</td>
</tr>
<tr>
<td>14-18</td>
<td>38</td>
<td>26</td>
</tr>
<tr>
<td>19-50</td>
<td>38</td>
<td>25</td>
</tr>
<tr>
<td>&gt;51</td>
<td>30</td>
<td>21</td>
</tr>
</tbody>
</table>
Fiber

- Indigestible portion of foods derived from plants; it is a type of Carbohydrate
  - 2 kinds of fiber
    - Soluble
    - Insoluble
  - Fermentable vs. non-fermentable
Fiber Consumption

Historically fiber has been a nutrient of concern from the USDA Dietary Guidelines for Americans.

90% of all Americans do not meet the daily dietary guidelines for fiber.

Average intake per day is ~16.1 gm for adults; 13.2 gm for children and adolescents.

https://health.gov/dietaryguidelines/2015/guidelines/

Nutrients, 2015 Feb 9;7(2):1119-30...
Types of Fiber
Insoluble (Indigestible)

- Passes thru intestines largely intact, limited fermentation, bulking agent, promotes regularity
- Helps to control and balance the pH of the GI tract
- Moves bulk thru GI tract, increases speed of waste elimination
- Corn bran, wheat bran, seeds, nuts, greens, strands, skins, root vegetables
Types of Fiber

Soluble

- Undigested fiber which forms a gel with liquid
- Binds with fatty acids, prolongs gastric emptying time which regulates blood sugar, lowers cholesterol and LDL,
  - viscous, non-viscous, fermentable and non fermentable
  - psyllium, oats/oatbran, pectin, barley, beans, peas, nuts
# Good Sources of Soluble and Insoluble Fiber

## Foods high in soluble and insoluble fiber

<table>
<thead>
<tr>
<th>Amount</th>
<th>Food Item</th>
<th>Soluble Fiber (g)</th>
<th>Insoluble Fiber (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 each</td>
<td>Dried figs</td>
<td>7.5</td>
<td>9.9</td>
</tr>
<tr>
<td>1 cup</td>
<td>Garbanzo beans/chickpea</td>
<td>8.6</td>
<td>15.4</td>
</tr>
<tr>
<td>1 cup</td>
<td>Large lima beans</td>
<td>8.9</td>
<td>24.9</td>
</tr>
<tr>
<td>1 cup</td>
<td>Soybeans-dry</td>
<td>12.6</td>
<td>18.0</td>
</tr>
<tr>
<td>1 cup</td>
<td>Red kidney beans</td>
<td>12.7</td>
<td>22.4</td>
</tr>
<tr>
<td>1 cup</td>
<td>Corn grits</td>
<td>15.4</td>
<td>2.5</td>
</tr>
<tr>
<td>1 cup</td>
<td>Carob flour</td>
<td>30.1</td>
<td>10.9</td>
</tr>
</tbody>
</table>

## Foods high in insoluble fiber

<table>
<thead>
<tr>
<th>Amount</th>
<th>Food Item</th>
<th>Insoluble Fiber (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>½ cup</td>
<td>Wheat bran</td>
<td>11.6</td>
</tr>
<tr>
<td>1 cup</td>
<td>Dried coconut</td>
<td>12.3</td>
</tr>
<tr>
<td>1 cup</td>
<td>Pistachio nuts</td>
<td>13.4</td>
</tr>
<tr>
<td>1 cup</td>
<td>Blackeyed cowpeas</td>
<td>15.4</td>
</tr>
<tr>
<td>1 cup</td>
<td>Almonds</td>
<td>18.3</td>
</tr>
<tr>
<td>1 cup</td>
<td>Lentils</td>
<td>22.1</td>
</tr>
<tr>
<td>1 cup</td>
<td>Corn bran</td>
<td>62.6</td>
</tr>
</tbody>
</table>
Fiber Supplements

- **Viscous Soluble Fiber**: Metamucil, Konsyl (psyllium), Citrucel (methylcellulose), Fibercon (calcium polycarbophil)
- **Non-Viscous Soluble Fiber**: Fibersure (inulin), Benefiber (wheat dextrin), Unifiber (cellulose)
- **Insoluble Fiber**: Wheat bran, wheat germ and rice bran

Fermentable fiber  Poorly fermentable fiber
Supplement options

- **Wheat bran** - rich in B vitamins, folic acid and Vit E, inhibits LDL oxidation, insoluble and fermentable. May impact absorption of minerals.

- **Benefiber** - Wheat Dextrin (<20ppm gluten); resistant starch, non-viscous, soluble. Mild laxation.

- **Fibercon** - Calcium Polycarbophil, synthesized fiber, viscous & soluble, poorly fermentable.

- **Metamucil** - Psyllium Husk - outer membrane of the plantago ovate; soluble, viscous and fermentable, lowers cholesterol.
<table>
<thead>
<tr>
<th>Health Benefits</th>
<th>Chol Reduct</th>
<th>Glycemic</th>
<th>BP Reduct</th>
<th>Weight Mgmt</th>
<th>Laxation</th>
<th>Immune-enhancing</th>
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<tbody>
<tr>
<td>Traditional Dietary Fibers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat bran</td>
<td>N</td>
<td>N</td>
<td>Prob</td>
<td>Prob</td>
<td>Y</td>
<td>Poss</td>
</tr>
<tr>
<td>Oat bran</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Soluble: Viscous</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B-Glucan</td>
<td>Y</td>
<td>Y</td>
<td>Prob</td>
<td>Prob</td>
<td>Min</td>
<td>Y</td>
</tr>
<tr>
<td>Soluble: Nonviscous</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partially Hydrolyzed Guar Gum</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Poss</td>
</tr>
<tr>
<td>Methylcellulose</td>
<td>Min</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Largely Soluble: Viscous</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Psyllium</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Poss</td>
</tr>
<tr>
<td>Insoluble</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cellulose</td>
<td>N</td>
<td>N</td>
<td>Poss</td>
<td>Prob</td>
<td>Y</td>
<td>Poss</td>
</tr>
<tr>
<td>Calcium polycarbophil</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Resistant Starch</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat dextrin</td>
<td>N</td>
<td>Uncert</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Poss</td>
</tr>
<tr>
<td>Resistant maltodextrin RS3</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Poss</td>
</tr>
<tr>
<td>High amylose corn starch (RS2)</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Min</td>
<td>Poss</td>
</tr>
<tr>
<td>Oligofructosides</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inulin</td>
<td>N</td>
<td>Min</td>
<td>N</td>
<td>Min</td>
<td>N</td>
<td>Y</td>
</tr>
</tbody>
</table>

Chol Reduct, hypcholesterolemic; Glycemic, decreases glycemic index; BP Reduct, decreases blood pressure; Weight Mgmt, enhances weight loss; N, no; Y, yes; Uncert, uncertain; Min, minimal; Prob, probable; Poss, possible
Resources for Fiber Lists

- http://www.dietitians.ca/Downloads/Factsheets/Food-Sources-of-Soluble-Fibre.aspx
- https://www.prebiotin.com/resources/fiber-content-of-foods/
Case Study

ER is a 12.5 yo girl, 60% height, 99% weight. Acanthosis Nigricans, FBG 99.

Constipation, stool hard (1-2 on stool scale) every 2-3 days. Occasionally missing school for belly aches.

Described by mom as a “chronic carb craver”

Struggled with finding the right physical activity. Was active less than 1 hr per day

Divorced working parents. Meals were often rushed and on the go. Take out or heat and serve meals, 2-3 x week.

Has not started to menstruate yet
Case Study

Assessment:

- Dietary recall: limited fruit and vegetable intake 1-2 fruits averaged per day. <1 vegetable per day. 5-8 serving of grain, often processed. 3-4 glasses of skim milk per day, cheese daily for snacks. “kid food”. Loves Ice Cream.

- DX: On average: excessive energy intake 500-1000 cal per day. Saturated fats >20gm per day, <2 serving of fruit and veggies per day. fiber < 10 gm per day. Limited water intake.
Case Study

Intervention:

- Discussed meal planning with mom and dad. Need for more balance, fruit and vegetables. Fortunately they were well accepted by ER.

- Change to whole grains; but reviewed portion sizes. oats, whole wheat bread and whole grain cereals, fiber goal was 18-22 gm per day.

- Increase water intake, limit milk to 3 cups per day.

- 5 - 7 serving of fruit and veggies per day.
Case Study

Return Visits:

- Visit #1, 1 month-
  - reports less constipation, stools are 4/5 on scale and are approximately every day and a half.
  - Feeling better, has tried some new vegetables and her new favorite snack is old fashion peanut butter with celery and few raisins. Eating 3-4 fruit and veggies per day.
  - Still eating out 2-3x week, fast foods.
  - Weight is stable, but has grown 1/4 inch.
  - Upset because she was cut from 6th grade basketball team. Still less than 1 hour PE most days
Case Study

- 2 month follow up visit:
- Reports no constipation. Stools daily.
- Eating 5 serving of fruit and veggies daily, excited about them, helping mom cook and plan.
- Less eating out, using crock pot. Shopping lists and meal planning tools from last session. Reading labels for fiber and portions sizes.
- Has grown another 1/4 in, is down 3#.
- Has been playing inter mural basketball and competitive cheerleading. Active ~1 hour 6 times per week.
Case Study

6 month follow up: 13 yo

Grown 1.5 ″, at the 80% ile for height. weight dropped an addition 3#, now at the 85% ile. BG normalized (fasting 81), lightening of acanthuses nigricans, has started to menstruate.

Continues to be active. riding bike and swimming at camp in the summer.

Vegetable and fruit intake is still high. mom states “she really loves them”. Prefers whole grains except for pizza crust.

Mom is concerned about weight loss. No signs of restricted behavior, just healthy eating habits, with some balance and treats.
IBS Constipation

Recommended treatment—Low FODMAP diet (poorly absorbed carbohydrates) originally proposed at Monash University in Melbourne Australia.

Goal of diet is to limit Fermentable Oligosaccharides, Disaccharides, Monosaccharides and Polyols (FODMAPs).

- Fructose, fructans, lactose, galactans and polyols

Monash University Website [http://www.med.monash.edu/cecs/gastro/fodmap/](http://www.med.monash.edu/cecs/gastro/fodmap/)
High FODMAP foods

- Fructose: apples, pears, cherries, watermelon, asparagus, corn syrup, high fructose corn syrup
- Fructans: wheat, rye, barley, onions, broccoli, chicory root, brussel spouts, cabbage
- Galactans: beans, tofu, tempeh
- Lactose: cow milk, goat milk, yogurt
- Polyols: stone fruit, watermelon, cauliflower, mushrooms and sugar alcohols.

Monash University Website  http://www.med.monash.edu/cecs/gastro/fodmap/
Low Fodmap Foods

- Carrots, zucchini, green beans, greens, spinach, kale, tomato, colored peppers, herbs
- Banana, berries, citrus fruit, cantaloupe, honeydew melon, grapes
- Wheat/ rye free bread products, corn products, oats, quinoa
- Small amounts of almonds, seeds
- Meats, poultry and fish

Monash University Website  http://www.med.monash.edu/cecs/gastro/fodmap/
Low Fodmap Diet

- Recommended for 12 weeks, then trial foods back in from High Fodmap foods
- Often recommending a probiotic while following Low Fodmap diet

Monash University Website  [http://www.med.monash.edu/cecs/gastro/fodmap/](http://www.med.monash.edu/cecs/gastro/fodmap/)

- *Ann Nutr Metab.* 2016;68 Suppl 1:8-17
Other Tips for Treatment of Constipation

- Establish potty time daily
- Make sure child feels safe sitting on the toilet
- Legs should not dangle, ideally sitting with knees up
- Breathe out, don’t push down (described as “Frozen Breaths”)
Rome IV Debuting First Functional Gastrointestinal Disorders Educational Material for Primary Care and Non-GI Clinicians, and Pediatric Professionals.

RALEIGH, NC (May 11, 2016) – The Rome Foundation, as part of its launch of new Rome IV diagnostic criteria later this month, will be releasing two volumes designed to help the busy primary care physicians, pediatricians and other non-gastroenterological providers who see patients with Functional Gastrointestinal Disorders.