Treat The Gut: Pediatric Function Constipation

Caitlin O’Connor ND
AANP 2017
Prevalance

• 3-5% of all peds visits
• Peak during preschool years
• >25% of referrals to pediatric gastroenterology specialists in the US
• 95% is functional vs. organic constipation
• In the USA, the total additional costs for childhood constipation have been estimated to be US$3.9 billion per year.

• Furthermore, the same study revealed that the mean total unadjusted annual expenditure for children with constipation was three times higher than that for children without constipation (US$3430/year versus US$1099/year).
One-fourth of children with functional constipation continued to experience symptoms at adult age. Older age at onset, longer delay between onset of symptoms and referral to a specialized pediatric gastrointestinal clinic, and lower defecation frequency at intake were related to poor clinical outcomes at adult age.

Long-Term Prognosis for Childhood Constipation: Clinical Outcomes in Adulthood
Marloes E. J. Bongers, MD, PhD, et al
www.pediatrics.org/cgi/doi/10.1542/peds.2009-1009
Why an integrative approach is needed

Studies have shown that only 60% of children with constipation achieve treatment success after one year of therapy. Children with fecal incontinence or who are younger than four years at onset of constipation are particularly at risk of poor long-term outcomes.
Children with constipation have a lower quality of life than do children with inflammatory bowel disease or gastroesophageal reflux disease.

Rome IV criteria: Functional GI Disorders, better defined as Disorders of Gut-Brain Interaction

Without a structural basis to explain its clinical features, our understanding of these disorders adhere to a biopsychosocial model which is best represented for these disorders in the growing field of neurogastroenterology. Symptoms are generated based on a complex interaction among factors such as microbial dysbiosis within the gut, altered mucosal immune function, altered gut signaling (visceral hypersensitivity) and central nervous system dysregulation of the modulation of gut signaling and motor function.
Rome IV Diagnostic Criteria for Functional Constipation

Must include 1 month of at least 2 of the following in infants up to 4 years of age:
1. 2 or fewer defecations per week
2. History of excessive stool retention
3. History of painful or hard bowel movements
4. History of large-diameter stools
5. Presence of a large fecal mass in the rectum

In toilet-trained children, the following additional criteria may be used:

6. At least 1 episode/week of incontinence after the acquisition of toileting skills
7. History of large-diameter stools that may obstruct the toilet
Rome IV Diagnostic Criteria for Functional Constipation 4 years and up

Must include 2 or more of the following occurring at least once per week for a minimum of 1 month with insufficient criteria for a diagnosis of irritable bowel syndrome:

1. 2 or fewer defecations in the toilet per week in a child of a developmental age of at least 4 years
2. At least 1 episode of fecal incontinence per week
3. History of retentive posturing or excessive volitional stool retention
4. History of painful or hard bowel movements
5. Presence of a large fecal mass in the rectum
6. History of large diameter stools that can obstruct the toilet

After appropriate evaluation, the symptoms cannot be fully explained by another medical condition.
History

- age of onset of symptoms
- **success or failure of toilet training**
- frequency and consistency of stools (preferably expressed according to existing stool scales)
- pain and/or bleeding when passing stools
- coexistence of abdominal pain
- fecal incontinence (if present, whether it is also nocturnal)
- withholding behavior
- dietary history
- changes in appetite
- nausea and/or vomiting
- weight loss
- temperament
- **stress, tension or transitions at home**
- Family history (HD, food allergies, inflammatory bowel disease, celiac disease, urinary bladder disease, thyroid, parathyroid, kidneys, or systemic diseases such as cystic fibrosis) — particularly maternal GI function
Additional history

• 5 day journal – diet, hydration, activity
• Hx of treatment trials
Common organic causes
• Cow’s milk (or other dietary protein) intolerance
• Celiac disease
• Hypothyroidism

Urgent causes:
• Infants – Hirschsprung disease, spinal dysraphism, sacral teratoma, infantile botulism
• All ages – Cystic fibrosis, lead poisoning, intestinal obstruction
Differential Diagnosis

- Celiac disease
- Hypothyroidism, hypercalcemia, hypokalemia
- Diabetes mellitus
- Dietary protein allergy
- Drugs, toxics
- Opiates, anticholinergics
- Antidepressants
- Chemotherapy
- Heavy metal ingestion (lead)
- Vitamin D intoxication
- Botulism
- Cystic fibrosis
- Hirschprungs
- Anal achalasia
- Colonic inertia
- Anatomic malformations
- Imperforate anus
- Anal stenosis
- Pelvic mass (sacral teratoma)
- Spinal cord anomalies, trauma, tethered cord
- Abnormal abdominal musculature (prune belly, gastroschisis, Down Syndrome)
- Pseudoobstruction (visceral neuropathies, myopathies, mesenchymopathies)
- Multiple endocrine neoplasia type 2By
Red Flags

- Constipation starting extremely early in life (<1 mo)
- Passage of meconium > 48 h
- Family history of HD
- Ribbon stools
- Blood in the stools in the absence of anal fissures
- Failure to thrive
- Fever

- Bilious vomiting
- Abnormal thyroid gland
- Severe abdominal distension
- Perianal fistula
- Abnormal position of anus
- Absent anal or cremasteric reflex
- Decreased lower extremity strength/tone/reflex
- Tuft of hair on spine
- Sacral dimple
- Gluteal cleft deviation
- Extreme fear during anal inspection
- Anal scars
PE

- growth parameters
- abdominal examination (muscle tone, distension, fecal mass)
- inspection of the perianal region (anal position, stool present around the anus or on the undergarments, erythema, skin tags, anal fissures)
- examination of the lumbosacral region (dimple, tuft of hair, gluteal cleft deviation, sacral agenesis, flat buttocks)
- Anal and cremasteric reflex
- Lower limb neuromuscular examination including tone, strength, and deep tendons reflexes should be ascertained
- Evidence does not support the use of digital rectal examination to diagnose functional constipation
A digital anorectal examination is not routinely necessary for the evaluation of patients with a typical history and symptoms of functional constipation. This is because the digital anorectal examination is unpleasant for the child and has only moderate sensitivity and specificity for detecting or confirming constipation in this group of patients. However, some providers perform a digital examination in selected cases of suspected functional constipation. The goals of the examination are to detect a fecal impaction, which would require a “cleanout” approach (initiation of treatment with high doses of laxatives and/or enemas), and to detect occult blood, which would require further diagnostic testing.

-UpToDate
DRE

Recommended for:

• Infants with constipation
• Children with symptoms since early infancy
• Infants or children with other alarm signs that suggest organic disease
• Children in whom the presence or degree of constipation is unclear (eg, meeting only one Rome IV criterion)
When the history is typical for FC, the perineum should be inspected, but a digital rectal examination may not be necessary until a treatment trial fails, there is uncertainty in the diagnosis, or there is suspicion of an anatomic problem.

Childhood Functional Gastrointestinal Disorders: Child/Adolescent Jeffrey S. Hyams et al Gastroenterology 2016;150:1456–1468
Lab work-up

• Celiac screen
• Thyroid screen – TSH and free T4
• Blood lead levels
Imaging?

- Abdominal x-ray – often used, not great evidence as there is inconsistent interpretation by different observers, are not particularly specific for constipation
  - There is no role for the routine use of an abdominal x-ray to diagnose FC, however plain abdominal radiograph may be used in a child if fecal impaction is suspected but in whom physical examination is unreliable/not possible
- Spinal X-ray – if concerned about malformations
- Barium enema – confirms diagnosis of Hirschsprung
- CTT
“Red flag” findings and diagnostic clues to an underlying condition: constipation reported from birth or first few weeks of life, failure to pass meconium or delay in passing meconium (more than 48 hours after birth in term baby), long narrow ribbon-like stools (more likely in a child under 1 year), previously unknown or undiagnosed weakness in legs, locomotor delay, and abdominal distension with vomiting.

Diagnostic clues to idiopathic constipation: constipation that starts after a few weeks of life with obvious precipitating factors (fissure, change of diet, or infections in children under 1 year; fissure, change of diet, timing of potty or toilet training, and an acute event such as infection, moving house, starting nursery or school, fears and phobias, major change in family, taking medicine; normal passage of meconium (within 48 hours after birth in term baby); child generally well, with normal weight and height; no neurological problems in legs; normal locomotor development; history of poor diet or insufficient fluid intake (or both); and changes in infant formula or weaning in child under 1 year.

-NICE
Risk Factors

• FGIDs affect approximately 1 in 4 school-aged children in Greece.
• The following characteristics are associated with a higher probability of any-FGID: female gender, living in a non-nuclear household, victimization, lower parental education level, infrequent physical activity, and high television exposure.

Functional gastrointestinal disorders in Greek Children based on ROME III criteria: identifying the child at risk. Bouzios et al Neurogastroenterol Motil. 2016 Sep 2
Risk Factors

- Maternal constipation may be a significant risk factor

Etiology of functional constipation

- The triggering event is most likely the universal instinct to avoid defecation because of pain or social reasons (e.g., school, travel).
- As a consequence of withholding, the colonic mucosa absorbs water from the feces and the retained stools become progressively more difficult to evacuate.
- This process leads to a vicious cycle of stool retention in which the rectum is increasingly distended, resulting in overflow fecal incontinence, loss of rectal sensation, and ultimately, loss of the normal urge to defecate.
- Increasing fecal accumulation in the rectum also causes decreased motility in the foregut, leading to anorexia, abdominal distention and pain.

Functional constipation accounts for most of the clinical constipation in children after the neonatal period. It can often be traced to a painful, frightening, or otherwise distressing experience associated with defecation that the child wants to avoid repeating. That unhappy experience may prompt the child to try to avoid repeating it, inadvertently leading to stool withholding behaviors that promote constipation – UpToDate
Functional constipation (FC) is often the result of repeated attempts of voluntary withholding of feces by a child who tries to avoid unpleasant defecation because of fears associated with evacuation. Withholding behavior leads to stool retention that leads the colon to absorb more water, creating hard stools. In the first years of life, an acute episode of constipation due to a change in diet may lead to the passage of dry and hard stools, which may cause painful defecation. In toddlers, the onset of constipation may coincide with toilet training, when excessive caregiver pressure to maintain bowel control and/or inappropriate techniques, such as the use of regular toilets that do not allow sufficient leg support, can lead to stool withholding.
Constipation

History, physical examination, occult blood testing

Delayed passage of meconium (more than 48 hours after birth)?

- Yes
  - Red flags? (Table 3)
    - Yes
      - Referral for evaluation of possible organic etiologies (e.g., Hirschsprung disease, cystic fibrosis)
    - No
      - Exclusively breastfed (older than two weeks)?
        - Yes
          - Most likely normal
        - No
          - Functional constipation

Treatment: Education and diet modification (e.g., fruit juice, such as prune; increased fluids; verification of formula preparation)

- Effective?
  - Yes
    - Maintenance therapy
  - No
    - Medication: Lactulose, sorbitol, polyethylene glycol solutions (Miralax), occasional glycerin suppository

- Effective?
  - Yes
    - Maintenance therapy
  - No
    - If therapy fails despite good adherence and education, refer for further evaluation
Children under 1 year: fewer than three complete stools a week (this does not apply to exclusively breast fed babies after 6 weeks of age), hard large stools, “rabbit droppings” or “nuts”, distress on defecating, bleeding associated with hard stools, straining, previous episode(s) of constipation, and previous or current anal fissure.

NICE
Normal Stool Patterns for Breastfed Infants

• 2+ BM a day for first 6-8 weeks
• After that can be quite variable
• Soft, liquid-y, yellow-ish, not stinky
• Very rare for breastfed babies to be constipated (1.1%)
• Normal to go up to 10 days without bowel movement, as long as no discomfort and stool is soft there is nothing to be worried about
• Once solids are introduced, BM should be daily
Breastfeeding protective against constipation: mechanism of action

- Large amounts of prebiotic oligosaccharides in human milk provide substrates for gut bacteria and this improves osmotic balance and stool consistency
- The fat composition of human milk may help create softer stools
- Breast milk contains non-digestible oligosaccharides, which act like dietary fiber, stimulate the growth of beneficial bacteria, and promote maturation of the gastrointestinal tract.
- Breast milk also has the optimal whey protein composition and a low phosphorous content.
- Increased levels of gastric inhibitory peptide, neurotensin, and vasoactive intestinal peptide are observed in formula-fed infants compared with those in breast-fed infants

Diets for Constipation Sun Hwan Bae Pediatr Gastroenterol Hepatol Nutr 2014 December 17(4):203-208
Normal Stool Patterns for Formula fed Infants

• Typically once daily
• More firm, brown and odorous then breastfed babies
• Much more common to be constipated (9.2%)
Infant Dyschezia

Must include in an infant <9 months of age:
• 1. At least 10 minutes of straining and crying before successful or unsuccessful passage of soft stools
• 2. No other health problems

A recent questionnaire-based study of 1447 mothers showed a prevalence of 2.4% in the first year of life

Failure to coordinate increased intra-abdominal pressure with relaxation of the pelvic floor results in infant dyschezia.

<table>
<thead>
<tr>
<th>Cause of straining</th>
<th>Clinical characteristics</th>
</tr>
</thead>
</table>
| Infant dyschezia                        | - Healthy infant zero to nine months of age  
- Soft stool passed after straining      |
| Constipation                            | - Healthy infant  
- Stools are hard or pellet-like                                                      |
| Anal fissure                            | - Healthy infant  
- May or may not have history of constipation  
- Fissure identified on inspection of anus  
- Straining may be caused by voluntary stool withholding                                 |
| Cow's milk intolerance                  | - Healthy infant  
- Diet contains cow’s milk protein (breast- or formula-fed)  
- Normal or loose stools with gross or occult blood and/or mucus                        |
| Hirschsprung disease                    | - Newborn or infant  
- History of delayed passage of meconium (after 48 hours of life)  
- Well- or ill-appearing  
- Constipation or abdominal distension; occasionally diarrhea  
- Rectal examination may reveal tight sphincter, empty ampulla, and/or explosive squirt  
- Anorectal manometry demonstrates absence of rectosphincteric reflex  
- Ganglion cells absent on rectal biopsy                                                  |
| Internal anal sphincter achalasia       | - Presentation and anorectal manometry similar to Hirschsprung disease as described al  
- Ganglion cells present on rectal biopsy                                                |
Fecal occult blood for infants

• May be helpful for determining cow’s milk protein intolerance
Constipation and Cow’s Milk Intolerance

• One study focused on 65 children (ages 11 to 72 months) with chronic constipation who had been referred to a pediatric gastroenterology clinic. Patients were given cow or soy milk for two weeks; feedings were reversed after a one-week washout period.

• Improvement in constipation was observed in 68 percent of children when fed with soy milk compared with none of the children with cow's milk.

• Responding children were more likely to have coexistent rhinitis, dermatitis, or bronchospasm. They were also more likely to have anal fissures and erythema or edema at baseline, evidence of inflammation of the rectal mucosa, and signs of hypersensitivity (such as specific immunoglobulin E [IgE] antibodies to cow's milk antigens).

• It is possible that constipation in this subset of children is a manifestation of a cow's milk "protein intolerance," which typically manifests during infancy as colitis or enterocolitis.

Infant Treatment Considerations

- Reassurance
- Trial of maternal dairy removal or formula switch
- Temporary discontinuation of solids, especially iron fortified cereals
- Prune juice
- Probiotics?
Formula additions to consider for constipation

• Enzymes: 1 capsule per bottle
• Probiotics: 5-25 billion of infant Bifido-based formula
• Omegas – 1/8 teaspoon Cod Liver Oil
• Mucilages: 1/8 teaspoon Althea or Ulmus powders
• Prebiotic oligosaccarides/colostrum
Prebiotics in formula

- 160 healthy term infants. Infants were randomly assigned to receive standard formula with 0.4 g/dL GOS/FOS (90% galactooligosaccharides and 10% long-chain inulin) or control formula (standard formula) during the first 12 weeks after birth.

- The results showed significantly higher frequency of soft stools and in prebiotic formula group as compared to control group. Regarding the digestive tolerance, Rao et al showed no difference between prebiotic and control formula group in the occurrence of colic, regurgitation, vomiting and reported crying.

- On the other hand, Ziegler et al31 evidenced that infants fed by a prebiotic supplemented formula (based on GOS and lactulose) had a higher risk of irritability, eczema and diarrhea.

The prebiotic inulin as a functional food – a review FanJH et al, European Review for Medical and Pharmacological Sciences 2016; 20: 3262-3265
Prophylactic Probiotics?

*Lactobacillus reuteri DSM 17938*

**Study Findings:** The treatment group had 238 children and the placebo group 230 children. There were no significant differences between the groups at enrollment or in attrition during the study. Differences in daily symptoms recorded by the parents at 1 and 3 months are summarized in the Table.

**Mean Daily Symptoms at 1 and 3 Months**

<table>
<thead>
<tr>
<th>Daily Symptoms</th>
<th>1 Month</th>
<th>3 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treatment</td>
<td>Placebo</td>
</tr>
<tr>
<td>Crying (minutes)</td>
<td>45</td>
<td>96</td>
</tr>
<tr>
<td>Stools (number)</td>
<td>4.01</td>
<td>2.8</td>
</tr>
<tr>
<td>Reflux (episodes)</td>
<td>No difference</td>
<td>No difference</td>
</tr>
</tbody>
</table>

Looking at secondary outcomes, treatment-group children had 44% fewer medical visits for gastrointestinal symptoms, 71% fewer emergency department visits, 82% fewer lost parental work days, and markedly less use of either prescribed or over-the-counter pharmacologic interventions. The study authors concluded that daily administration of probiotic to these infants was associated with a reduction in reported incidents of functional gastrointestinal symptoms.

Constipation
  ↓
History, physical examination
  ↓
Red flags? (Table 3)
  ↓
Yes  No
Referral for further evaluation  Functional constipation
  ↓
Fecal impaction?
  ↓
Yes  No
Initiate oral or rectal medications for disimpaction
  ↓
Effective?
  ↓
Yes  No
Reassess, reeducate, monitor treatment, adherence, change medications
  ↓
Effective?
  ↓
Yes  No
Maintenance therapy  Referral for further evaluation
  ↓
Treatment: Education, behavior modification, diet modification, oral medications, close follow-up
  ↓
Effective after two weeks?
  ↓
Yes  No
Maintenance therapy  Referral for further evaluation
Children or young people over 1 year: fewer than three complete stools per week, overflow soiling, rabbit droppings or nuts, large infrequent stools that can block the toilet, poor appetite that improves with passage of a large stool, waxing and waning of abdominal pain with passage of stools, evidence of retentive posturing, anal pain, previous episode(s) of constipation, previous or current anal fissure, painful bowel movements, and bleeding associated with hard stools

NICE
Assess all children with idiopathic constipation for faecal impaction. Use both history taking and physical examination to diagnose faecal impaction—looking for overflow soiling, faecal mass palpable abdominally, and, if indicated, rectally. The presence of one or both of these on physical examination together with the history is indicative of impaction.

NICE
• Treatment of chronic functional constipation and fecal incontinence typically requires a comprehensive program, including the use of laxatives, behavior changes, and dietary changes.

• The type and intensity of the intervention should be tailored to the severity of constipation and the child's developmental stage, and close follow-up is often necessary.
Chronic constipation causes the colon to be unresponsive to stool burden, due to distension. It follows that effective treatment requires consistent and complete emptying of the colon, so that it becomes conditioned to work on its own, a concept known as “bowel retraining”.
Steps to bowel retraining:

• Disimpaction
• Prolonged laxative treatment and behavior therapy to achieve regular evacuation and avoid recurrent constipation
• Dietary changes (primarily increasing fiber content) to maintain soft stools
• Gradual tapering and withdrawal of laxatives as tolerated
The goal of therapy is the passage of soft stools, ideally once per day, and no less than every other day.
<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Separate hard lumps</td>
<td>Very constipated</td>
</tr>
<tr>
<td>2</td>
<td>Lumpy and sausage like</td>
<td>Slightly constipated</td>
</tr>
<tr>
<td>3</td>
<td>A sausage shape with cracks in the surface</td>
<td>Normal</td>
</tr>
<tr>
<td>4</td>
<td>Like a smooth, soft sausage or snake</td>
<td>Normal</td>
</tr>
<tr>
<td>5</td>
<td>Soft blobs with clear-cut edges</td>
<td>Lacking fibre</td>
</tr>
<tr>
<td>6</td>
<td>Mushy consistency with ragged edges</td>
<td>Inflammation</td>
</tr>
<tr>
<td>7</td>
<td>Liquid consistency with no solid pieces</td>
<td>Inflammation</td>
</tr>
</tbody>
</table>
Weeks to months, and sometimes years, of laxative and behavior therapy may be necessary before this goal is achieved.
Clean out

Constipation-associated

• fecal incontinence
• significant stool mass palpable on digital rectal or abdominal examination, or on abdominal radiograph
• history of incomplete or infrequent evacuation
• Urinary incontinence after returning after successful potty competence

Successful disimpaction is usually indicated by abundant fecal production and decreased episodes of soiling, as reported by the parents
Fig. 1. Flowchart of evaluation and management of functional constipation in children. *Proper diet and fluid intake.* "Polyethylene glycol (PEG) is recommended as the first choice for disimpaction. Medications and changes can be found in Table 1. "PEG is recommended as the first choice for maintenance treatment. The first evaluation should be scheduled after 2 weeks.
The type of laxative is not as important as using an adequate dose and ensuring compliance; the choice should be individualized according to circumstances, familiarity, and the child's acceptance — UpToDate
# Evaluation and Treatment of Constipation in Children and Adolescents

## Table 5. Therapies for Disimpaction in Children

<table>
<thead>
<tr>
<th>THERAPY</th>
<th>DOSAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oral</strong></td>
<td></td>
</tr>
<tr>
<td>Osmotics</td>
<td></td>
</tr>
<tr>
<td>Polyethylene glycol 3350</td>
<td>1.5 g per kg per day</td>
</tr>
<tr>
<td>(Miralax)*</td>
<td></td>
</tr>
<tr>
<td>Polyethylene glycol solution</td>
<td>25 mL per kg per hour via nasogastric lavage</td>
</tr>
<tr>
<td>(Golytely)*</td>
<td></td>
</tr>
<tr>
<td>Magnesium citrate</td>
<td>&lt; 6 years: 2 to 4 mL per kg per day</td>
</tr>
<tr>
<td></td>
<td>6 to 12 years of age: 100 to 150 mL per day</td>
</tr>
<tr>
<td></td>
<td>&gt; 12 years: 150 to 300 mL per day</td>
</tr>
<tr>
<td><strong>Stimulants</strong></td>
<td></td>
</tr>
<tr>
<td>Senna (Senokot)</td>
<td>2 to 6 years of age: 2.5 to 7.5 mL (8.8 mg per 5 mL); ½ to 1 ½ tablets (8.6 mg per tablet) per day</td>
</tr>
<tr>
<td></td>
<td>6 to 12 years of age: 5 to 15 mL; 1 to 2 tablets per day</td>
</tr>
<tr>
<td>Bisacodyl (Dulcolax)</td>
<td>≥ 2 years: 5 to 15 mg (1 to 3 tablets) per day in a single dose</td>
</tr>
<tr>
<td><strong>Lubricants</strong></td>
<td></td>
</tr>
<tr>
<td>Mineral oil</td>
<td>15 to 30 mL per year of age per day</td>
</tr>
<tr>
<td><strong>Rectal agents</strong></td>
<td></td>
</tr>
<tr>
<td>Enemas (one per day)</td>
<td></td>
</tr>
<tr>
<td>Saline</td>
<td>5 to 10 mL per kg</td>
</tr>
<tr>
<td>Mineral oil</td>
<td>15 to 30 mL per year of age up to 240 mL</td>
</tr>
</tbody>
</table>

*—May be used in infants < 1 year.

Information from references 2, and 24 through 26.
PEG 3350 (Miralax) is standard

- Polyethylene glycol 3350 – 1 to 1.5 g/kg/day by mouth for up to six days
- The daily dose is dissolved in approximately 10 mL/kg of water or flavored beverage
- In a randomized placebo-controlled study, these doses successfully disimpacted 95 percent of children
PEG 3350 (Miralax)

• PEG 3350 is a soluble, inert polymer (polyethylene glycol) that is not absorbed and acts by osmosis and volume expansion in the large intestine.

• Recommended for adult 1x/day use for up to 7 days
Pros to Miralax

- Palatability and patient acceptance
- Highly effective
- Small trials demonstrate safety
Miralax controversy

• Never been approved by FDA for children
• FDA testing in 2008 revealed trace amount of ethylene glycol and diethylene glycol (antifreeze)
• Follow-up testing in 2013 did not reveal impurities over the acceptable amounts, but did acknowledge that trace amounts of EG and PEG were allowable and shouldn’t be concerning for approved use (less then 7 days in adults)
• FDA case reports of tics, tremors and OCD behaviors
• 1/2015 FDA funded an investigation at Children’s Hospital of Philadelphia looking into safety and absorption rates of PEG 3350
• Data is still being gathered
Yet no one knows if small amounts of EG or DEG found in the laxatives or present once metabolized might harm children, especially those given the laxatives chronically. No detectable amount of either chemical should be present in food or medication, said Jon Clark, the vice president for chemical medicines and external development at U.S. Pharmacopeia, a nonprofit that sets quality standards for medicines and other products – New York Times, 1/5/2015
Miralax

• The results of this meta-analysis indicated that the mean change in weekly stool frequency did not differ significantly between children treated with PEG and those treated with non-PEG laxatives (milk of magnesia, mineral oil, sorbitol, lactulose)

• However, the combined OR indicated that the proportions of the successful disimpaction were significantly higher in children treated with PEG compared with those treated with non-PEG laxatives

Efficacy and Complications of Polyethylene Glycols for Treatment of Constipation in Children A Meta-Analysis Chen et al Medicine 93(16):e65
## Typical regimen for a child with recurrent or chronic constipation without fecal impaction or incontinence

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Start 2 to 4 teaspoons (3.5 teaspoons = 17 grams) of PEG 3350 (e.g., MiraLax, GlycoLax) once daily, in 4 to 8 ounces (120 to 240 mL) of noncarbonated beverage (or appropriate dose of another laxative).</td>
</tr>
<tr>
<td>Step 2</td>
<td>Increase or decrease PEG 3350 by 1 to 2 teaspoons every 2 to 3 days, until the desired result of daily soft stools is achieved. Maximum dose is 1 heaping tablespoon (17 grams) twice daily.</td>
</tr>
<tr>
<td>Step 3</td>
<td>Follow-up by phone or a return visit within 1 month to be sure the laxative is effective.</td>
</tr>
<tr>
<td>Step 4</td>
<td>Continue to work on adding dietary fiber and extra liquids to the diet each day.</td>
</tr>
<tr>
<td>Step 5</td>
<td>After 6 to 8 weeks of soft daily bowel movements, begin to taper the dose of PEG 3350 by ⅓ to 1 teaspoon every 2 weeks, until daily movements continue without the need for a laxative.</td>
</tr>
<tr>
<td>Step 6</td>
<td>If stools become hard once again, increase the dose slightly and retry weaning off the laxative in another 6 to 8 weeks.</td>
</tr>
<tr>
<td>Step 7</td>
<td>This process may take from 2 to 4 weeks to six months, but the end result should be resolution of the constipation.</td>
</tr>
</tbody>
</table>

This table describes a typical regimen for children older than three years with mild or moderate constipation **without** fecal impaction. Children with mild chronic constipation may be treated with dietary changes alone rather than medication, if desired. Children **with** fecal impaction, with or without overflow incontinence, should first be disimpacted with a regimen of oral and/or rectal medications. In most cases, these steps should be combined with family education and behavior modification (toileting) to enhance efficacy and prevent relapse. For details, refer to the text of the UpToDate topic on chronic constipation in children.
Magnesium Citrate Solution

- Prescription is 1.745g/ml
- 1 ml = 58.1 mg
- 2-4 ml/kg = 116.2 – 232.4mg/kg

22 pound kid would use 1,150 – 2,300 mg magnesium citrate! (for disimpaction, not maintenance)
Rectal medications

For patients with severe impaction, we prefer to use rectally administered medications rather than oral medications because stimulants can cause intense discomfort and may not be effective in this setting. In addition, rectal medications are more rapidly effective than oral medications for disimpaction and may be a powerful motivator for toilet sitting.

However, enemas are invasive and may be difficult to administer to an uncooperative or fearful child.

Sodium phosphate enemas, or mineral oil enemas followed by a sodium phosphate enema may be used for rectal disimpaction.

Bisacodyl suppositories may be used for older children, and glycerin suppositories for infants. These approaches are generally not as effective as enemas but are well tolerated.

-UpToDate
**Example of treatment plan for a 4-year-old child with fecal incontinence**

<table>
<thead>
<tr>
<th></th>
<th>A. Small fecal impaction (oral medications)</th>
<th>B. Large fecal impaction (oral and rectal medication)</th>
</tr>
</thead>
</table>
| **Day 1**        | - Educate family and caregiver about fecal impaction and overflow incontinence and the need for long term laxative therapy  
                   - Start PEG (e.g., Miralax, Glycolax, Pegalax), 1 gram/kg once daily, given in the morning.  
                   - **Day 2 to 3**  
                   - Continue PEG once daily  
                   - **Day 4 to 6**  
                   - If child is beginning to pass 1 to 2 soft to loose stools daily, continue above dose of PEG  
                   - If child is not passing soft to loose stools, increase dose of PEG to 1.5 grams/kg, divided into two doses. Soiling should gradually decrease and stop.  
                   - Establish regular toileting patterns by having the child sit on the toilet for 5 to 10 minutes, 2 to 3 times daily after meals  
                   - **Day 7 to 30**  
                   - Be sure parent calls if not making progress, so further adjustments in PEG dose can be made. Occasionally it is necessary to increase PEG to twice daily dosing.  
                   - **1 month**  
                   - Return office visit to evaluate progress and to reinforce need for regular laxative therapy  
                   - Provide handout or references for fiber-rich diet and have family work to increase fiber content of diet, for long-term maintenance  
                   - **1 to 6 months**  
                   - Return office visit every 1 to 2 months to reinforce therapy and adjust dose of laxative if necessary  
                   - **6 to 12 months (or longer)**  
                   - Once the child is maintaining normal bowel movements without soiling for several months, consider gradually tapering laxative over 2 months  
                   - Be sure patient is on a fiber-rich diet  
                   - Some children require ongoing laxative treatment for one or more years  
                   - **Beyond 12 months**  
                   - Follow as long as it takes for resolution. Can be months to several years before encopresis resolves completely. |
| **Day 2 to 3**   | - Educate family as in column A  
                   - Start PEG 1 to 1.5 grams/kg daily, divided into two doses.  
                   - Continue PEG twice daily  
                   - **Day 4 to 6**  
                   - If child has not passed a large amount of stool, give sodium phosphate enema (e.g., Fleet enema), 33 to 66 mL, depending on the size of the child  
                   - Continue twice daily dosing of PEG for up to six days total, until the child has passed a large amount of stool  
                   - Once the child is having soft stools at least once daily, reduce PEG to 1 gram/kg, given once daily in the morning.  
                   - Establish regular toileting patterns (as described in column A) |

This treatment plan describes the author’s approach to a typical four-year-old child* with constipation and fecal incontinence. Alternative regimens and considerations are described in the topic text.
Maintenance

• The typical dose is 0.4 to 0.8 g/kg per day (up to 17 g).
• In a dose-ranging trial, the dose of 0.4 g/kg/day was most likely to give high success rates (74 percent) while generating fewer complaints of abdominal pain or fecal incontinence than higher doses.
• The effective dose in an individual patient is not predictable, and many patients require relatively high doses for initial treatment of constipation, with somewhat lower maintenance doses.
• Therefore, we suggest an empiric approach to dosing. In our practice, we use an initial dose of 4 tsp (17 g = approximately 3.5 tsp) for patients weighing 20 kg or more, increased or decreased by 1/2 tsp to 1 tsp every other day until the consistency of the stools is soft to loose. We have rarely had to use more than 6 to 7 tsp per day.
• For patients weighing less than 20 kg, it is reasonable to use a slightly lower initial dose (0.4 to 0.8 g/kg/day), with dose adjustments up or down to achieve soft stools. - UpToDate
### Table 6. Maintenance Therapies for Children with Constipation

<table>
<thead>
<tr>
<th>THERAPY</th>
<th>DOSAGE</th>
<th>ADVERSE EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Osmotics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polyethylene glycol 3350 (Miralax)*†</td>
<td>0.5 to 0.8 g per kg up to 17 g per day</td>
<td>Anaphylaxis, flatulence</td>
</tr>
<tr>
<td>Lactulose†</td>
<td>1 mL per kg per day once or twice per day, single dose or in two divided doses</td>
<td>Abdominal cramps, flatulence</td>
</tr>
<tr>
<td>Magnesium hydroxide</td>
<td>&lt; 2 years: 0.5 mL per kg per day</td>
<td>Infants are susceptible to magnesium overdose (hypermagnesemia, hyperphosphatemia, hypocalcemia)</td>
</tr>
<tr>
<td></td>
<td>2 to 5 years of age: 5 to 15 mL per day</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 to 11 years of age: 15 to 30 mL per day</td>
<td></td>
</tr>
<tr>
<td></td>
<td>≥ 12 years: 30 to 60 mL per day</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medication may be given at bedtime or in divided doses</td>
<td></td>
</tr>
<tr>
<td>Sorbitol (e.g., prune juice)*†</td>
<td>1 to 3 mL per kg once or twice per day in infants</td>
<td>Similar to lactulose</td>
</tr>
<tr>
<td><strong>Stimulants</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Senna (Senokot)†</td>
<td>1 month to 2 years of age: 1.25 to 2.5 mL (2.2 to 4.4 mg) at bedtime (&lt; 5 mL per day); 8.8 mg per day</td>
<td>Idiosyncratic hepatitis, melanosis coli, hypertrophic osteoarthritis, analgesic nephropathy</td>
</tr>
</tbody>
</table>

*—May be used in infants < 1 year.

Information from references 2, and 24 through 26.
Magnesium Hydroxide
(Milk of Magnesia)

• Not for use in infants (less than one year) or patients with renal insufficiency
• Under 2: .5 mg/kg/day
• 2-5: 5-15 ml/day
• 6-11: 15-30 ml/day
• OR 1 to2 mL/kg, once daily
• Generally 400mg/5ml
• 22 pound kid – 9-10 ml or about 800 mg
• Toxicity unlikely to occur at less then 5,000 mg/day
One case report of death from hypermagnesemia in the literature of a 28 month old after daily use of 2400 mg for a week. He had a history of severe mental retardation, spastic quadriplegia, and seizure disorder of unknown cause. He received nighttime mechanical ventilation via a tracheostomy tube for central hypoventilation and received all nutrition and medications via a gastrostomy tube.

Fatal Hypermagnesemia in a Child Treated With Megavitamin/Megamineral Therapy John K. McGuire Pediatrics Feb 2000 105(2)
Magnesium hydroxide — Magnesium hydroxide (milk of magnesia) is an osmotic laxative that has a long history of success, but has been largely replaced by PEG because of palatability. It releases cholecystokinin, which stimulates gastrointestinal motility and secretion. Magnesium hydroxide should be avoided in infants or patients with renal insufficiency since they are susceptible to hypermagnesemia. - UpToDate
Supplemental Magnesium Upper Limit

Children, 1 to 3 years of age: 65 mg daily
Children, 4 to 8 years of age: 110 mg daily
Children, 9 to 18 years of age: 350 mg daily
Miralax vs. Milk of Magnesia

• 39 children treated with MOM, 40 with PEG
• Compliance rates were 95% for polyethylene glycol and 65% for milk of magnesia.
• After 12 months, 62% of polyethylene glycol treated children and 43% of milk of magnesia-treated children exhibited improvement, and 33% of polyethylene glycol-treated children and 23% of milk of magnesia-treated children had recovered.
• Polyethylene glycol and milk of magnesia did not cause clinically significant side effects or blood abnormalities, except that 1 child was allergic to polyethylene glycol.

A Randomized, Prospective, Comparison Study of Polyethylene Glycol 3350 Without Electrolytes and Milk of Magnesia for Children With Constipation and Fecal Incontinence Vera Loening-Baucke, MD, Dinesh S. Pashankar, MD PEDIATRICS Volume 118, Number 2, August 2006
Effects of Fiber

There are only two mechanisms by which fiber can provide a laxative effect: (1) Poorly fermentable insoluble fiber particles can mechanically irritate the gut mucosa, stimulating water/mucous secretion if the particles are sufficiently large/coarse (fine/smooth particles can be constipating); and (2) non-fermentable viscous/gel-forming fiber can retain its water-holding capacity throughout the large bowel to resist dehydration [1–3]. Both mechanisms require that the fiber resist fermentation to remain intact and present throughout the large bowel (must be present in stool) and that the fiber increase stool water content, which is the primary mechanism for both stool softening and increased stool bulk.

• Relatively small changes in percent stool water content can lead to relatively large changes in stool texture: hard stool 72 % water content; soft/formed stool 76 %; loose stool 80 %
Miralax vs Fiber

The mixture of acacia fiber, psyllium fiber (67.7% and 17.3%, respectively) and fructose (AFPFF) and PEG+E were administered orally at a dose of 16.8 g daily and 0.5 g/kg body weight daily, respectively. Increased doses up to 22.4 g daily for AFPFF and 1 g/kg body weight daily for PEG+E were allowed by the authors for children not improved after at least 3 days of treatment. A proper toilet training, with regular stool sittings for 5-10 minutes after each meal, was required.

*Children of both groups underwent rectal disimpaction by rectal enema (120 mL sodiumdioctyl sulfosuccinate and sorbitol) on 3 consecutive days to achieve an empty rectum before starting the treatment trial*

Compliance with PEG was 96%, only 72% for fiber blend.

At the end of the study treatment period, 77.8% of children treated with AFPFF and 83% of children treated with PEG+E had improved. *No statistically significant difference in any of the measured outcomes within the 2 groups was reported.* Therefore, according to our overall data, in this study we could not definitely demonstrate superior efficacy of one medication over the other for any of the measured outcomes.

A Randomized, Prospective, Comparison Study of a Mixture of Acacia Fiber, Psyllium Fiber, and Fructose vs Polyethylene Glycol 3350 with Electrolytes for the Treatment of Chronic Functional Constipation in Childhood Paolo Quitadamo, et al  J Pediatr 2012;161:710-15
Glucomann

• Successful treatment, which was physician defined as three or more bowel movements per week, one or fewer soiling episodes per week, and no abdominal pain, was diagnosed in 45% of children consuming glucomannan (100 mg/kg body weight), versus 13% of children consuming placebo.

• Parent-defined improvement was reported in 68% of children consuming glucomannan versus 13% of children consuming placebo.

• Used after disimpaction

Fiber (glucomannan) is beneficial in the treatment of childhood constipation. Loening-Baucke et al Peadiatrics 2004 Mar;113(3 Pt 1):e259-64.
Plum derived mixed fiber (SupraFiber) vs. psyllium

- RCT, double blind of 72 adults with constipation - 40 given mixed fiber, 32 given psyllium
- 5 grams 2x/day in water after meals
- 75% of patients responded in both groups
- Mixed fiber also decrease gas and bloating in 50%

Randomized clinical trial: mixed soluble/insoluble fibre vs. psyllium for chronic constipation  A. Erdogan et al Aliment Pharmacol Ther 2016; 44:35–44
## SUPRAFIBER
### NUTRITION FACTS

<table>
<thead>
<tr>
<th>Serving Size</th>
<th>1 Level TBSP (6.4g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servings Per Container</td>
<td>About 48</td>
</tr>
</tbody>
</table>

**Amount Per Serving**

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Value</th>
<th>% Daily Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Total Carbohydrate</td>
<td>6g</td>
<td>2%</td>
</tr>
<tr>
<td>Dietary Fiber</td>
<td>4g</td>
<td>16%</td>
</tr>
<tr>
<td>Soluble Fiber</td>
<td>2g</td>
<td></td>
</tr>
<tr>
<td>Insoluble Fiber</td>
<td>2g</td>
<td></td>
</tr>
<tr>
<td>Sugars</td>
<td>Less than 1g</td>
<td></td>
</tr>
<tr>
<td>Vitamin D</td>
<td>351U</td>
<td>10%</td>
</tr>
<tr>
<td>Vitamin K</td>
<td>5mcg</td>
<td>6%</td>
</tr>
<tr>
<td>Calcium</td>
<td>20mg</td>
<td>2%</td>
</tr>
<tr>
<td>Iron</td>
<td>0.27mcg</td>
<td>2%</td>
</tr>
<tr>
<td>Copper</td>
<td>0.07mcg</td>
<td>4%</td>
</tr>
<tr>
<td>Sodium</td>
<td>14mg</td>
<td>&lt;1%</td>
</tr>
</tbody>
</table>

*Percent Daily Values are based on a 2,000 calorie diet.

**INGREDIENTS:** Prune Fiber, Apple, Acacia Fiber, Powdered Cellulose, Blueberry, Xanath Gum, Pomegranate, Acai Fiber
Pysllium

• Non-fermentable, gel forming fiber
• Metamucil. (psyllium) can be mixed in 8 ounces of water or juice and taken 1–3 times per day.

Appropriate doses are as follows:
Children 2–5 years  3/4 teaspoon
6–11 years  1/2 tablespoon
12 years  1 tablespoon

• After relief of constipation, it is critical to continue a fiber-rich diet with plenty of fluids and to maintain physical activity and a regular toileting schedule.

Senna and cascara are the most used; they contain some anthraquinone drugs, known as sennosides and cascarosides, which are glycoside derivatives of hydroxyanthracene. These glycosides arrive intact to the colon, where the glycosidases produced by the micro-biota break the glycoside bond and release the active substances, mainly rhein and rheinanthrone. The latter stimulate the colonic peristalsis through activation of the secretory and motor functions, mediated by the increase in the synthesis and release of PGs and other autacoids. Despite being widely used and effective laxatives, no RCT has been, however, carried out with them in patients affected by FC.

Probiotics and nutraceuticals for IBS, CIC and IBD D Currò et al British Journal of Pharmacology (2016)
Senna

- Stimulant laxative
- 10 to 20 mg/kg/dose orally at bedtime, not to exceed 872 mg per day
- Active ingredient in Ex-Lax
- Not recommended in kids under 1
- Smooth Move Tea – 1 tea bag contains about 1000 mg of Senna plus 900 mg of additional carminative herbs
- If using tea, start with 1 tablespoon and increase by an additional tablespoon nightly not to exceed ½ cup
Other considerations

- Triphala – ¼ to ½ teaspoon in water before bed
- Kan Herbs Easy Going
- Ready Set Go (Orthomolecular Products)
- Chewable Enzymes
- Caricol (papaya puree)
Diju is a Chinese herbal formula that stimulates digestive juices and acts as a natural stool softener. It is gentle, effective and fantastic for travel.*

Directions:
Take 10 pellets with meals. Increase as needed to bowel tolerance, up to 80 per day maximum.

Supplement Facts:
Serving Size: 10-30 pellets
Pellets per container: ~800*

*This statement has not been evaluated by the FDA. This product is not intended to diagnose, treat, cure or prevent any medical condition.

If pregnant or lactating, consult your physician. KEEP OUT OF REACH OF CHILDREN

Wild Crafted Ingredients:
Aloe Leaf, Scullcap Root, Amur Cork Tree Bark, Sapphora Tree Flower (Bud), Coptis Root, Rhubarb Root, Cape Jasmine Fruit, Honey (Binder) & magical blessings.

Tummy Temple, Seattle WA
www.tummytemple.com
Detoxify. Energize. Relax.
Diju

- Children under 12 should start off taking 3 pills twice daily, morning and evening. Increase the number of pills by one each time until the desired results are achieved. The quantity of pills should never exceed twice their age daily. (E.g. A 10 year old should never take more than 20 pills per day.). Use DiJu at these quantities in the same method as adults for hard stool, constipation and irregular bowel movements. At age 12, children may start taking the same amount as adults. Not for use in children under 4.
Other dietary tips

- Pickles before meals
- “Pumpkin Pudding”
  - ½ cup pumpkin puree
  - 2-3 dried figs soaked overnight
  - 1 teaspoon hemp seed oil
  - Give 1-3 tablespoons/day
- 1 teaspoon Slippery Elm Powder with 1 tablespoon warm water with a pinch of cinnamon
- Flaxseed “tea”
  - 1 teaspoon flax seed in warm water, sit 5 minutes, and drink the gel

- Fruit-Eze Paste
  - Jam-like mixture of prunes, raisins, dates and prune juice
  - 1-5 yrs: 1-3 teaspoons
  - 6 and up – 3-6 teaspoons
  - Generally tasty and well tolerated
- Flaxseed oil:
  - Infants: one teaspoon a day
  - Toddlers: two teaspoons a day
  - Children and adults: one tablespoon a day
- Prunes
  - Soak prunes in warm water overnight and then serve with hot whole grain cereal the next day.
  - 1/2 cup prune juice + 1 TBS lemon juice + 1 cup water in the evening before bed
Herbal Formulas per Mary Bove, ND

Bowel Relaxant Formula
- 1 part Catnip
- 1 part Crampbark
- 1 part Fennel
- ½ part Hops
Can be prepared as glycerite, tincture or tea

For pain/cramping
- 1 teaspoon lobelia tincture
- 1 teaspoon ginger tincture
Add to 1 oz bottle and fill with water, administer 5-10 drops as needed

Bowel Stimulants
- 10 to 20 drops tincture in warm water 3x/day
  - Dandelion Root
  - Fennel Seed
  - Licorice Root
  - Yellow Dock
1 tsp magnesium "Natural Calm" powder + 1 tsp "ready set go" by Orthomolecular Products + 1 oz prune juice + water to taste
(per Molly Gray, ND, LM)
Length of treatment

• Wait until optimal bowel habits are achieved and stable for at least six months before laxative use is decreased or discontinued. Some children require ongoing laxative treatment for one or more years.

• Maintenance interventions need to be continued for several weeks to months after a regular bowel habit is established.

• Children who are toilet training should remain on laxatives until toilet training is well established.
Behavior Modification

- Effective education of the parents and child with regard to constipation is crucial in changing chronic behavior patterns. A primary goal is to remove negative attributions. The parent or caretaker must understand that soiling due to overflow incontinence does not constitute willful and defiant behavior by the child but represents physiologic loss of continence. The child should therefore not be scolded, or otherwise punished, for soiling episodes.

- In toddlers with constipation, toilet training should be postponed since it will not be successful until rectal awareness is restored and defecation is pain free.
Behavior Modification

• After starting the laxative treatment, parents should be advised to encourage the child to use the toilet for 5 to 10 minutes at the same time each day, preferably after breakfast or dinner.

• In children who are not fully toilet trained, we delay this toileting plan until the child has had at least two to four weeks of effective laxative treatment, to make sure that he or she is not experiencing any pain or hard stools when using the toilet.

• If the child fails to have a bowel movement for several days, it may be necessary to use an enema to empty the rectum and then increase the laxative dose. If soiling recurs, disimpaction, may be necessary
Behavior Modification

• Toilet-sitting – The child’s parents or caretakers should organize, encourage, and supervise a program of regular toilet-sitting. The child should sit on the toilet shortly after a meal, for 5 to 10 minutes, two to three times per day.

• Toilet sitting episodes should occur at the same time each day and be timed with a timer or stopwatch [84].

• The routine should be followed every day, particularly during times of transition (eg, holidays, vacations, or weekends).

• The child’s adherence to the program should be encouraged with positive reinforcers rather than negative reinforcers (criticism or punishment).

• For children whose feet do not touch the floor sitting on a regular toilet seat, it is helpful to use a stool for foot support.
Behavior Modification

- Reward system – The parents or caretakers should implement a reward system that is tailored to the child and in which the reward is provided for effort (i.e., toilet sitting) rather than success (i.e., evacuation in the toilet).

- Rewards for preschoolers may include stickers or small sweets, reading books or singing songs while sitting, or special toys that are only used during toilet sitting.

- Rewards for school aged children may include reading books together, activity books, or hand-held computer games that are only used during sitting time, or coins that can be redeemed for small prizes.
Behavior Modification

Monitoring – The parents or caretaker should use a diary or log to record bowel movements, the use of medication/supplements, and episodes of fecal incontinence, abdominal pain, and wetting.
Parents and child should have a "rescue" plan if the child goes more than three days without a stool or has other indications of recurrence (ie, hard stools, abdominal pain, smears in the underwear). The rescue plan may involve the use of an enema or suppository followed by an increase in the laxative dose.
Behavior Modification

• Rescue remedy
• Lavender
• Music
• Reading books
• Anything to promote a calm and relaxed attitude during defecation
Food Allergy

• The aims of this study were to evaluate the implication of food allergy as a cause of paediatric constipation and to determine the diet period needed to tolerate the constipation-causing foods.
• Fifty-four children aged 6 months to 14 years (median, 42 months) suffering from chronic constipation (without anatomic abnormalities, coeliac disease or hypothyroidism), unresponsive to a 3-month laxative therapy, were prospectively evaluated. All participants were evaluated for allergy to cow's milk, egg, wheat, rice, corn, potato, chicken, beef and soy, using skin tests (SPT), serum specific IgE and atopy patch test (APT).
• A withdrawal of the APT-positive foods was instructed. Thirty-two children had positive APT; 15 were positive to one; six, to two and 11, to three or more food allergens, wheat and egg being the commonest.
• After withdrawing the APT-positive foods for an 8-week period, constipation had improved in 28/32 children, but a relapse of constipation was noticed after an oral food challenge, so they continued the elimination diet.
• Tolerance to food allergens was achieved in only 6/28 after 6 months, compared to 25/28 after 12 months and to all after a 2-year-long elimination.
• Food allergy seems to be a significant etiologic factor for chronic constipation not responding to treatment, in infants and young children. APT was found to be useful in evaluating non-IgE allergy-mediated constipation, and there was no correlation of APT with IgE detection. Tolerance was adequately achieved after 12 months of strict food allergen elimination.

Milk, egg and wheat most common factors.

Cows Milk and Constipation

• A food allergy to cow milk protein can also cause constipation.
• A crossover dietary trial demonstrated an association between chronic functional constipation and cow milk consumption
• In one study, type IV allergies developed frequently and lymphocyte stimulation test values were related to constipation. Symptoms improved in the majority of infants after eliminating the cow milk antigen
• Colon peristalsis in infants with constipation is abolished after ingesting cow’s milk but recovers after stopping cow’s milk.
• Colonic stenosis due to a cow milk protein allergy mimicking Hirschsprung’s disease is well known


• In children whose constipation is unresponsive to other measures, and especially in those with atopic symptoms, we suggest a trial for at least two-weeks of eliminating all cow's milk protein from the diet. If the constipation improves substantially, the diet should be continued. A non-dairy form of milk can be used as a substitute. We suggest this approach because eliminating cow’s milk from the diet improves constipation in some children. This is particularly true in children with atopic symptoms, probably because of an occult cow’s milk intolerance.

• In one double-blind crossover study in 65 constipated children who were refractory to laxative therapy, 68 percent of children improved while receiving soy milk compared with cow's milk. Constipation recurred within days of reintroduction of cow's milk.

• Another study suggested that constipation can be a delayed clinical manifestation of cows' milk protein intolerance, particularly in children with a personal or family history of atopy.

• Although not clinically proven, it is also possible that excessive consumption of milk may contribute to slowed peristalsis and constipation.

- UpToDate
Proposed mechanism of action for fiber and constipation

- Fiber increases stool bulk and accelerates colon transit
- Fermenting fiber produces short-chain fatty acids (butyrate, propionate, acetate, etc.), which increase osmotic load and accelerate colon transit;
- Short-chain fatty acids change the intraluminal microbiome (mass) directly or indirectly by decreasing luminal pH, which accelerates colon transit; and
- Fiber contains water.

Diets for Constipation Sun Hwan Bae Pediatr Gastroenterol Hepatol Nutr 2014 December 17(4):203-208
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Diets for Constipation Sun Hwan Bae Pediatr Gastroenterol Hepatol Nutr 2014 December 17(4):203-208
• Low fiber diets are a risk factor
• Less then ½ of American children meet recommended fiber intake
• Fiber may be a marker for a diet that supports gut health
• Fiber supplementation can be an effective treatment as long as fecal impaction has been addressed
• Avoid supplemental fiber under 18 months
Table 3  Recommended total fiber intake for children 1–18 years of age.

<table>
<thead>
<tr>
<th>Age</th>
<th>Adequate intake&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Age in years + 5 g/d</th>
<th>Age in years +10 g/d</th>
<th>AAP, 0.5 g/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys (g/d)</td>
<td>Girls (g/d)</td>
<td>g/d</td>
<td>g/d</td>
</tr>
<tr>
<td>1–3 years</td>
<td>19</td>
<td>19</td>
<td>6–8</td>
<td>11–13</td>
</tr>
<tr>
<td>4–8 years</td>
<td>25</td>
<td>25</td>
<td>9–13</td>
<td>14–18</td>
</tr>
<tr>
<td>9–13 years</td>
<td>31</td>
<td>26</td>
<td>14–18</td>
<td>19–23</td>
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<tr>
<td>14–18 years</td>
<td>38</td>
<td>26</td>
<td>19–23</td>
<td>24–33</td>
</tr>
<tr>
<td>Range 1–18 years</td>
<td>19–38</td>
<td>19–38</td>
<td>6–23</td>
<td>11–33</td>
</tr>
</tbody>
</table>

Data from refs. 28–30

<sup>a</sup> US Dietary Reference Intakes, includes functional fiber.

Abbreviations: AAP, American Academy of Pediatrics.
Low fiber diet is a risk factor

- A community-based survey on the prevalence of constipation in children 3–5 y old in Hong Kong found that almost 30% had constipation based on the Rome II pediatric criteria. Mean dietary fiber intake of these children was low (4.1 g/d), less than one-half of the dietary fiber intake recommended by the AAP.
- Similarly, one-third of children in the United Kingdom (mean age of 10 y) were constipated. In both studies, children who were not constipated had higher fiber consumption.
- In a sample of Irish children ages 5–8 y old, the incidence of constipation was twice as high in children with inadequate fiber intake than in children with adequate fiber consumption levels (13.6 vs. 6%).
- Thus, evidence supports an association between low intakes of fiber and the high prevalence of childhood constipation.

In fact, 9 in 10 children fail to achieve the IOM’s recommendation for fiber intake, which is admittedly the higher of the 2 fiber intake recommendations, but these data show that one of the main issues in child nutrition and diet quality is not necessarily centered around the types of fiber but the amount of foods consumed that contribute any fiber.

• Relative risk of about 4.0 for low-fiber diet
Sample diet for 5 year old

• Goal: 15 g/day
• Breakfast: Easy Smoothie and Autumn Muffin (8 grams)
• Lunch: seed cracker, hummus, baby carrot, turkey slices (5 grams)
• Snack: Poop Cookie (7 grams) and kiwi (2 grams)
• Dinner: Lentil soup (7 grams)
• 34 grams total
“Poop” cookies (from Nourishing Meals) 7 grams per cookie

- ¼ cup ground chia
- ½ cup hot water
- ½ cup melted coconut oil
- 1 cup almond butter
- 1 cup coconut sugar
- 5 cups rolled oats
- ¾ teaspoon baking soda
- ¾ teaspoon sea salt
- 1 tablespoon cinnamon
- 1 cup raisins
- Dark chocolate chips (optional)

Preheat oven to 325. Place chia seeds in a large bowl and pour hot water over them, whisk together and rest a few minutes. Add oil, almond butter, sugar and vanilla. Whisk well. Add oats, baking soda, salt and cinnamon. Stir well. Add raisins and chocolate. Drop by the spoonful on to greased cookies sheet and press down with palm of hand. Bake 12-15 minutes. Makes about 18 cookies.
Autumn Muffins (4 grams/muffin) from realeverything.com

- 2 C blanched almond flour
- 1 tsp cinnamon
- 1 tsp ground allspice
- 1/2 tsp baking soda
- 1/2 tsp salt
- 1/4 C honey or maple syrup
- 1/4 C coconut oil or butter (room temperature)
- 2 eggs
- 1 tsp pure vanilla extract
- 3/4 C peeled, cored and shredded apple (about 1 medium apple)
- 3/4 C shredded carrot (about 1 medium carrot)
- 1/2 C shredded zucchini
- 1/2 C pistachios
- 1/2 C raisins

Grease your pan and pre-heat your oven to 350. Sift together flour, spices, baking soda. In a separate bowl, beat your wet ingredients until well combined. Stir flour mixture into wet ingredients until fully incorporated. Fold in remaining ingredients. Pour batter into greased bundt pan, smoothing the top. Bake for about 25-30 minutes, until knife comes out clean. Cool for 20 - 30 minutes, then turn out onto plate. Makes 12 muffins.
Easy Smoothie – 4 grams

• 1 cup frozen blueberries
• 1 cup frozen cherries
• 1 ripe banana (can sub ¼ avocado)
• 1 cup almond milk (can sub any non-dairy/soy milk)
• ½ cup spinach

Blend – makes 3-4 servings

Can add additional fiber (chia, psyllium, glucomann)
Kiwi

- Green kiwifruit contains 2-3 g of dietary fiber per 100 gm. Fiber plays a physicochemical role during constipation.
- Actinidine, a protease enzyme in green kiwifruit, stimulates upper gastrointestinal tract motility. Possible induction of activity in the colon remains to be clarified.
- Kissper, a peptide in green kiwifruit, has been characterized by anion selectivity and ion channeling.
- Phytochemicals occurring naturally in the fruit may have biological significance.

Plum

They contain high levels of fiber (6.1 g/100 g), fructose (fructan), and sorbitol (14.7 g/100 g). Large amounts of phenolic compounds (184 mg/100 g), mainly as neochlorogenic and chlorogenic acids, may aid in the laxative effect.

Fluids

• To ensure adequate hydration, children with chronic constipation or fecal incontinence should be encouraged to consume at least 32 to 64 ounces (960 to 1920 mL) of water or other non-milk liquids per day, particularly if they are using fiber supplements.

• Therefore, we recommend limiting the intake of cow’s milk to 24 fluid ounces (720 mL) per day.
Fluids

Additional fluid during treatment for chronic functional constipation led to better outcomes in terms of bowel movement frequency and stool consistency in children who were administered polyethylene glycol.

Mechanics

• Feet should be supported (not dangling) with knees up at 90 degree angle
  – Stool or squatty potty
  – Continued use of child potty until tall enough for feet to rest on floor
Physical Activity

• Children spending time in the highest tertile of light, moderate, and total activity at the age of 2 years had significantly less functional constipation in the fourth year of life. For functional constipation in the third year of life, the results were in similar direction but not statistically significant.

• Additionally, children with physical activity of more than the WHO recommendation of 60 min/day had significantly less functional constipation in the fourth year of life.

Low muscle tone

• Congenital (Down’s Syndrome, mitochondrial disorder)
• Acquired
  – Chronic laxative use
  – Low movement (don’t forget about vitamin M)
Low muscle tone

• Clinical Signs
  – Worse with fiber
  – History of mild motor delays
  – “Buddha Belly”
  – Preference for laying on the floor
  – Poor Stamina
  – Mouth hangs open, increased drooling
Low Muscle Tone

- L-carnitine at a dose of 50 to 100 mg per kg of body weight can be helpful in both cases (per Kelly Dorfman, MS, LDN)
- Start slow and work up to therapeutic dose
Carnitine study
Constipation and dysbiosis

Dysbiosis of intestinal flora, high frequencies of Clostridium and Enterobacteriaceae species, which are rarely isolated in healthy children, have been reported in children with constipation.

Proposed mechanism of action for probiotics and constipation

• Bifidobacteria and lactobacilli produce lactic acid, acetic acid, and other acids, which lower pH in the colon and enhance peristalsis.

• Probiotics may exert anti-inflammatory effect and immunomodulation effect, which may improve certain mechanism of dysmotility.

• Metabolic functions of the altered microbiota may affect intestinal luminal content. For example, methane gas can slow gut transit, and probiotics may improve this effect.

• Particular probiotic strains stimulate motility and peristalsis, which is particularly helpful to treat slow transit constipation.
• Lactobacillus reuteri has a positive effect on bowel frequency in infants with functional chronic constipation but no improvements in stool consistency are observed

• Bifidobacteria (B. bifidum, B. infantis, and B. longum) and Lactobacillus (L. casei, L. plantarum, and L. rhamnosus) increase bowel movement frequency, decrease fecal incontinence, and reduce abdominal pain in children 4-16 years of age; however, they have no effect on stool consistency

• In one study, Lactobacillus GG was ineffective as an adjunct to lactulose for treating constipation in children

Diets for Constipation Sun Hwan Bae Pediatr Gastroenterol Hepatol Nutr 2014 December 17(4):203-208
• This double-blind placebo-controlled, randomized study enrolled 45 children under 10 years old with chronic constipation. They were randomly assigned to receive Lcr35 (8 x 10⁸ c.f.u./day; n = 18), MgO (50 mg/kg/day; n = 18), or placebo (n = 9) orally twice daily for 4 weeks.

• Lcr35 was effective in treating children with chronic constipation. There is no statistically significant difference in efficacy between MgO and Lcr35, but less abdominal pain occurred when using Lcr35.
2017 lc35 update
Bifidobacterium Breve

- Daily administration of about 10 billion CFUs of B. Breve
- Twenty children (75% male, mean age 7.4) were included in this pilot study. The defecation frequency per week significantly increased from 0.9 at baseline to 4.9 in week 4. The mean stool consistency score increased from 2.6 at baseline to 3.5 in week 4. The number of faecal incontinence episodes per week significantly decreased from 9.0 at baseline to 1.5 in week 4. Abdominal pain episodes per week significantly decreased from 4.2 at baseline to 1.9 in week 4

• Consider dosing probiotics at night before bed on empty stomach to stimulate the Migrating Motor Complex (MMC)
A large systemic analysis of the 74 clinical studies investigated the safety of probiotics and synbiotics in children ages 0–18 years and included individuals who were healthy, immune-compromised patients, and obese subjects, as well as patients with intestinal disorders, infections, and inflammatory disorders.

They concluded that “probiotic and/or synbiotic administration in children is safe with regard to the specific evaluated strains, dosages and duration.”

There do, however, continue to be safety concerns for certain high-risk patient populations in whom probiotic administration may be contraindicated. These high-risk groups include preterm infants, children with innate or acquired immunodeficiency, and children with indwelling catheters; limited evidence of probiotic administration exists in these groups.

Most of the cases of bacterial sepsis or fungemia in children have been reported from probiotic administration in patients with a central line or in children with short gut syndrome with increased intestinal permeability and inflammation.
Dietary support of microbiome

We can utilize diet to support the biodiversity of the microbiome. One of the most important aspects of diet is the inclusion of cultured and fermented foods. These foods provide a rich source of probiotics, including *Lactobacillus* and *Bifidobacteria*, to inoculate the gut. Fermentation also makes foods more digestible, increases vitamin and enzyme activity, and extends shelf life.

Common fermented foods include yogurt, kefir, natto, tempeh, olives, miso soup, kimchee, sauerkraut, fermented vegetables, pickled ginger, raw pickles, hard cheeses, sourdough bread, kombucha, green tea, black tea, beer, and wine. If you look at this list, you’ll note that these are foods that have been consumed daily in various cultures. Eating several fermented foods daily supports the microbiota. Varying these will increase the diversity of the microbiota.

It’s important to look for products that have live microbes. This can be difficult. For example, most of the sauerkraut that is available has been pasteurized; pickles have been preserved with sodium benzoate; wines have been preserved with sulfites. Look for refrigerated pickles and sauerkraut; look for wines that do not contain sulfites or other preservatives.
Polyphenols in fruits and vegetables act in a similar way as prebiotics. There is a reciprocal relationship between enteric bacteria and polyphenols. Polyphenols promote the growth of *Lactobacilli* and *Bifidobacteria* by serving as a food source, while inhibiting growth of pathogens. Conversely, the polyphenolic metabolites exert antioxidant and anti-inflammatory actions that both support gut health and optimize the environment for the microbiome.

Examples of polyphenol-rich foods include apples, onions, chocolate, green tea, and red wine.
Prebiotics are the starches that provide a fermentable food source for intestinal *Lactobacilli* and *Bifidobacteria* to thrive. Bacterial digestion of prebiotic foods also produces short-chain fatty acids (eg, butyric acid), which colonocytes use for health, maintenance, and repair.

It could be argued that prebiotics are even more important that probiotics in a healthy diet.

Prebiotic-rich foods include onions, garlic, leeks, Jeruselum artichokes, bananas (especially more green than ripe), plantain, legumes, root vegetables like chicory and burdock root, asparagus, peas, maple sugar, and honey.
Case Study

- 5 year old patient with chronic constipation
- Started with intro of formula at 1 week old
- Worse with solid food intro at 6 mo – did regular enemas from 6-9 month
- Now almost daily BM but has significant straining, small sticky with pellets 2-3x/week
- Nightly stomach aches, lower appetite recently
- GI doc recommended daily miralax
- Celiac testing negative but gluten-free at time of test, also iron and vitamin D deficient, thyroid wnl
- Growth and development on track
- Taking Enfamil Iron and vitamin D daily
- Drinking milk with most meals
Plan:
• Discontinue milk and most dairy
• Discontinue iron supplement for now
• Pumpkin Pudding 1 tablespoon/day
• Castor oil belly rubs with lavender
• 20 oz water a day
• Kids Probiotic
• Ready Set Go – 1 teaspoon a day

Follow-up:
• No more stomach aches, stools easy to pass 😊
• Now on maintenance plan of low gluten and dairy diet
• Use Ready Set Go and Pumpkin Pudding as needed a couple times/month
A MODERN DAY GUIDE TO MASSAGE FOR CHILDREN

ADDRESSING COMMON CHILDHOOD DISCOMFORTS

ABDOMINAL MASSAGE FOR CONSTIPATION, GAS AND TUMMY ACHES
A common complaint of many children, is upset tummies. Not only due to eating too much ice cream and candy, but other times, the child may experience discomfort from excess gas, constipation, or even stress. Abdominal massage has proven very effective in helping with elimination and relief.

CHILDREN’S MASSAGE STROKES | ABDOMINAL MASSAGE HOW TO
The techniques below are described with the child laying on their back looking at you. They may be performed in other positions, but it is imperative that the strokes follow the correct direction.

MOON
With your right hand, trace a half circle (moon shape) on child’s tummy from 12 o’clock - 6 o’clock.

RAINBOW
Draw a big rainbow, starting on child’s right side (your left) draw to child’s left side (your right) REMEMBER: clockwise motion only.

NURTURING TOUCH
Loving and still, rest your warm palms on the tummy.

STARS
Using the pads of your finger tips, gently march across child’s tummy from child’s right side to child’s left side in a rainbow shape.

SUN
Place left hand on child’s tummy and make a large clockwise circle.

SOOTHING STROKE
Gently stroke down the tummy to signal the end of this massage.

MASSAGE SHOULD NOT BE PERFORMED ON THE ABDOMEN WITHIN 30 MINUTES AFTER EATING.

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THE INFORMATION CONTAINED HEREIN DOES NOT REPLACE MEDICAL ADVICE. CONTACT TINA ALLEN @LIDDLEKIDZ.COM
Comprehensive Stool Testing

- Can be helpful in cases that are resistant to treatment and/or cases with high clinical suspicion of dysbiosis
Case study

- 4 yr old pt with constipation since 1 yr
- On Miralax sporadically since then
- Hx daily enemas for months at a time
- Pinworms at 15 mo
- Gi specialist did barium enema – wnl
- Thyroid wnl
- Bedwetting at night with recent worsening in frequency
- Daily fiber, prune juice, magnesium, enzymes, probiotic
- BMs are explosive, sticky, lots of gas and bloating
- Good appetite, growth and development on track
- Mom with significant history of parasites
GI Panel
• +3 Klebsiella sp
• +3 Enterobacter sp
• +1 Cryptosporidium
• +1 Dividing yeast

Tx
• Biocidin 4 drops 2x/day for 2 weeks alternating with 1/8 teaspoon of MSM powder 2x/day for 2 weeks
• Glutamine 500 mg/day
• 3 months total tx

At 6 weeks
• Decrease gas and bloating
• Pooping 2-3x/day without added magnesium/fiber/prune combo
• Able to better recognize urge to have a BM

At 12 weeks
• No more gas and bloating
• Stools now normal – nice long tubes
Antimicrobial Agents

Biocidin - Vegetable glycerin, Bilberry extract, Noni, Milk Thistle, Echinacea, Goldenseal, Shiitake, White Willow, Garlic, Grapeseed extract, Black Walnut, Beet, Raspberry, Plantain, Fumitory (, Gentian, Tea Tree oil, Galbanum oil, Lavender oil, Oregano oil, Alcohol (potato source)

Dose 1 drop per 10 lbs body weight 1-3x/day

Purge the Spirits (Heron Botanicals) - Water, alcohol, vegetable glycerin, Epazote seed, Chinese Tree-of-Heaven leaf & twig, Quassia bark, Sweet Wormwood aerial parts in flower, Anise fruit, Gentian root, Garlic bulb, Black Walnut hulls, Oregon Grape root & fruit, Ginger rhizome, Tansy aerial parts in flower, Neem leaf, Western Red Cedar branch tips, Sagebrush aerial parts, Celandine whole plant, Chinese Rhubarb root, citric acid

Dose ¼ -1/2 teaspoon 3x/day

Treat at least one month, often up to three
SIBO