Nutrition in IBD: Enteral Nutrition and Alternative Diets

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Objectives

• Role of Nutrition in IBD
• Enteral Nutrition
• Alternative Diets
  ○ Specific Carbohydrate Diet
Role of Nutrition

• The malnutrition of IBD is multi-factorial:
  o Chronic inflammation
  o Increased metabolic requirements
  o Anorexia
  o Malabsorption

<table>
<thead>
<tr>
<th>Nutritional Measure</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anemia</td>
<td>60-80%</td>
</tr>
<tr>
<td>Albumin</td>
<td>25-80%</td>
</tr>
<tr>
<td>Iron</td>
<td>39-81%</td>
</tr>
<tr>
<td>Vitamin B12</td>
<td>20-60%</td>
</tr>
<tr>
<td>Folic Acid</td>
<td>36-54%</td>
</tr>
<tr>
<td>Calcium</td>
<td>13%</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>11%</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>75%</td>
</tr>
<tr>
<td>Zinc</td>
<td>40-50%</td>
</tr>
</tbody>
</table>

JE Teitelbaum, WA Walker, UpToDate, 2009; K Vagianos et al JPEN 2007; 31: 311

Location, Location, Location

Sites of Absorption
- Iron
- Folate

- Carbohydrates
- Fats
- Proteins
- Calcium
- Magnesium
- Trace elements
- Vitamins

- Vitamin B12
- Bile salts
- Short chain fatty acids

Water and electrolytes
Role of Nutrition

- Incidence of IBD is increasing possibly due to a more “Western Diet” of refined processed foods?
- Increased risk of IBD (CD and UC) for diet high in total fat, omega-6 fatty acids and animal proteins
- Decreased risk of CD for diet high in fruits and fiber
- Decreased risk of UC for a diet high in vegetables

Hou JK et al. Am J Gastroenterol. 2011

Nutrition as Medicine

- Holistic approach
- Avoid medication side effects
- Limited studies conducted (most outside the US)
  - Variety of protocols and subjective outcomes
- Overlap of IBD and IBS symptoms
- Physician expertise
- Need RD and MD given risk for weight loss and malnutrition
Enteral Nutrition as Primary Therapy for Crohn’s Disease

As Induction and Maintenance Therapy for Crohn’s Disease

Enteral Nutrition = Formula

- Broad use world-wide for induction in CD
  - Providers in Western Europe (65%), Canada (36%) versus US (4%) report frequent use
  - Up to 80% remission rates in children

- Proposed mechanism of action
  - Nutritional repletion
  - Correct intestinal permeability
  - Monotony – minimize exposure
  - Modification of intestinal bacteria
  - Altered inflammatory cascade

Lionetti et al. JPEN 2005.
Critch et al. JPGN 2012.
### Steroids vs. Enteral Nutrition

<table>
<thead>
<tr>
<th>Study subgroup</th>
<th>Enteral Nutrition n/N</th>
<th>Steroids n/N</th>
<th>Odds Ratio M-H (Fixed 95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B. Borrel 2003</td>
<td>15/19</td>
<td>12/18</td>
<td></td>
</tr>
<tr>
<td>B. Corazza 2004</td>
<td>12/19</td>
<td>8/10</td>
<td></td>
</tr>
<tr>
<td>B. Lindor 1992</td>
<td>2/10</td>
<td>5/10</td>
<td></td>
</tr>
<tr>
<td>B. Toshi 1991</td>
<td>24/55</td>
<td>41/52</td>
<td></td>
</tr>
<tr>
<td>B. Mugford 1990</td>
<td>21/51</td>
<td>32/44</td>
<td></td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>192</strong></td>
<td><strong>160</strong></td>
<td></td>
</tr>
</tbody>
</table>

- Overall remission rate for steroids 75%, for EN 49%
- BUT only 2/3 of adult patients tolerated formula

**Zachos et al. Cochrane 2007**

### Steroids vs. Enteral Nutrition

- Better outcomes in children because:
  - Improved compliance
  - Improved linear growth
- Increased percentage of newly diagnosed cases
- Different disease distribution (75% ileocecal)
Controversies

- Formula Composition
  - No difference with various carbohydrate, fat or protein components
- Disease location
  - Some studies suggest better remission rates in patients with small bowel vs. colonic disease
- Nasogastric tube vs. Oral
  - Similar remission rates
  - May be challenge to take adequate volumes orally

Griffiths et al. JPGN 2000.
Afzal et al. Dig Dis Sci 2005

Barriers to Use

- Compliance
  - Withdrawal rate: NGT (8%), oral (34%)
  - 50% relapse after 6 months of regular diet
- Socially stigmatizing
- Lack of provider experience
- Cost and lack of insurance coverage
  - Grocery store vs. formula/supplies for NGT

Levine et al. JPGN 2003.
Stewart et al. JPGN 2011.
Formula “Prescription”

- Induction: At least 8 weeks
- Allow 3-4 weeks to assess efficacy
- 120% of recommended dietary allowance
  - PO – Goal 2-4 portions a day
  - Allow water or clear fluids (clear soda, soup broth, popsicles) as max 10% of energy intake
  - Gum, hard candy are OK
  - Vitamin D and Calcium supplementation
  - Increase if hunger, activity, weight loss

Critch J et al. JPGN 2012.

Other “Prescriptions”

- Semi-elemental formula via NGT
  - NGT placed each night
  - 10-12 hours for 7 nights per week
- 10-20% of calories as unrestricted foods
- Side effects reported
  - Morning emesis 40%
  - Nausea 33%
  - Increased bowel movements 20%
  - Issues removing NGT 20%

Gupta et al. Inflamm Bowel Dis 2013
Maintenance Therapy

• Supplemental night feeds
  • Patients on nightly feeds relapse less than regular diet (43% vs. 79%)
  • May need up to 4-6 nights per week
• Partial oral formula diet (50% of needs) vs. unrestricted diet
  o Lower Relapse rate 27% vs. 64%
• Cyclical exclusive enteral nutrition
  o 1 month every 4 months

Wilschanski et al. Gut 1996
Belli, Seidman et al. Gastro 1988
Tagaki et al. Aliment Pharmacol Ther 2006

Alternative Dietary Interventions
Individually Tailored Exclusion Diet

- Enteral nutrition for 2 weeks in 78 patients
- Corticosteroid taper over 12 weeks versus placebo and exclusion diet
  - Slow daily addition of foods, leaving out the “problematic foods”
    - Time to relapse
      - 3.8 months on steroids (2 year relapse rate 79%)
      - 7.5 months on diet (2 year relapse rate 62%)
    - Cereal, dairy products and yeast were most often identified triggers

Riordan. Lancet 1993

Modified Fat Diets

<table>
<thead>
<tr>
<th>Diet Name</th>
<th>Description</th>
<th>Deficiencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetarian or Vegan</td>
<td>No animal fat</td>
<td>Iron Vitamin B12 (Vegan) Calcium (Vegan) Vitamin D (Vegan) Omega-3-fatty acids</td>
</tr>
<tr>
<td>Semi-Vegetarian Diet</td>
<td>Reduced animal fat</td>
<td>As above</td>
</tr>
</tbody>
</table>
A Semi-Vegetarian Diet

- Lacto-ovo-vegetarian fiber rich diet
  - Daily – egg, yogurt, fruits, vegetables, legumes, potatoes
  - Unrefined brown rice, miso, pickled vegetables, algae
  - Some milk, green tea
  - Meat (once every 2 weeks), Fish (once a week)
  - Discouraged sweets, bread, cheese, margarine, fast food, carbonation, juice

Chiba et al. World Journal of Gastro. 2010

Semi-Vegetarian Diet

- Remission achieved in CD with enteral nutrition, infliximab, surgery
- Diet started at induction and continued as maintenance therapy for 2 years
- Results
  - 22 patients
  - Only medication therapy: 5ASA
  - Compliance 75% with semi-vegetarian diet
  - Of these 16 compliant patients, 15 were in “remission”
    - Half had normal CRP
Carbohydrate Exclusion

<table>
<thead>
<tr>
<th>Diet Name</th>
<th>Restrictions</th>
<th>Deficiencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Residue</td>
<td>&lt;10-15gm of insoluble fiber</td>
<td>Folate</td>
</tr>
<tr>
<td></td>
<td>Green leafy vegetables</td>
<td>Vitamin A</td>
</tr>
<tr>
<td></td>
<td>Nuts, seeds, popcorn</td>
<td>Vitamin C</td>
</tr>
<tr>
<td></td>
<td>Whole grains</td>
<td>Potassium</td>
</tr>
<tr>
<td></td>
<td>Raw fruit with peels</td>
<td></td>
</tr>
<tr>
<td>Lactose free</td>
<td></td>
<td>Calcium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vitamin D</td>
</tr>
<tr>
<td>Specific Carbohydrate Diet*</td>
<td>Allows only monosaccharides, Restricts lactose, sucrose, starches, grains, and legumes</td>
<td>Folate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thiamine,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vitamin B6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Calcium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vitamin D</td>
</tr>
<tr>
<td>Low FODMAPs</td>
<td>Fermentable Oligo-, Disaccharides Foods with high fructose Sorbitol, mannitol, xylitol</td>
<td></td>
</tr>
<tr>
<td>Gluten Free</td>
<td>Avoidance of wheat, barley, rye</td>
<td>None if substitutes</td>
</tr>
</tbody>
</table>
Unrefined Carbs + High Fiber

- Heaton et al – “Bristol Diet” in CD
  - In combination with medications (5ASA, AZA)
  - Whole meal flour, brown rice, fruit and vegetables
  - Diet group with less hospitalizations, less surgery
- Ritchie et al – Unrefined carbs vs. low fiber
  - Remission or mildly active CD (only 5ASA)
  - White flour and rice + no sugar limit vs. Avoid all
  - No clear difference in clinical course
- Kanauchi et al – Mild moderate UC
  - 20-30gm/day germinated barley
  - Improve bowel symptoms and increased beneficial bacteria

Heaton et al. British Medical Journal 1979
Ritchie et al. British Medical Journal 1987
Kanauchi. J Gastro. 2002

Gluten Free Diet

- Controversy about possible increased incidence of celiac disease in IBD
- No clear evidence that gluten free diet affects disease activity
- Non-celiac gluten sensitivity
  - Poorly absorbed peptide → Malabsorption
  - Avoidance of gluten may improve symptoms such as diarrhea and bloating
FODMAPs

<table>
<thead>
<tr>
<th>Include</th>
<th>Avoid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banana, Blueberry, Citrus, Melon,</td>
<td>Apples, Apricots, Cherries, Pears</td>
</tr>
<tr>
<td>Carrots, Celery, Corn, Lettuce, Eggplant</td>
<td>Brussel Sprouts, Cabbage, Legumes Onions, Artichokes</td>
</tr>
<tr>
<td>Rice, Oats</td>
<td>Gluten</td>
</tr>
<tr>
<td>Hard cheese</td>
<td>High lactose</td>
</tr>
<tr>
<td>Maple Syrup</td>
<td>Sweeteners, Honey, High fructose corn syrup</td>
</tr>
</tbody>
</table>

- Gearry et al. - 52 CD pts and 20 UC pts
- 70% adherence and 50% response
  - Less abdominal pain
  - Bloating
  - Flatulence
  - Diarrhea


Specific Carbohydrate Diet

- Originally used by Sidney Haas in early 1950s to treat celiac disease
- Popularized by Elaine Gottschall
  - Breaking the Vicious Cycle
- Eliminate refined/processed foods

<table>
<thead>
<tr>
<th>Allowed</th>
<th>Restricted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh fruits, vegetables</td>
<td>Wheat, rice, corn</td>
</tr>
<tr>
<td>Honey, unsweetened fruit juice</td>
<td>Canned</td>
</tr>
<tr>
<td>Navy beans, lentils, split peas</td>
<td>No potatoes, yams</td>
</tr>
<tr>
<td>Hard cheeses, homemade yogurt (lactose free)</td>
<td>Chickpeas, bean sprouts</td>
</tr>
<tr>
<td>“Milks”</td>
<td>Commercial yogurt, sour cream</td>
</tr>
<tr>
<td>Meat, fish, poultry, eggs, most nuts</td>
<td>Processed/canned/smoked proteins</td>
</tr>
</tbody>
</table>
Specific Carbohydrate Diet

SCD Similars

GAPS diet -
- The Gut and Psychology Syndrome
- Broths and bone stocks
- Animal fats
- Organ meats
- Fermented vegetables
- Use of ghee
- Less beans/legumes
- Kefir
- Later: Sea vegetables and pure cocoa

Paleo Diet
- All natural animal fats and natural fats (ghee, avocado)
  - More omega 3
- Low carbs (no starchy root vegetables, white rice and other starches)
- High fiber fruits and vegetables
- Lean meats
- No fermented/cultured dairy (OK on GAPS)
- No refined salt or oils
- No processed foods

No scientific literature to date investigating these diets
Evidence for SCD

- **Seattle Children’s Hospital**
  - Review of 7 children with Crohn’s disease on the SCD without immunosuppressive medications
  - Average time on diet 14.6 ± 10.8 months
  - All symptoms (via PCDAI score) were notably resolved after 3 months on the SCD
  - Serum albumin, CRP, hematocrit and stool calprotectin normalized or significantly improved during follow-up in all patients
  
  Suskind et al. JPGN 2014

Evidence for SCD

- **Atlanta**
  - 9 pediatric patients with active CD
  - No changes or addition of medications
    - 4 on 6MP, 1 on 5ASA, 1 on Budesonide
  - Improvement in symptoms over initial 12 weeks
  - 33% lost weight
  - Improved anemia, ESR and albumin (not statistically significant)
  - Improvement sustained in 7 children for 52 weeks
    - Two with capsule endoscopy that documented mucosal healing
  
  Cohen et al. JPGN. 2014
Our SCD Experience

- Lucile Packard Children's Hospital
- 11 pediatric patients with CD,
- Started SCD at time of diagnosis or flare.
  - SCD simple (diet alone, with antibiotics or 5-ASA)
  - SCD with immunomodulators (brief corticosteroids and/or stable thiopurine)
  - Mean age at diagnosis of CD was 11.0 ± 3.2 years
  - Mean age at start of the SCD 11.8 ± 3.0 years

![Boxplot showing hematocrit levels at different stages of diet](image-url)
Our Prospective Study

- Children with CD on SCD
  - Symptom assessment using PCDAI
  - Weight and Height
  - CBC, ESR, CRP, CMP with Albumin
  - Fecal calprotectin, lactoferrin
  - Dietary Analysis
  - Quality of Life Survey
  - Cytokine analysis, stool microbiota

- Stable or weaning medication therapy
- 1 month “deadline” for improved symptoms, maintaining weight and normalization of laboratory values
- Preliminary analysis of patients is underway
Conclusions

• Benefit of enteral nutrition for induction in Crohn’s Disease
• Benefit of partial enteral nutrition to maintain remission in Crohn’s disease
• Specific Carbohydrate Diet and Semi-vegetarian Diet for maintenance of remission in Crohn’s disease?
• Improvement in symptoms with an individually tailored exclusion diet
  o FODMAPS or Gluten Free

Keys to Successful Nutritional Therapy

• Team – Patient, Family, Physician, Registered Dietician
• Clear timeline
• Standard of care disease assessment
  • Labs, fecal calprotectin, procedures to assess efficacy
• Calorie goals, growth monitoring
• Vitamin supplementation (calcium, Vitamin D)
• Support in the kitchen – time, $$$, online
• Support from other families
• Decide on “plan B” in advance
Questions?

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