An update on dietary considerations for inflammatory bowel disease

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Honorary Senior Lecturer

Inflammatory bowel disease (IBD)

Ulcerative colitis vs. Crohn’s disease

<table>
<thead>
<tr>
<th>Site</th>
<th>Ulcerative colitis</th>
<th>Crohn’s disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colon only</td>
<td>Colon (50%)</td>
<td>Small intestine (40%)</td>
</tr>
<tr>
<td></td>
<td>Small intestine (50%)</td>
<td>Both (30%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inflammation</th>
<th>Ulcerative colitis</th>
<th>Crohn’s disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous</td>
<td></td>
<td>Patchy</td>
</tr>
<tr>
<td>Mucosal</td>
<td></td>
<td>Deep &amp; fissuring</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Ulcerative colitis</th>
<th>Crohn’s disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bloody diarrhea</td>
<td></td>
<td>Pain, diarrhea, fever, weight loss, PEM</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Ulcerative colitis</th>
<th>Crohn’s disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immunosuppression</td>
<td></td>
<td>Immunosuppression</td>
</tr>
<tr>
<td>Colectomy</td>
<td>Surgery</td>
<td>Anti-TNF antibody Diet</td>
</tr>
</tbody>
</table>

Outcome measures in IBD

Subjective
- Disease activity index – CDAI, HBI
- Quality of life - IBDQ
- Food-related quality of life
- Symptom assessment

Objective
- Inflammatory markers (CRP, faecal calprotectin)
- Endoscopic score
- Histology
- Radiology – CT, MRI
- Complications, length of stay, cost

Dietary considerations
- IBD service standards
- Undernutrition
- Nutritional assessment
- Exclusive and partial enteral nutrition
- Food reintroduction
- Dietary fibre
- Pre-surgical nutritional optimisation
- Functional gastrointestinal symptoms

Nutritional problems in inflammatory bowel disease:
The patient perspective

Journal of Crohn’s and Colitis (2011)
Alexis Prince *, Kevin Whelan *, Arifa Woosta *, Miranda C.E. Lomer *, Dianne P. Reidlinger *, *

Nutritional problems experienced

Food and nutrition problems experienced

<table>
<thead>
<tr>
<th>Problems, n (%)</th>
<th>CD (N=47)</th>
<th>UC (N=25)</th>
<th>IBD (N=72)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>44 (94)</td>
<td>16 (64)</td>
<td>60 (83)</td>
</tr>
<tr>
<td>Lethargy</td>
<td>42 (89)</td>
<td>19 (76)</td>
<td>61 (85)</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>36 (77)</td>
<td>21 (84)</td>
<td>57 (79)</td>
</tr>
<tr>
<td>Gut problems</td>
<td>40 (85)</td>
<td>21 (84)</td>
<td>61 (85)</td>
</tr>
<tr>
<td>Social activities</td>
<td>33 (70)</td>
<td>13 (52)</td>
<td>46 (64)</td>
</tr>
<tr>
<td>Micronutrient deficiency</td>
<td>28 (60)</td>
<td>14 (56)</td>
<td>42 (58)</td>
</tr>
</tbody>
</table>

* Significant difference for weight issues CD vs. UC; p=0.002 (Fisher’s exact test)

National UK audits in inflammatory bowel disease (IBD) highlight a deficit of dietitians in gastroenterology: a priority for improvement supported by national IBD standards

All patients with IBD should have access to a dietitian
Minimum 0.5WTE Dietitian allocated to Gastroenterology

IBD standards 2013 www.ibdstandards.org.uk
Inflammatory bowel disease

What the quality statement means for patients, service users and carers

People with inflammatory bowel disease, and their family members or carers, have support from a care team made up of a range of different professionals (including nurses, doctors, dietitians, and pharmacists). The type of support they get should depend on the person's age (for example, whether they are an adult or a child), and should help to deal with any concerns about the condition and its treatment.

Aetiology & mechanisms of undernutrition in IBD

Assessment of nutritional status

Body composition: Anthropometry

### Body composition: Bio-electrical impedance

<table>
<thead>
<tr>
<th>BIA (n=8 studies)</th>
<th>Crohn's disease</th>
<th>Ulcerative colitis</th>
<th>Healthy subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benjamin et al. 2011</td>
<td>FFM in CD versus UC and healthy subjects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capristo et al. 1998a</td>
<td>FFM did not differ between groups</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benjamin et al. 2011</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-invasive, no radiation, portable</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Muscle strength and function

<table>
<thead>
<tr>
<th></th>
<th>Crohn’s disease</th>
<th>Ulcerative colitis</th>
<th>Healthy subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geerling et al. 1998</td>
<td>4 Hamstring strength in remission CD versus healthy subjects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valentini et al. 2008</td>
<td>1 Hamstring strength (NGS) in remission CD/UC versus healthy subjects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wiroth et al. 2005</td>
<td>NGS did not differ between remission CD and healthy subjects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valentini et al. 2008</td>
<td>4 strength endurance and repetition in remission CD versus healthy subjects</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

No data for active disease
40% remission patients versus 75% active disease report fatigue (Graff et al. 2013)

### Current practice in relation to nutritional assessment and dietary management of enteral nutrition in adults with Crohn’s disease

<table>
<thead>
<tr>
<th>Type of assessment</th>
<th>Dedicated number of dietetic sessions for gastroenterology*</th>
</tr>
</thead>
<tbody>
<tr>
<td>~&lt;5 per week</td>
<td>~&lt;5 per week</td>
</tr>
<tr>
<td>(n = 172)</td>
<td>(n = 123)</td>
</tr>
<tr>
<td>Anthropometry</td>
<td>3.8 (1.0)</td>
</tr>
<tr>
<td>Biochemical</td>
<td>4.6 (2.8)</td>
</tr>
<tr>
<td>Clinical†</td>
<td>6.5 (1.8)</td>
</tr>
<tr>
<td>Dietary intake</td>
<td>3.3 (1.9)</td>
</tr>
<tr>
<td>Economic</td>
<td>1.7 (1.0)</td>
</tr>
<tr>
<td>Total†</td>
<td>20.1 (5.8)</td>
</tr>
</tbody>
</table>

*CRP <20 mg/L plasma zinc
**CRP <10 mg/L plasma selenium, vitamins A and D
***CRP <5 mg/L vitamin B6 and vitamin C

### Self-Screening for Malnutrition Risk in Outpatient Inflammatory Bowel Disease Patients Using the Malnutrition Universal Screening Tool (MUST)

<table>
<thead>
<tr>
<th>Nutrient/problem</th>
<th>Crohn’s disease</th>
<th>Ulcerative colitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaemia</td>
<td>6.74</td>
<td>9.67</td>
</tr>
<tr>
<td>Iron</td>
<td>36</td>
<td>81</td>
</tr>
<tr>
<td>Folate</td>
<td>3.54</td>
<td>6.36</td>
</tr>
<tr>
<td>Vitamin B12</td>
<td>15.48</td>
<td>1.18</td>
</tr>
<tr>
<td>Calcium</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Vitamin D</td>
<td>18.70</td>
<td>17.79</td>
</tr>
<tr>
<td>Magnesium</td>
<td>14.33</td>
<td>18.24</td>
</tr>
<tr>
<td>Zinc</td>
<td>3.5</td>
<td>6</td>
</tr>
</tbody>
</table>

*Filipi et al 2006 (CD in remission)
Geerling et al 1999 (IBD)
Vagianos et al 2007 (IBD)
Valentini et al 2008 (IBD in remission)

### Assessment of micronutrient status

Quantitative data on the magnitude of the systemic inflammatory response and its effect on micronutrient status based on plasma measurements†‡

Clinical interpretation of plasma micronutrients depends on degree of inflammation
CRP <20 mg/L plasma zinc
CRP <10 mg/L plasma selenium, vitamins A and D
CRP <5 mg/L vitamin B6 and vitamin C

### Guidelines for the management of inflammatory bowel disease in adults

Malnutrition in IBD is common and multi-factorial in origin. Nutritional assessment, including BMI is important: there are validated tools such as Malnutrition Universal Screening Tool (MUST) to guide assessment,50 (http://www.bapen.org.uk/musttoolkit.html(last accessed Oct 2010)). Patients with active colitis may have secondary lactose intolerance and a dairy free diet may reduce gas and bloating (EL5, RGD).

4.1 Nutrition

### IBD patients with nutritional deficiencies (%)
Impact of Exclusive Enteral Nutrition on Body Composition and Circulating Micronutrients in Plasma and Erythrocytes of Children with Active Crohn's Disease: Tufts Research Ethics Board 2013:33;071-13R1

Kostoulas, G., Canini, S., Woodhouse, J., Shepherd, R., O'Reilly, P., Hawkey, C., and Zinman, A. (2013)

Dietary management in IBD

Crohn's disease or ulcerative colitis

Disease severity – active and remission

Symptom control

Diet to treat active CD (to induce remission)

Enteral nutrition compared with steroids

Which enteral formula?

Comparison of elemental versus non-elemental diet

Low fat versus high fat

Zachos et al 2007 Cochrane Database Syst Rev
Effect of Exclusive Enteral Nutrition on Health-Related Quality of Life for Adults With Active Crohn’s Disease

Zhan Guo, Rong Wu, Wenying Gu, Jianling Gong, Wei Zhang, Yi Li, Li-Gui Meng, and Jiashu Li.


- Polymeric diet 4 weeks
- N=13
- Oral and nasogastric overnight
- 11 clinical remission CDAI
- IBDQ significant improvement
- 8 patients expressed willingness to use EN again if relapsed

Impact of Exclusive Enteral Nutrition on Body Composition and Circulating Micronutrients in Plasma and Erythrocytes of Children with Active Crohn’s Disease

Kostantinos Gerantonidis, PhD,’11 Dinah Silver, PhD,² Andrew O’Keefe, PhD,² Nicola Myers, PhD,² Elke Buchner, Dr.,² Karen Hussain, MBBCh,² Gemma O’Rielly, PhD,² Pascale Huggett, PhD,²,’3 and Christine Ann Edwards, PhD.

TGF Journal 2013, 18:1572-1581

- Exclusive enteral nutrition 6-8 weeks (n=17)
- Modulen IBD
- Lean mass but not fat mass improved
- Carotenoids depleted – levels in enteral feed insufficient?
- Other micronutrients improved

The efficacy of exclusive nutritional therapy in paediatric Crohn’s disease, comparing fractionated oral vs. continuous enteral feeding

Attal M., Freyman M., Bauer G.J., Germain-Langlais N., Tabary S., Serresi M., Carbon O., Guest C., and M. Rencontre.

Aliment Pharmacol Ther 2013, 38: 1026-1034

- ITT Remission: oral n= 34/45 (75%) enteral 52/61 (85%); P = 0.157
- Significant decrease in PCDAI (P < 0.0001)
- Significant improvements in anthropometry and inflammatory indices
- No difference between oral versus enteral route except weight increase higher in enteral group (P = 0.043)
- Subgroup of patients (n=14) mucosal healing on follow-up endoscopies showing a clear correlation to remission (7/8 oral 5/8 enteral)
- Compliance rates (87% and 90%) were similar.
- Noncompliant patients had lower mucosal healing and remission rates.

Mechanisms: How does enteral nutrition work?

- Nutrients are major components of the luminal contents
- Bowel rest Luchs et al 1983; Greenberg et al 1988
- Reduced antigenic load Lomer et al 2001
- Improve nutritional status Gorard et al 1993; Teahon et al 1995
- Supplementation of nutrients glutamine Zoli et al 1995; Akobeng et al 2000
- TGFβ Fell et al 2000
- Fatty acid content Gassull et al 1995; Geerling et al 2000
- Change in gut microbiota

Formula

<table>
<thead>
<tr>
<th>2000kcal</th>
<th>Modulen IBD</th>
<th>Fortisip</th>
<th>Vital</th>
<th>E028 Extra</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume</td>
<td>2340ml</td>
<td>2340ml</td>
<td>2325 ml</td>
<td></td>
</tr>
<tr>
<td>Protein (g)</td>
<td>72g (14.4%)</td>
<td>48g (18%)</td>
<td>48g (11.6%)</td>
<td></td>
</tr>
<tr>
<td>Fat (g)</td>
<td>94g (42.3%)</td>
<td>78g (33%)</td>
<td>74g (36.6%)</td>
<td></td>
</tr>
<tr>
<td>LCT % of total energy</td>
<td>52%</td>
<td>35%</td>
<td>36%</td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Whole protein</td>
<td>Whole protein</td>
<td>Caseinate, whey protein hydrolysate</td>
<td></td>
</tr>
<tr>
<td>Presentation</td>
<td>Powder</td>
<td>Liquid</td>
<td>Liquid</td>
<td></td>
</tr>
<tr>
<td>Osmolarity</td>
<td>725</td>
<td>546</td>
<td>687</td>
<td></td>
</tr>
<tr>
<td>Cost (GBP)</td>
<td>13.06</td>
<td>12.60</td>
<td>19.97</td>
<td>27.95-29.66</td>
</tr>
</tbody>
</table>
Practical considerations

- MD team approach and patient choice
- Primary or adjunctive treatment
- Outcome measures – clinical response or mucosal healing
- Calculate requirements: predictive equation +/- stress factor / PAL
- Manage refeeding risk
- Gradual introduction over 3 days and minimum 10 days
- Wean off food and caffeine
- Manage risk of obstruction in stricturing disease
- Monitoring - side effects, clinical response, nutritional status
- Oral versus nasogastric

PROFESSIONAL GUIDELINE

British Dietetic Association evidence-based guidelines for the dietary management of Crohn’s disease in adults

Recommendations – exclusive enteral nutrition

<table>
<thead>
<tr>
<th>Steroids</th>
<th>Recommended by SIGN</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Considered to be a first line treatment option for induction of remission in adults with active Crohn’s disease. Enteral nutrition can be offered as an alternative primary or adjunctive treatment option to induce remission.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When enteral nutrition is used for induction of remission:

- Elemental or non elemental formulas can be used
- The formula can be given orally or via an enteral feeding tube
- The formula should be given for a minimum period of ten days


ESPEN guideline: Clinical nutrition in inflammatory bowel disease


3.4.9.1. Efficacy of nutritional therapy. There have been no placebo-controlled trials of nutritional therapy for active CD in adult patients. However, elemental or polymeric diets appear less effective than corticosteroids. In a Cochrane systematic review, the four rigorously controlled trials comparing enteral therapy (n=130 patients) with prednisolone (n=123 patients) showed steroids to be more effective (OR 0.3, 95% CI 0.17-0.52). The number needed to treat was 4. There was no difference in efficacy between elemental and polymeric diets. A distinction must be drawn between primary therapy to induce remission and adjunctive therapy to support nutrition.
**Food Reintroduction – 3 approaches**

**Elimination Diet (Riordan et al 1993)**

- Following disease remission achieved with EEN
- Reintroduce one new food daily
- Monitor symptoms
- Exclude foods that cause symptoms
- Remission rate at 2 years = 79% (62% in steroids)

**LOFFLEX - Woolner et al 1998**

- Fat <50g/day
- Fibre NSP <10g/day
- Modified exclusion diet avoidance of foods that symptoms in >5% patients
- Baseline diet for 2 weeks
- Individual foods tested for 4 days each
- Food and symptom diary
- Remission rate 59% at 2 years

**Rapid Food Reintroduction (Faiman et al 2014)**

**Recommendations – food reintroduction diets**

- Following induction of remission by nutritional means, food reintroduction diets such as elimination or LOFFLEX diet can be considered for maintenance of remission
- High fibre diets should not be recommended as a food reintroduction diet
Partial enteral nutrition (PEN)

Increasing interest in PEN

- No need to stop all food
- Less taste fatigue
- Improved adherence in adults

- Elemental or whole protein formula
- Oral versus nasogastric
- Variability in energy provided 35-75%
- Other dietary constituents – a free or restrictive diet

Partial Enteral Nutrition with a Crohn’s Disease Exclusion Diet Is Effective for Induction of Remission in Children and Young Adults with Crohn’s Disease (Inflamm Bowel Dis 2014;20:1355-1366)

Sigal Boneh, RG*; Tamar Pfiffer, G*; HD Sigal, MD*; Tsh Garnes, MD*; Moni Broum, RD, PhD* and Ari Levine, MD†*

47 patients
- 0-6 weeks
  - 50% enteral nutrition (Modulen or paediasure)
  - 50% exclusion diet
- 6-12 weeks
  - 25% enteral nutrition (Modulen or paediasure)
  - 75% exclusion diet

Exclusion diet

Sigal-Boneh et al Inflamm Bowel Dis 2014

- 51 adults CD in recent remission (CDAI<150)
- PEN (elemental, 50% energy) plus normal diet for up to 2 years versus normal diet for up to 2 years
- Relapse rate
  - PEN 35% versus normal diet 64%
Nutritional therapy versus 6-mercaptopurine as maintenance therapy in patients with Crohn's disease


J Crohns Colitis. 2016 Sep 22. pii: jjw168. [Epub ahead of print]

Surgery and IBD

Up to 70% of patients with Crohn’s disease require abdominal surgery

Lifetime surgery rates in ulcerative colitis 23-30%

Post-operative complications more commonly seen in IBD than other diseases

Suboptimal nutritional status impairs surgical outcome

Nutritional optimisation of pre-surgical Crohn's disease patients with enteral nutrition significantly decreases length of stay and need for a stoma


Preoperative Nutritional Therapy Reduces the Risk of Anastomotic Leakage in Patients with Crohn’s Disease Requiring Resections

Zhen Guo, Dong Gao, Jianfeng Gong, Weiming Zhu, Ligen Zuo, Jing Sun, Ning Li, and Jiashun Li

Gastroenterology Research and Practice 2016

<table>
<thead>
<tr>
<th>Complications</th>
<th>Non-NT group</th>
<th>NT group</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anastomotic leakage</td>
<td>7 (179)</td>
<td>1 (2.3)</td>
<td>0.023</td>
</tr>
<tr>
<td>Reoperation due to</td>
<td>3 (77)</td>
<td>1 (2.3)</td>
<td>0.338</td>
</tr>
<tr>
<td>anastomotic leakage</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Exclusive enteral nutrition provides an effective bridge to safer interval elective surgery for adults with Crohn’s disease


13/51 EEN avoided surgery
38 EEN matched to 76 controls

Energy requirements
Henry equation + activity + stress factor
Modulen IBD
1 kcal/ml or if limited tolerance concentrated to reduce volume
3 patients unable to tolerate >4 weeks EEN
Prednisolone and bridged to thiopurine
Food reintroduction after 6 weeks

Preoperative oral polymeric diet enriched with transforming growth factor-beta 2 (Modulen) could decrease postoperative morbidity after surgery for complicated ileocolonic Crohn’s disease

SCANDINAVIAN JOURNAL OF GASTROENTEROLOGY 2016

Katharina Beugger*, Arnaud Bouquet*, Solibah Abdallah*, Frédéric Carbonell*, Christophe Preux* and Stéphane Barré*

Prospective study
Complicated CD 'high risk' (n=35)
Obstructive symptoms
Steroids
>10% weight loss
EEN (n=34/35)
1 nausea and vomiting at 7 days
Uncomplicated surgery 'low risk' (n=21)

Optimise nutritional status pre-operatively

- Surgical resection more successful if carried out when nutritional status has been optimised
- Prevent and treat undernutrition before surgery
- Maintain nutritional status post-surgery
- Initiate nutritional support in patients where it is anticipated that surgery will mean 60-75% of oral intake cannot be maintained. (Preferably use enteral route)

Dietary fibre and IBD

ESPGN guideline: Clinical nutrition in inflammatory bowel disease

Alistair Ferber 1, Johannes Escher 1, Xavier Hübnermeier 1, Stannissie Kirch 2, Zeljko Kresmar 3, Séphine Scheider 1, Raman Shemir 1, Kalina Stoevdobova 4, Nicolette Werdini 1, Anthony E. Wiskin 1, Stephan C. Bischoff 1

Clinical Nutrition 2017

Optimise nutritional status pre-operatively
Avoidance of Fiber Is Associated With Greater Risk of Crohn’s Disease Flare in a 6-Month Period

Carol S. Brotherton, Christopher A. Martin, Wilie D. Long, Michael D. Kappeler, and Robert S. Sandor
Clinical Gastroenterology and Hepatology 2016;14(10):1128-1133

<table>
<thead>
<tr>
<th>RCTs</th>
<th>3/10 studies in UC reported benefit of fibre supplementation on outcome</th>
<th>23 RCTs – 1296 patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0/12 studies in CD</td>
<td>1/1 study in pouchitis</td>
</tr>
</tbody>
</table>

Recommendation for dietary fibre and stricturing disease

Fibrous foods are contraindicated in the presence of strictures due to the risk of mechanical obstruction (Meier & Gassull, 2004)

Prevalence of functional bowel symptoms in IBD

Original Article

What Are the Top 10 Research Questions in the Treatment of Inflammatory Bowel Disease? A Priority Setting Partnership with the James Lind Alliance

Ailsa L. Hart,* Miranda Lomax,* Azmina Verjee,* Karen Kemp,* Omar Faz,* Ann Daly,* Julie Bolsover,* John McLaughlin*

Conclusions

Dietitians in IBD under-resourced
High prevalence of undernutrition in IBD
Nutritional assessment in IBD vital
A role for exclusive enteral nutrition as primary and adjunctive treatment
Food reintroduction needs careful consideration
Partial enteral nutrition and exclusion diets...
Pre-surgical nutritional optimisation
Avoid unnecessary dietary fibre restriction
Manage functional bowel symptoms through dietary means