Navigating the Gut: The Science of Diet in Inflammatory Bowel Disease

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Disclosures

Michelle Pearlman, M.D., faculty for this educational activity, has no relevant financial relationships with ineligible companies to disclose, and has indicated that the presentation or discussion will not include off-label or unapproved product usage.

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Learning Objectives

Objective 1: Enhance Awareness and Knowledge

- To increase awareness among healthcare professionals about the pivotal role of nutrition in managing IBD.

Objective 2: Explore Evidence-Based Approaches

- To review the latest scientific research and evidence supporting diverse nutritional strategies for IBD management.

Objective 3: Equip with Practical Guidance

- To equip healthcare providers with evidence-based dietary guidelines and practical recommendations for effectively assisting IBD patients in optimizing their nutrition for improved outcomes.

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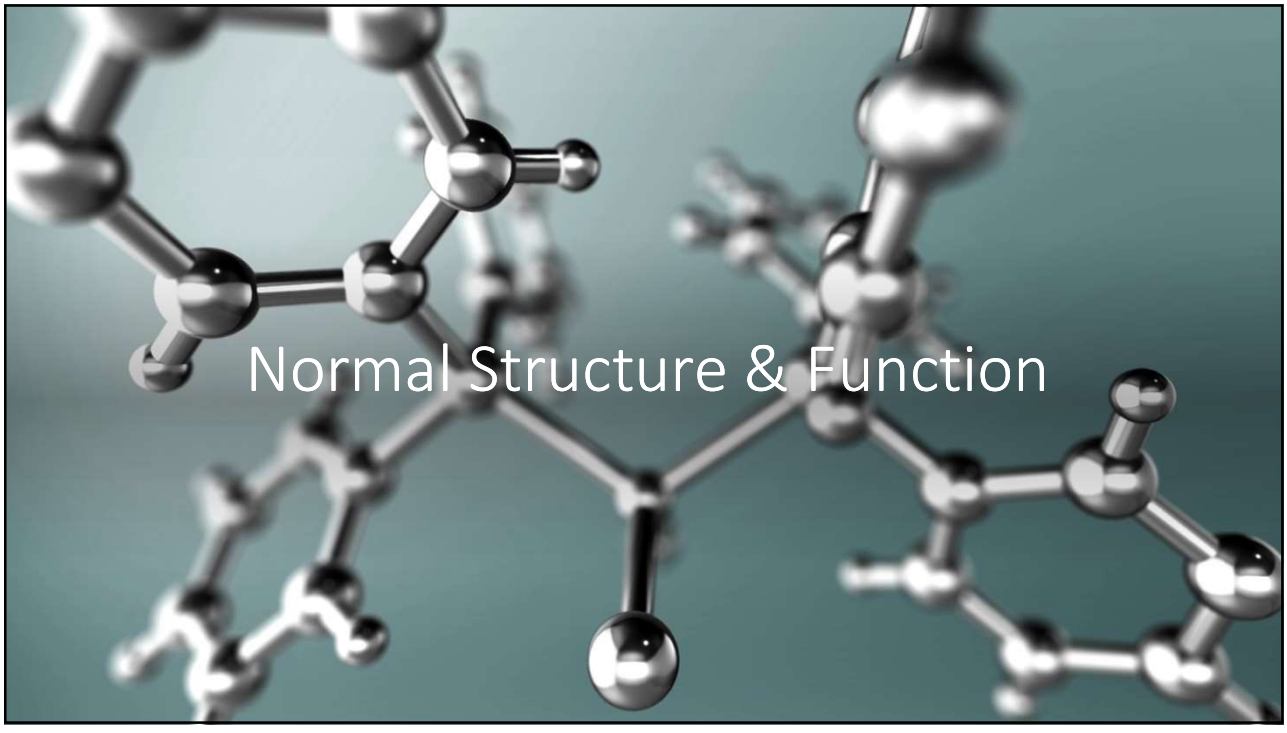

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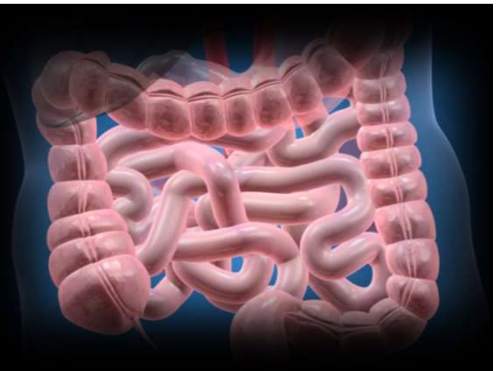
What is the GUT?



Gut epithelium

GALT

Enteric NS

Microbiome

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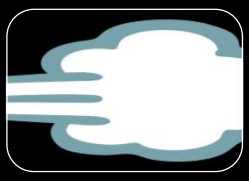
Normal Physiological Food Reactions

Large volume meals → distension, regurgitation

Fatty foods delay gastric emptying by altering motility

Legumes, cruciferous vegetables, onions enhance intestinal gas production

Non-absorbable or poorly digested sugars & carbohydrates → bloating, diarrhea, flatulence



Passing intestinal gas is NORMAL (14X per day)

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IBD Prevalence

Global IBD Increase: Rapid rise in cases worldwide.

Genetics: Stable, pointing to non-genetic factors for IBD rise.

Environmental Factors: Pollution and lifestyle changes contribute to higher IBD rates.

Diet: Processed and low-quality foods linked to gut inflammation and IBD risk.

Antibiotics: Overuse disrupts gut microbiota, increasing IBD susceptibility.

Adams S.M., Bornemann P.H. Ulcerative colitis. *Am. Fam. Physician.* 2013;87:699–705

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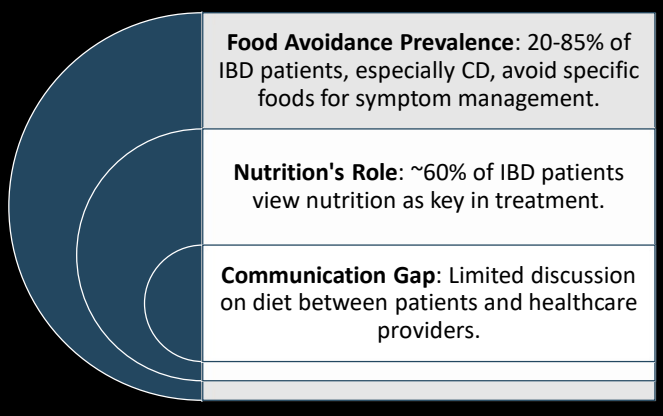
Current Landscape



Food Avoidance Prevalence: 20-85% of IBD patients, especially CD, avoid specific foods for symptom management.

Nutrition's Role: ~60% of IBD patients view nutrition as key in treatment.

Communication Gap: Limited discussion on diet between patients and healthcare providers.

Massironi et al. Clinical Nutrition. 2013; 32(6), 904–910.
Tinsley A, Ehrlich O, Hwang C, et al. Inflammatory Bowel Diseases. 2016; 22(10), 2474-2481.

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Challenges in Nutrition Research for IBD

- **Complex Interactions**: Between various food groups.
- **Varied Dietary Models**: Multiple food groups interact, influencing disease progression.
- **Individual Responses**: Food elimination impacts vary; may worsen or alleviate symptoms.
- **Personalization**: Essential to tailor dietary recommendations to individuals.

Ananthakrishnan A.N., Khalili H., Konijeti G.G., Higuchi L.M., De Silva P., Korzenik J.R., Fuchs C.S., Willett W.C., Richter J.M., Chan A.T. A prospective study of long-term intake of dietary fiber and risk of Crohn's disease and ulcerative colitis. *Gastroenterology.* 2013;145:970–977. doi: 10.1053/j.gastro.2013.07.050.
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Impact of Nutrition on IBD

Role of Diet in IBD

Nutrition plays a crucial role in managing IBD symptoms and reducing inflammation.

Effects on Nutrient Absorption

Inflammation in the intestines can impair nutrient absorption, leading to nutritional deficiencies in IBD patients, which further exacerbates the condition.

Malnutrition is very common.

Gut Microbiota and Inflammation

The balance of gut microbiota is essential for regulating inflammation in IBD, making diet an important factor in influencing the gut microbiome and managing symptoms.

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Food Avoidance and Nutritional Therapy

Food Avoidance in IBD

Approximately 60% of IBD patients consider nutrition important

Medical Nutritional Therapy

Aims to manage symptoms and reduce inflammation

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Impact of Western Diet on Gut Microbiota

- **Dysbiosis from Diet**: Western diet high in fat and sugar causes gut dysbiosis in mice.
- **Microbiota Changes**: Increase in harmful bacteria; decrease in beneficial bacteria.
- **Insoluble Fiber's Role**: Low insoluble fiber intake in Western diet exacerbates microbiota imbalance.
- **Fiber's Importance**: Crucial for a healthy gut microbiota.

Raza G.S., Putaala H., Hibberd A.A., Alkoniemi E., Tiihonen K., Mäkelä K.A., Herzig K.H. Polydextrose changes the gut microbiome and attenuates fasting triglyceride and cholesterol levels in Western diet fed mice. *Sci. Rep.* 2017;7:5294. doi: 10.1038/s41598-017-05259-3Miggiano G.A.D., Gasbarrini A., Mele M.C. Food Components and Dietary Habits: Keys for a Healthy Gut Microbiota Composition. *Nutrients.*
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Gut Microbes: The Unsung Heroes in Digestion and Immunity

- Polysaccharide Fermentation: Polysaccharides indigestible by humans are fermented by gut bacteria.
- Production of SCFAs: This fermentation process produces Short Chain Fatty Acids (SCFAs) - acetate, propionate, and butyrate.
- SCFAs' Crucial Roles: Mainly produced by Bifidobacterium and Lactobacillus, SCFAs are vital for maintaining immune homeostasis and act as signaling molecules connecting the immune, nervous, and gastrointestinal systems.

Roopchand D.E., Carmody R.N., Kuhn P., Moskal K., Rojas-Silva P., Turnbaugh P.J., Raskin I. Dietary polyphenols promote growth of the gut bacterium *Akkermansia muciniphila* and attenuate high-fat diet–induced metabolic syndrome. *Diabetes.* 2015;64:2847–2858. doi: 10.2337/db14-1916

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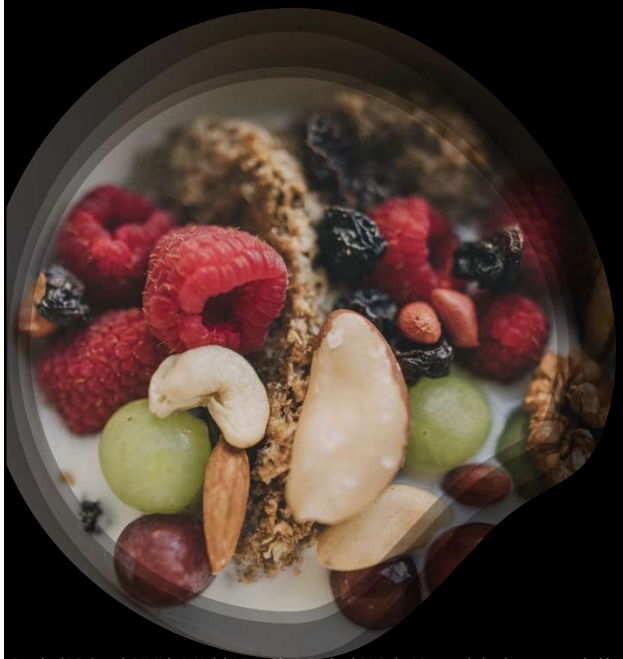

Fiber & Polyphenols: Powering Gut Health & Fighting Inflammation

- **SCFA Production:** Influenced by the consumed fiber type and the dominant gut bacteria.
- **Fiber's Prebiotic Role**: Stimulates beneficial bacteria, boosts SCFA, supports colonocyte energy.
- **Diet and Gut Health**: Plant-based diets enhance commensal bacteria and SCFA, improving gut health.
- **Polyphenols' Impact**: Support cellular function, reduce inflammation, improve barrier integrity.

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Diet's Impact on Gut Health:
A Closer Look
• Lipopolysaccharide Source: A component of Gram-negative bacteria in the gut.
• Dietary Microparticles: Inorganic microparticles from food additives bind with lipopolysaccharides, forming antigenically active substances.
• Immune Response Modulation: These substances can modulate both local and systemic immune responses.
• Sulfur Compounds and Processed Foods: Foods high in sulfur compounds and processed foods promote the growth of sulfate-reducing bacteria (SRB).

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Nutritional Therapy: Goals
• Maintain or restore nutritional balance (correct any deficiencies)
• Manage GI symptoms
• Reduce intestinal inflammation

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Dietary Recommendations During IBD Flares

Current Dietary Practices: Low residue diet

I.e. No whole nuts, seeds, raw fruits, and vegetables.

Dairy Products: Avoidance of lactose-containing dairy products.

Questionable Evidence: There is limited scientific evidence supporting these dietary restrictions.

Potential Risks of Fiber Avoidance: Avoiding fiber may paradoxically increase the risk of future IBD flares.

Need for Personalized Nutrition: Lack of transition to personalized dietary recommendations in the outpatient setting overlooks the dynamic changes in individual disease journeys.

Shah N, Parian A, Mullin G, & Limketkai B. Nutrition in Clinical Practice. 2015; 30(4), 462-473.

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Dietary Strategies for Managing Symptoms

Balanced Diet and IBD

Including adequate nutrients from various food groups is crucial for managing IBD symptoms and promoting overall health.

Avoiding Pro-inflammatory Foods (Limiting concentrated sugars, high-fat foods, and alcohol)

Fiber and Hydration

Maintaining an appropriate fiber intake and ensuring proper hydration, often need to minimize fiber during flare (can worsen diarrhea/bloating)

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When to avoid or limit fiber?

- CD
  - Intestinal stenosis/luminal narrowing
  - Severe diarrhea
    - Limit insoluble fiber

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What types of fiber are recommended?

- Soft, peeled, cooked fruits/vegetables (steamed/pureed veggies or fruit without seeds/skin)
- Refined grains

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Nutritional Support: PO, EN & PN

- Elemental Diet: Mild-Mod CD: Consider 4 -12 week trial Exclusive Enteral Nutrition (EEN)
  - Polymeric or elemental formula
  - Data suggests:
    - Induce remission, Improve nutrition status, Improve body composition, Mucosal healing, Decrease pro-inflammatory cytokines
- Consider Partial Enteral Nutrition (PEN) if unable to maintain nutrition status by mouth
  - Semi-elemental or elemental formula
- Parenteral Nutrition (PN) not considered primary therapy for IBD
  - Unable to tolerate EN
  - Nonfunctional gut
  - SBS <150 cm functional small bowel

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Estimated Calorie Needs: BMI

- BMI <15
  - 36-45 kcal/kg
- BMI 15-19
  - 31-35 kcal/kg
- BMI 20-29
  - 26-30 kcal/kg
- BMI >30
  - 15-25 kcal/kg

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Estimated Protein Requirements

- 1-1.5 g/kg
- If active disease, closer to 1.5 g/kg
- Use ideal BW if BMI >30

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Structural SBS

Quick definition: < 200 cm functional small intestine remaining +/- IC valve

Resection/loss of length

- Resection of ≤50% bowel (300 cm) - No significant morbidity, losses
- Resection of ≥75% bowel (450 cm) - Significant losses needing EN/PN

Obtain measurement from gross specimen report for measurement or operative report

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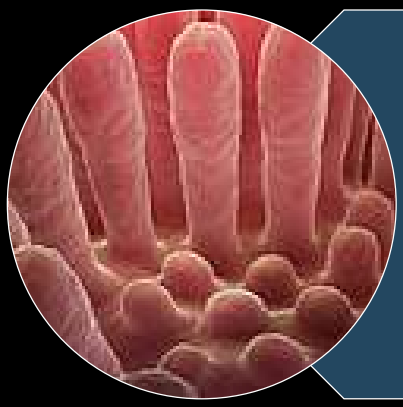
Functional SBS



Loss of mucosal absorptive surface BUT normal intestinal length

- Small bowel enteropathies
- Radiation enteritis
- IBD
- Enterocutaneous fistulas

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General Principles: SBS

Most ***digestion*** in duodenum

Most ***absorption*** in duodenum & proximal jejunum

Fluid & electrolyte depletion is earliest event in SBS

Function improves with time 2/2 intestinal adaptation

Digestion is not the problem: transit is

Management Goals:

- keep food in contact w/ remaining mucosal surface for as long as possible
- Increase mucosal surface area

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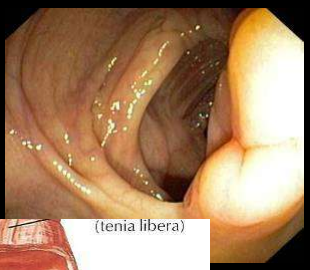
Importance of Ileocecal Valve

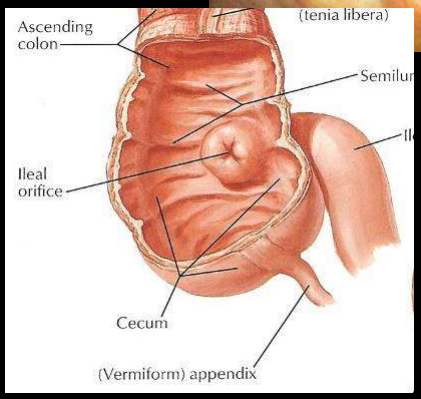
Presence/absence significant factor in management

Ileal brake feedback mechanism controls meal transit & digestion (GLP-1 & PYY from ileal L cells released post prandial → slow transit, better adaptation)

Prevents SB bacterial overgrowth

Impacts need/duration for PN





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Extent of Ileal Resection & Fat Consumption

- Length of ileum resected impacts bile salt pool
  Short Ileal Resection (<100 cm resected)– Fat restriction helps but fat provides good calories and reduces EFAD
  BS pool maintained
  Cholestyramine helps
  ↑Ca++, Mg++, zinc absorption and reduces diarrhea

>100 cm resected – need more fat intake (MCTs)
BS pool depleted
Cholestyramine worsens
Consider MCT oil in those with fat malabsorption, up to 50 g (8 tablespoons) in small amounts

- Effect of unabsorbed bile salts & fatty acids
  - Bacteria deconjugate bile salts→ – Toxic
  - Bacteria convert fat → hydroxy fatty acids → stimulates active secretion (secretory diarrhea) + increased contractility

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Value of Retained Colon

Colonic Adaptation
- Dilation, lengthening, proliferation

Provides huge fluid/electrolyte absorption
- Fluid absorption can nearly double 2L → 4L per day
- Less likely to require EN/PN

Capability of "colonic salvage"
- Bacteria act on carb/fiber to produce short chain fatty acids
- Colon can absorb up to 500 kcal/d as SSFAs and lactate

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Are all liquids created equal?

Hyper-osmolar fluids induce secretion from enterocytes (attempt to dilute conc of luminal contents → increase diarrhea

Hypo-osmolar fluids (pull sodium and water into the lumen)→ increase diarrhea

Normal bowel, sodium reabsorbed in distal small intestine

End jejunostomy, sodium and fluid are lost in stool

ORS: replace sodium losses and promote water reabsorption (utilize sodium-glucose transport system)

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Oxalate Kidney Stones: Colon Intact

- Normally Ca++ binds oxalate, excreted
- Unabsorbed FAs bind Ca++, oxalate absorbed
- Rx provide extra Ca++ (Tums) >> restrict oxalate rich foods

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Lactose Intolerance

- Reported in 44-70% of IBD patients
- Encourage other high calcium and vit D food/beverage sources
  - Tofu
  - Greens
  - Lactose free Greek yogurts, cottage cheese
  - Non-dairy milks

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To Gluten or Not to Gluten in IBD

- **No Direct Evidence:** Current research does not support gluten elimination.
- **FODMAPs Factor:** Improvements on a GFD may stem from reduced FODMAP intake.

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Low FODMAP Diet: A Double-Edged Sword

- **Diet Basics:** Limit intake of fermentable carbs to reduce small intestine water absorption and large intestine gas production.
- **Symptom Relief:** Aims to alleviate pain, discomfort, and bloating by reducing fermentable substrates for intestinal bacteria.
- **SIBO Management:** Considered for treating SIBO often seen in IBD patients.
- **Nutritional Concerns:** Implementation challenges and potential risks of nutrient deficiencies.

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Carbs in Combat: SCD & Anti-Inflammatory Diets vs. IBD

- The Specific Carbohydrates Diet (SCD): Eliminates complex carbs and disaccharides, excluding most grains and certain dairy, favoring honey over sugar.
- **SCD Rationale:** Aims to prevent dysbiosis, protect the intestinal barrier, and reduce inflammation by simplifying digestion.
- **Anti-Inflammatory Diet:** Modifies SCD to further limit pro-inflammatory carbs and emphasizes anti-inflammatory foods, including prebiotics and probiotics.
- **Probiotic Benefits:** Supports a healthy gut microbiota, blocks harmful bacteria, and enhances the gut's protective lining.

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Mediterranean Magic: A Feast for IBD Relief

- **Diet Composition:** High in raw veggies, fruits, unsaturated fats, pulses, dairy, and fish; low in red meat and processed foods.
- **Antioxidant-Rich:** Packed with vitamins A, C, β-carotene, minerals, and flavonoids for potential anti-inflammatory benefits.
- **Clinical Evidence:** Studies show both the Mediterranean diet and SCD can lead to remission in CD patients, and reduction in calprotectin levels.
- **Microbiota and Inflammation:** Some research indicates the MD helps normalize gut microbiota and reduce inflammatory markers in IBD patients.
- **Lifestyle Synergy:** The diet's benefits are amplified by a healthy lifestyle, including regular exercise, non-smoking, and moderate red wine consumption.

Lo C.-H., Khalili H., Song M., Lochhead P., Burke K.E., Richter J.M., Giovannucci E.L., Chan A.T., Ananthakrishnan A.N. Healthy Lifestyle Is Associated with Reduced Mortality in Patients with Inflammatory Bowel Diseases. *Clin. Gastroenterol. Hepatol.* 2020;19:87–95.e4. doi: 10.1016/j.cgh.2020.02.047
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Dietary Guidance from the International Organization for the Study of Inflammatory Bowel Diseases (IOIBD)

- **Vegetables and Fruits**: Moderate to high intake recommended, except for Crohn's Disease (CD) patients with intestinal strictures. Limit insoluble dietary fiber (e.g., cauliflower, Chinese cabbage, spinach, tomatoes, dry pulses, raspberries, gooseberries, kiwi, avocados).
- **Cereal Products**: Important source dietary fiber.
- **FODMAP Diet**: Reduced intake for IBD patients with functional bowel disorders.
- **Gluten and Wheat**: No recommendation for avoidance.
- **Meat Consumption**:
  - No restrictions for CD patients on red meat, poultry, or eggs.
  - Ulcerative Colitis (UC) patients should reduce red meat intake due to saturated fatty acids, especially myristic acid, linked to relapse incidence.
- **Fats**: Eliminate trans and saturated fatty acids in all IBD patients.
- **Dairy Products**:
  - Avoid milk and unpasteurized products.
  - No clear guidelines on pasteurized dairy, but higher lactose intolerance prevalence in CD and UC suggests eliminating milk-derived products.
  - Caution with additives in dairy products (emulsifiers, carrageenans, thickening agents).
- **Processed Foods**: Avoid due to additives (maltodextrin, emulsifiers, thickeners, nanoparticles, sulfur compounds) as per IOIBD guidelines.

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Clinical Pearls: IBD Patients

- Despite the variety of diets studied in IBD patients, there are no clear recommendations for applying one specific diet in all patients.
- Avoid processed foods, products rich in food additives and containing high amounts of saturated and trans fatty acids.

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Prioritize Protein

- How to be strategic with your calories if you cannot tolerate larger volumes of food
- Obtain more calories from liquids vs solids
- Sip on low sugar protein shakes in between meals
- Add unflavored protein powders to foods (bone broth, shakes, yogurt)
- Eat low volume/calorie dense foods every 1-2 hours to reach macronutrient goals (avocado, nut butters, full fat Greek yogurt)

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Active Flare Recommendations

- Reduce items that may worsen diarrhea/cramping bloating
  - Insoluble vs soluble fiber
  - Concentrated sugar
  - Saturated fat
  - Caffeine
  - Alcohol
  - Sugar Alcohols
  - High output diarrhea, consider ORS

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Dietary Tips for Patients and Providers

Try to limit the following liquids	Drinking/Eating Tips	Oral Rehydration Solutions
• Water • Soda • Alcohol • Caffeine (coffee/ tea) • Artificial Sweeteners • Ensure/Boost • Fruit juice • Limit simple sugars	• Limit drinking any liquid with meals or within 30 minutes of a meal • Chew food well to maximize digestion and absorption • Eat small, frequent meals/snacks • Complex carbs 40-60% total kcal • Protein 20-30% total kcal	• Pre-made (Pedialyte), WHO ORS solution or follow homemade recipe • Sip throughout the day

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