Gastroenterology 2023;■:1–12

# AGA Clinical Practice Update on Diet and Nutritional Therapies in Patients With Inflammatory Bowel Disease: Expert Review

Jana G. Hashash,[1] Jaclyn Elkins,[2] James D. Lewis,[3] and David G. Binion[4]

[1]Division of Gastroenterology and Hepatology, Mayo Clinic, Jacksonville, Florida; [2]Department of Nutrition, Mayo Clinic, Jacksonville, Florida; [3]Division of Gastroenterology and Hepatology, Perelman School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania; and [4]Division of Gastroenterology, Hepatology, and Nutrition, University of Pittsburgh, Pittsburgh, Pennsylvania

**DESCRIPTION:** Diet plays a critical role in human health, but especially for patients with inflammatory bowel disease (IBD). Guidance about diet for patients with IBD are often controversial and a source of uncertainty for many physicians and patients. The role of diet has been investigated as a risk factor for IBD etiopathogenesis and as a therapy for active disease. Dietary restrictions, along with the clinical complications of IBD, can result in malnutrition, an underrecognized condition among this patient population. The aim of this American Gastroenterological Association (AGA) Clinical Practice Update (CPU) is to provide best practice advice statements, primarily to clinical gastroenterologists, covering the topics of diet and nutritional therapies in the management of IBD, while emphasizing identification and treatment of malnutrition in these patients. We provide guidance for tailored dietary approaches during IBD remission, active disease, and intestinal failure. A healthy Mediterranean diet will benefit patients with IBD, but may require accommodations for food texture in the setting of intestinal strictures or obstructions. New data in Crohn's disease supports the use of enteral liquid nutrition to help induce remission and correct malnutrition in patients heading for surgery. Parenteral nutrition plays a critical role in patients with IBD facing acute and/or chronic intestinal failure. Registered dietitians are an essential part of the interdisciplinary team approach for optimal nutrition assessment and management in the patient population with IBD. **METHODS:** This expert review was commissioned and approved by the AGA Clinical Practice Updates Committee and the AGA Governing Board to provide timely guidance on a topic of high clinical importance to the AGA membership and underwent internal peer review by the CPU Committee and external peer review through standard procedures of *Gastroenterology*. The best practice advice statements were drawn from reviewing existing literature combined with expert opinion to provide practical advice on the role of diet and nutritional therapies in patients with IBD. Because this was not a systematic review, formal rating of the quality of evidence or strength of the presented considerations was not performed.

## BEST PRACTICE ADVICE STATEMENTS

**BEST PRACTICE ADVICE 1:** Unless there is a contraindication, all patients with IBD should be advised to follow a Mediterranean diet rich in a variety of fresh fruits and vegetables, monounsaturated fats, complex carbohydrates, and lean proteins and low in ultraprocessed foods, added sugar, and salt for their overall health and general well-being. No diet has consistently been found to decrease the rate of flares in adults with IBD. A diet low in red and processed meat may reduce ulcerative colitis flares, but has not been found to reduce relapse in Crohn's disease. **BEST PRACTICE ADVICE 2:** Patients with IBD who have symptomatic intestinal strictures may not tolerate fibrous, plant-based foods (ie, raw fruits and vegetables) due to their texture. An emphasis on careful chewing and cooking and processing of fruits and vegetables to a soft, less fibrinous consistency may help patients with IBD who have concomitant intestinal strictures incorporate a wider variety of plant-based foods and fiber in their diets. **BEST PRACTICE ADVICE 3:** Exclusive enteral nutrition using liquid nutrition formulations is an effective therapy for induction of clinical remission and endoscopic response in Crohn's disease, with stronger evidence in children than adults. Exclusive enteral nutrition may be considered as a steroid-sparing bridge therapy for patients with Crohn's disease. **BEST PRACTICE ADVICE 4:** Crohn's disease exclusion diet, a type of partial enteral nutrition therapy, may be an effective therapy for induction of clinical remission and endoscopic response in mild to moderate Crohn's disease of relatively short duration. **BEST PRACTICE ADVICE 5:** Exclusive enteral nutrition may be an effective therapy in malnourished patients before undergoing elective surgery for Crohn's disease to optimize nutritional status and reduce postoperative complications. **BEST PRACTICE ADVICE 6:** In patients with IBD who have an intra-abdominal abscess and/or phlegmonous inflammation that limits ability to achieve optimal nutrition via the digestive tract, short-term parenteral nutrition may be used to provide bowel rest in the preoperative phase to decrease infection and inflammation as a bridge to definitive surgical management and to optimize surgical outcomes. **BEST PRACTICE ADVICE 7:** We suggest the use of parenteral nutrition for high-output gastrointestinal fistula, prolonged ileus, short bowel syndrome, and for patients with IBD with severe malnutrition when oral and enteral nutrition has been trialed and failed or when enteral access is not feasible or contraindicated. **BEST PRACTICE ADVICE 8:** In patients with IBD and short bowel syndrome, long-term parenteral nutrition should be transitioned to customized hydration management (ie, intravenous electrolyte support and/or oral rehydration solutions) and oral intake whenever possible to decrease the risk of developing long-term complications. Treatment with glucagon-like peptide-2 agonists can facilitate this transition. **BEST PRACTICE ADVICE 9:** All patients with IBD warrant regular screening for malnutrition by their provider by means of assessing signs and symptoms, including unintended weight loss, edema and fluid retention, and fat and muscle mass loss. When observed, more complete

evaluation for malnutrition by a registered dietitian is indicated. Serum proteins are no longer recommended for the identification and diagnosis of malnutrition due to their lack of specificity for nutritional status and high sensitivity to inflammation. **BEST PRACTICE ADVICE 10:** All patients with IBD should be monitored for vitamin D and iron deficiency. Patients with extensive ileal disease or prior ileal surgery (resection or ileal pouch) should be monitored for vitamin B12 deficiency. **BEST PRACTICE ADVICE 11:** All outpatients and inpatients with complicated IBD warrant co-management with a registered dietitian, especially those who have malnutrition, short bowel syndrome, enterocutaneous fistula, and/or are requiring more complex nutrition therapies (eg, parenteral nutrition, enteral nutrition, or exclusive enteral nutrition), or those on a Crohn's disease exclusion diet. We suggest that all newly diagnosed patients with IBD have access to a registered dietitian. **BEST PRACTICE ADVICE 12:** Breastfeeding is associated with a lower risk for diagnosis of IBD during childhood. A healthy, balanced, Mediterranean diet rich in a variety of fruits and vegetables and decreased intake of ultraprocessed foods have been associated with a lower risk of developing IBD.

*Keywords:* IBD; Nutrition; Diet; CDED; Parenteral Nutrition.

The central purpose of the gastrointestinal tract is nutrition, and this essential function is often compromised in patients with inflammatory bowel disease (IBD). There is growing recognition of the role of diet in the care of patients with IBD, as both an etiopathogenic risk factor and, more recently, as a disease-modifying modality. Historically, there was limited guidance regarding diet for patients with IBD. Other than to counsel on avoiding foods that worsen symptoms and to avoid foods that may predispose to obstruction in those with strictures, health care providers had limited diet-related input to give their patients. Although such dietary advice may help improve symptoms in the acute setting, these approaches frequently led patients with IBD to avoid what are traditionally considered healthy foods, even after achieving clinical remission. New insights have resulted from the investigation of diet and nutrition in the overall care of patients with Crohn's disease (CD) and ulcerative colitis (UC). The aim of this American Gastroenterological Association Clinical Practice Update is to provide best practice advice statements on the role of diet and nutritional therapies in the treatment of patients with IBD, with a focus on common clinical scenarios encountered during IBD care.

**Best Practice Advice 1: Unless there is a contraindication, all patients with IBD should be advised to follow a Mediterranean diet rich in a variety of fresh fruits and vegetables, monounsaturated fats, complex carbohydrates, and lean proteins and low in ultraprocessed foods, added sugar, and salt for their overall health and general well-being. No diet has consistently been found to decrease the rate of flares in adults with IBD. A diet low in red and processed meat may reduce ulcerative colitis flares, but has not been found to reduce relapse in Crohn's disease.**

The guidance for consumption of healthy eating patterns, such as the Mediterranean diet rich in fruits and vegetables, for IBD management is a substantial revision from past instructions (Figure 1, Table 1). Prior emphasis on a low-residue, low-fiber diet is reasonable for patients with IBD who are experiencing symptomatic disease flares and worsening abdominal symptoms, but whenever possible, long-term IBD management should attempt to reintroduce fresh fruits, vegetables, and fiber (preferably soluble fiber). Recent prospective, randomized, short-term (6–12 weeks) studies have suggested that a Mediterranean diet and a more structured specific carbohydrate diet were equally effective in achieving symptomatic remission and calprotectin response (Table 1).[1] Importantly, the use of a Mediterranean diet may mechanistically improve the diversity of the gut microbiome and metabolome and hold additional long-term health benefits, such as reduction of cardiovascular disease, metabolic syndrome, and cancer. An independent validation of the efficacy of the Mediterranean diet for patients with IBD was performed by Chicco et al.[2] Nutritional counseling was provided to 142 patients with IBD. After 6 months, both patients with UC and patients with CD adhering to the Mediterranean diet had lower rates of active disease, inflammatory biomarker elevation, and improved quality of life.

To date, there is no consistent evidence supporting the avoidance of gluten in patients with IBD in the absence of a celiac disease diagnosis or suspected gluten sensitivity. Although the use of a low fermentable oligo-, di-, and monosaccharide and polyols (FODMAP) diet was found to improve symptoms in patients with IBD in a prospective, randomized trial, this may be accompanied by potential negative long-term consequences.[3] The low-FODMAP diet results in the reduction of certain fecal microbiome organisms and reduced generation of the short-chain fatty acid butyrate, a key nutrient for gut epithelial health. Research has found that the organisms that are diminished in patients on a low-FODMAP diet tend to be associated with endoscopic and clinical remission when found in abundance, raising concern about the long-term effects of low-FODMAP diets.[4–6] Thus, short-term use of a reduced-fiber, low-FODMAP dietary approach during a symptomatic IBD flare may be helpful, but as patients achieve symptom resolution, we propose that a return to a healthy Mediterranean-style diet is in the best long-term interest of patients with IBD.

Adherence to a healthy, balanced Mediterranean diet will confer the additional benefit of effectively reducing intake of ultraprocessed foods, which often contain added sugar, excess salt, and other food additives. High consumption of ultraprocessed foods has been implicated in the

***Abbreviations used in this paper:*** **CD, Crohn's disease; CDED, Crohn's disease exclusion diet; EEN, exclusive enteral nutrition; EN, enteral nutrition; ESPEN, European Society for Parenteral and Enteral Nutrition; FODMAP, fermentable oligo-di-and monosaccharide and polyols; GLP-2, glucagon-like peptide-2; IBD, inflammatory bowel disease; IVF, intravenous fluids; NPO, nil per os (nothing by mouth); PEN, partial enteral nutrition; PN, parenteral nutrition; PO, per os (by mouth); RD, registered dietitian; SBS, short bowel syndrome; UC, ulcerative colitis.**


0016-5085/$36.00
https://doi.org/10.1053/j.gastro.2023.11.303

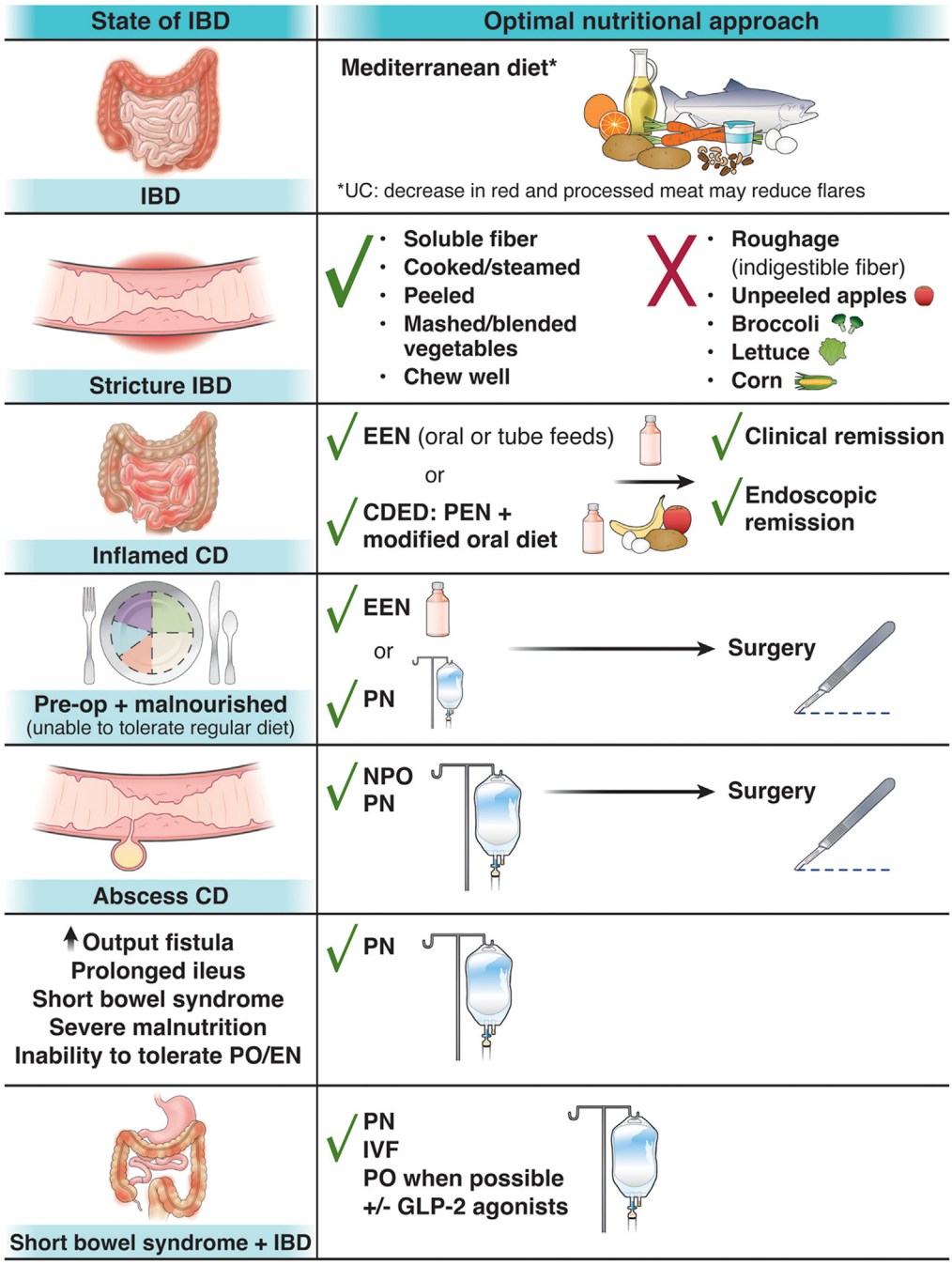


**Figure 1.** Optimal nutritional approach by clinical state of IBD.

emergence of health problems throughout the world, including chronic inflammation, and IBD with CD has the strongest association,[7,8] At present, it is not known which dietary components of the Mediterranean diet that are emphasized vs those that are minimized underlie its overall efficacy in improving the health of patients with IBD. Specific dietary components that patients with IBD should be cautioned to avoid are sugar-sweetened beverages, which have been linked to etiopathogenic risk and a more severe multiyear clinical course of IBD in a recent prospective cohort study.[9,10] IBD-specific diet and nutrition guidance for patients and caregivers are available from Crohn's and Colitis Canada and Crohn's and Colitis Foundation.[11,12]

**Best Practice Advice 2: Patients with IBD who have symptomatic intestinal strictures may not tolerate fibrous, plant-based foods (ie, raw fruits and vegetables) due to their texture. An emphasis on careful chewing and cooking and processing of fruits and vegetables to a soft, less fibrinous consistency may help patients with IBD who have concomitant intestinal strictures incorporate a wider variety of plant-based foods and fiber in their diets.**

Inflammatory injury of the gastrointestinal tract can lead to intestinal remodeling with scarring and strictures,

**Table 1.** Diets That Have Been Studied in Patients With Inflammatory Bowel Disease

| Diet | Description/Rationale | Comments |
|---|---|---|
| The Mediterranean diet | Plant-focused diet emphasizing variety of whole grains, fruits, and vegetables.<br>Main fat source is from fish, olive oil, nuts, and seeds.<br>Lean protein sources are from low-fat dairy, poultry, fish, shellfish, beans, and/or legumes.<br>Higher saturated fat containing meats (ie, red meat) are consumed at much lower frequency and quantity. | A recent study (2021)[1] suggested that for adults with mild to moderate CD, the Mediterranean diet has similar efficacy to a specific carbohydrate diet.<br>The Mediterranean diet aligns with a moderate- to high-fiber diet for those in remission.<br>The Mediterranean diet has demonstrated health benefits separate from IBD, such as reduced cardiovascular disease incidence. |
| Specific carbohydrate diet | Nutritionally complete grain-free diet, low in sugar and lactose. Restricts all hard-to-digest carbohydrates, only eating those that are easy to break down.<br>Examples of included foods:<br>Additive free meat and oils (white vinegar, cider, and mustard)<br>Sugar-free coffee, tea, nut butters, and juice<br>Low-lactose dairy<br>Nonstarchy vegetables<br>Examples of foods not allowed:<br>Grains and grain products<br>Candy or foods made with high-fructose corn syrup<br>High-lactose dairy<br>Starchy vegetables<br>Sugars, excluding honey<br>Hypothesis is that these foods fuel "bad" bacteria in the gut, and thus avoiding them aids "good" bacterial survival. | Challenging to follow.<br>There have been limited large-scale studies showing evidence of benefit. Relatively similar efficacy to Mediterranean diet in DINE-CD (Diet to Induce Remission in Crohn's Disease) trial. |
| Low-FODMAP diet | Elimination rechallenge diet that limits fermentable oligosaccharides, disaccharides, monosaccharides, and polyols, which are short-chain carbohydrates (sugars) that the small intestine absorbs poorly. These are omitted from the diet for up to 8 wk, then reintroduced 1 at a time. | May be worth trying in patients with IBD who have concomitant IBS-like symptoms. |
| CDED[a] | Whole foods diet designed to limit foods that may adversely affect the microbiome or alter intestinal barrier function. Diet is initiated in 3 phases and each phase is 6 wk long and includes partial EN (liquid formula either by mouth or enterically infused).<br>Phase 1:<br>Mandatory intake of fish, chicken breast, and eggs<br>Allows rice, cooled potatoes, tomatoes, onion, garlic, ginger, olive oil, and canola oil<br>Limited quantities of cucumber, carrots, spinach, lettuce, bananas, apples, avocados, strawberries, melon, and citrus juices<br>Phase 2:<br>Phase 1 foods + tuna, whole-grain bread, oats, yams, and red peppers<br>Certain vegetables, beans, peas, turnips, and parsnips are reintroduced after wk 10<br>Phase 3:<br>"Maintenance phase"<br>Phase 1 and 2 foods + more seafood, eggs, cocoa, coffee, grains, some dairy, and alcohol if tolerated | May be worth attempting in patients with mild to moderate CD with short duration of flares.<br>Allows for some solid foods compared with the 100% liquid nature of EEN; may improve compliance and be easier to follow. |

[a]Please refer to Figure 2.

making fibrous, plant-based foods a trigger for obstructive symptoms (Figure 1). Although previous IBD dietary guidance has suggested avoiding these foods, successful reintroduction of fruits and vegetables can be achieved with careful chewing, as well as cooking and processing of these foods to achieve favorable, soft textures that may allow safe ingestion of dietary fiber.[13,14] Patients readily understand the difference in texture between a fibrous, unpeeled apple (a culprit for obstruction) and the thick, liquid texture of applesauce (easily tolerated) to illustrate this dietary accommodation. Patients with IBD in remission who do not have intestinal strictures do not need to limit their fiber intake.

**Best Practice Advice 3: Exclusive enteral nutrition using liquid nutrition formulations is an effective therapy for induction of clinical remission and endoscopic response in Crohn's disease, with stronger evidence in children than adults. Exclusive enteral nutrition may be considered as a steroid-sparing bridge therapy for patients with Crohn's disease.**

**Best Practice Advice 4: Crohn's disease exclusion diet, a type of partial enteral nutrition therapy, may be an effective therapy for induction of clinical remission and endoscopic response in mild to moderate Crohn's disease of relatively short duration.**

Exclusive enteral nutrition (EEN) is a form of intense dietary therapy that demands that the entirety of a person's caloric intake come from commercially available oral liquid meal replacements, excluding all other foods, typically for a 6- to 8-week period.[15–17] EEN is usually consumed by mouth. EEN is most often initiated in pediatric patients with CD and is routinely offered as a first-line, steroid-sparing therapy, achieving clinical remission rates similar to corticosteroids (between 60% and 80%).[18] Although EEN is not as widely prescribed for adult patients with CD, several studies reported that when tolerated, EEN may be effective for inducing clinical and biochemical remission.[19–23] It is important to acknowledge that the lack of definitive adult data is likely related to difficulties in trial recruitment, as well as poor adherence to the EEN regimen itself. The risk of product fatigue is high with EEN, and adults may find this more challenging to ingest day to day, particularly in group settings where food is being consumed. There is no evidence to support the use of any one particular EEN product, and standard polymeric formulations are generally well tolerated. Prudent selection of products containing nutritional balance and that are calorically individualized to the patient is key for patient safety. Common products used may be varied amounts of Ensure Plus (Abbott Nutrition), Kate Farms, among a multitude of polymeric oral supplements, or traditional EN support products consumed orally, such a Jevity (Abbott Nutrition). The therapeutic mechanism underlying the success of EEN has not been defined, but easily tolerated texture, low salt content, and a modulatory effect on the microbiome have been hypothesized.

Partial enteral nutrition (PEN) provides an option for patients who wish to try therapy with a meal replacement formula, but are unable to adhere to an EEN regimen. Most research has not focused on the specific table food components of PEN regimens.[24,25] The Crohn's disease exclusion diet (CDED) has been studied as a PEN regimen in combination with specific foods.[26] The CDED is a whole foods diet designed to only exclude or limit foods perceived to adversely affect the microbiome and/or alter function of the intestinal barrier. Implemented in 3 phases (phase 1 from week 1–6; phase 2 from week 7–12; and phase 3 from week 13 forward), it combines PEN with 50% of the calories coming from a nutrition supplement and a small list of required foods that are low in fiber, taurine, and saturated fat. The diet is slowly advanced to incorporate more foods at week 7, maintaining 25% of daily calorie intake from PEN in phases 2 and 3 (Figure 2). Although initial studies on the CDED exclusively used the formula Modulen IBD (Nestlé Health Science), some providers opt to use alternative oral nutrition supplements.

In a study by Levine et al comparing the effectiveness of EEN with CDED in children with mild to moderate CD, CDED was found to be better tolerated than EEN and equally effective for inducing clinical remission by week 6.[27–29] In this same study, the authors found a higher proportion of patients sustaining remission after the CDED phase 2 diet compared with PEN and usual diet at week 12. A retrospective study by Niseteo et al[27] had similar results, although they concluded that 1–2 weeks of EEN followed by the CDED had comparable efficacy to EEN alone for inducing clinical remission of CD in children, and led to better pediatric growth trends. In a retrospective analysis, Sigall et al[30] found that CDED may be useful as salvage therapy for pediatric and young adult patients with CD who experience loss of response to biologic therapy. Although most of these diets meet key nutritional guidelines, it is prudent to monitor for nutritional deficiencies.

Data on the use of EN in the treatment of active UC are limited. Studies to date suggest that EN is safe and well tolerated in patients with UC with severe acute flares and can improve prealbumin levels. These preliminary data suggest a potential clinical benefit in patients with UC who may have difficulty tolerating a regular diet.[31]

**Best Practice Advice 5: Exclusive enteral nutrition may be an effective therapy in malnourished patients before undergoing elective surgery for Crohn's disease to optimize nutritional status and reduce postoperative complications.** Surgery is often required for patients with CD, most commonly for symptomatic intestinal strictures that impair a patient's ability to tolerate solid food. In this setting, liquid nutrition can be attempted to optimize patients in the preoperative setting.[32] Oral EEN can be considered in such situations, however, infusion through an enteral access device may be indicated in those with more severe malnutrition, especially when elemental nutrition is being implemented. Recent prospective studies in oncologic surgery have confirmed that malnutrition contributes to excess perioperative morbidity and mortality, and there are emerging data that correcting malnutrition, including oral supplementation, can help to reduce this risk.[33]

In a prospective study of adult patients with CD and malnutrition, Costa-Santos et al[34] found that preoperative

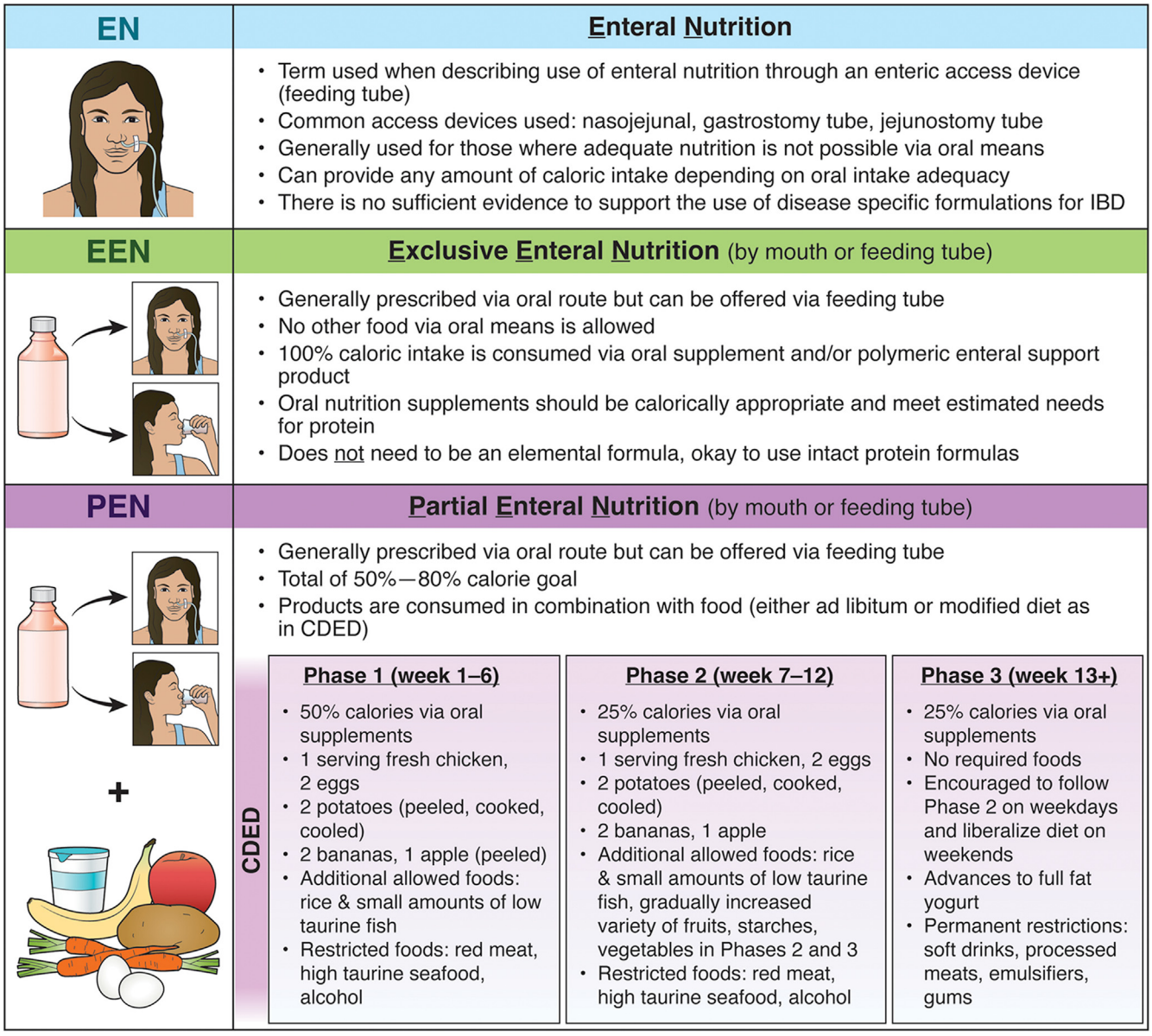


**Figure 2.** Therapeutic EN strategies in IBD.

EEN improved disease activity, C-reactive protein, and nutritional status (ie, serum albumin). More importantly, malnourished patients with CD who were treated with preoperative EEN had low postoperative complication rates, comparable with surgical outcomes in well-nourished patients with CD. This suggests a preventive benefit of nutritional "prehabilitation" using EEN before surgery.

In a systematic review by Rocha et al,[35] EEN was well tolerated in preoperative patients with CD. Two of the largest studies reviewed found preoperative EEN to be an independent protective factor against infectious and noninfectious complications, including anastomotic leaks, intra-abdominal abscesses, surgical site infections, ileus, unplanned stomas, and reoperation.

**Best Practice Advice 6: In patients with IBD who have an intra-abdominal abscess and/or phlegmonous inflammation that limits ability to achieve optimal nutrition via the digestive tract, short-term parenteral nutrition may be used to provide bowel rest in the preoperative phase to decrease infection and inflammation as a bridge to definitive surgical management and to optimize surgical outcomes.**

**Best Practice Advice 7: We suggest the use of parenteral nutrition for high-output gastrointestinal fistula, prolonged ileus, short bowel syndrome, and for patients with IBD with severe malnutrition when oral and enteral nutrition has been trialed and failed or when enteral access is not feasible or contraindicated.**

**Best Practice Advice 8: In patients with IBD and short bowel syndrome, long-term parenteral nutrition should be transitioned to customized hydration management (ie, intravenous electrolyte support and/or**

**oral rehydration solutions) and oral intake whenever possible to decrease the risk of developing long-term complications. Treatment with glucagon-like peptide-2 agonists can facilitate this transition.**

Penetrating and stricturing complications of IBD (ie, phlegmon and intra-abdominal abscess) may make achieving adequate nutrition via the digestive system challenging. Attempts to feed a damaged gut, which has already experienced complications, may further worsen clinical symptoms and underlying pathology, limiting ability to achieve nutritional and caloric goals via the digestive tract (oral or enteral nutrition [EN]). Parenteral nutrition (PN) may be warranted in these clinical scenarios to correct nutritional deficiency, while allowing the injured gut to rest, decreasing microbial contamination of compromised bowel and ultimately improving operative outcomes.[36,37] Whenever possible, EN (feeding via enteral tube) is the preferred route of nutrition over PN for benefits associated with maintaining gut integrity, function, and for providing vital nutrient source for the microbiota, which has been noted to reduce infectious complications.[38,39] If the gut is accessible and safe for use, it is the superior route for feeding and it can be used in combination with PN to help achieve nutritional intake goals.

Explicit indications for PN support in the IBD adult population include intestinal failure, being malnourished with clear and definable contraindications to EN, having failed EN support trials, in patients who lack sufficient bowel function to maintain or restore nutrition status, in patients who need to be kept nothing by mouth for at least 7 days before surgery, and when EN is not feasible or is insufficient to meet total nutrient needs for at least 7–10 days.[40,41] Examples of when PN may be necessary are high-output intestinal fistulae (>500 mL/24 h), high ostomy output (>2000 mL/24 h), and inability to maintain >60% of energy and protein goals via either oral nutrition or EN for 7–10 days.

Historically, patients with IBD who have undergone extensive resections comprised a significant subgroup of the population with acquired short bowel syndrome (SBS). SBS in patients with IBD is an indication for prolonged PN support, but this life-saving modality comes with the risk of central venous catheter complications (ie, central line–associated bloodstream infections, and thrombotic vascular complications), as well as hepatobiliary complications, such as PN-associated liver disease, hypertriglyceridemia, and cholestasis.[42,43] The care of patients with SBS, including patients with IBD with intestinal failure, is complex and optimal management was addressed recently in a dedicated American Gastroenterological Association Clinical Practice Update.[44] PN dependance with SBS is not always indefinite, due to intestinal adaptation, which often takes 1–2 years to achieve maximum effect with improved nutrient absorption and slowed gastrointestinal transit. Approximately 50% of adults and 73% of children with SBS can wean off of PN support.[45] Although these adjustments are often spontaneous, they may be enhanced through optimized oral dietary intake (separating the bulk of liquids from solid foods at mealtime, ie, "dry meals"), avoidance of sugar-sweetened beverages with high osmotic load (eg, soft drinks and sodas), timing of antidiarrheal agents with enteral feeding, and medications such as the glucagon-like peptide-2 agonists, which enhance adaptation through increase of villous height, crypt depth, and effects on gastrointestinal motility. Efforts to transition to oral intake and/or continue enteric stimulation should be made whenever possible in the long-term management of SBS.[45] Oral rehydration solutions, composed of water, sugar, and salt are particularly helpful due to the osmolarity having affinity for improved intestinal absorption. In patients with IBD and SBS who are at persistent risk of dehydration, transition to intravenous solutions with customized electrolytes may be administered as an alternative to PN containing calorie support during long-term management. Ideally, management of patients with IBD with SBS will benefit from interdisciplinary teams of physicians, midlevel providers, pharmacists, and registered dietitians (RDs) with expertise in the care of intestinal failure and administration of PN.

**Best Practice Advice 9: All patients with IBD warrant regular screening for malnutrition by their provider by means of assessing signs and symptoms, including unintended weight loss, edema and fluid retention, and fat and muscle mass loss. When observed, more complete evaluation for malnutrition by a registered dietitian is indicated. Serum proteins are no longer recommended for the identification and diagnosis of malnutrition due to their lack of specificity for nutritional status and high sensitivity to inflammation.**

**Best Practice Advice 10: All patients with IBD should be monitored for vitamin D and iron deficiency. Patients with extensive ileal disease or prior ileal surgery (resection or ileal pouch) should be monitored for vitamin B12 deficiency.**

Malnutrition and other nutritional deficits are common, underrecognized complications in IBD, especially among patients with CD and those who have had multiple surgeries. Malnutrition is associated with poor IBD outcomes, including increased number of emergency department visits, increased number and duration of hospitalizations, nonelective surgeries, higher mortality, reduced response to medical therapy, and poor quality of life.[46–50] European Society for Parenteral and Enteral Nutrition (ESPEN), Academy of Nutrition and Dietetics, and American Society for Parenteral and Enteral Nutrition recommend screening for malnutrition at diagnosis and routinely during long-term management in all patients with IBD. RDs can effectively aid in the diagnosis and treatment of malnutrition in the IBD population.

Historically, serum proteins, such as albumin, were used to help identify and diagnose malnutrition. However, serum proteins lack specificity for dietary intake or nutritional status and are highly sensitive to inflammatory activity. Fluctuation in serum protein levels among patients with IBD and their variable association with formally diagnosed malnutrition have resulted in expert consensus to not use these biomarkers for diagnosing malnutrition.[51–54] Hypoalbuminemia is still a useful biomarker in IBD, identifying

patients at higher risk of surgical complications and diminished response to anti–tumor necrosis factor therapy.

The American Society for Parenteral and Enteral Nutrition and ESPEN convened an international consensus statement developing a standardized etiology-based approach for identifying malnutrition that focuses on the cause of malnutrition and characterizes severity through a detailed nutritional history, as well as a practical nutrition–focused physical examination.[55,56] Malnutrition is characterized by 2 or more of the following: clinically significant weight loss, reduced energy intake, loss of lean mass, loss of subcutaneous fat mass, fluid accumulation, and diminished functional status as demonstrated by formal grip strength testing. Other notable criteria used for malnutrition screening are the Global Leadership Initiative on Malnutrition criterion and ESPEN criteria. The ESPEN criteria consider body mass index (calculated as kg / $m^2$) $<$18.5 as a diagnostic criterion for malnutrition.[57] The Global Leadership Initiative on Malnutrition criteria diagnose malnutrition by the presence of at least 1 of the following phenotypes: clinically significant weight loss, low body mass index, and reduced muscle mass, and one of the following etiologic criteria: reduced food consumption, impaired assimilation of nutrients, and inflammation.[58] The abridged patient-generated subjective global assessment is a new validated IBD-specific malnutrition screening tool that was published recently.[59]

Malnutrition in patients with IBD most commonly results from decreased oral intake, increased energy and protein requirements and increased gastrointestinal losses associated with inflammatory states, malabsorption, disease activity, and SBS, as well as the use of certain medications. In a national sample of inpatients, the relative odds for having malnutrition was 5.57 times higher among patients with IBD compared with patients without IBD.[50] The overall prevalence of malnutrition identified in IBD outpatient clinics was 16%, with more than one-half of the malnourished patients having CD (56.8%).[47,57]

Vitamin D, iron, and vitamin B12 are some of the common micronutrient deficiencies occurring in patients with IBD. These may arise due to chronic mucosal inflammation, excessive dietary restriction, prolonged bowel rest, malabsorption, anatomic changes to length and absorptive capacity, and medication-related nutrient interactions. Other vitamin and mineral deficiencies that are important to consider in certain patients with IBD, depending on their risk factors, include zinc, copper, and fat-soluble vitamin deficiencies, as well as folic acid, especially in patients on methotrexate and sulfasalazine.[60,61] Serum values of micronutrients may fluctuate in cases of active inflammation, as many are acute phase reactants (eg, ferritin and copper may increase with inflammation, and zinc, folate, and selenium may decrease with inflammation), so it is encouraged to check these levels in patients with quiescent disease and to follow-up after repleting deficiencies. Deficiency in vitamin D can lead to loss of bone mineral density and subsequent metabolic bone disease. Vitamin D deficiency is more often associated with CD. There are emerging data suggesting a novel role for vitamin D in immune homeostasis and improved ability to control chronic inflammation.[62]

All patients with IBD, regardless of age, are at risk for anemia. For laboratory screening of iron deficiency anemia, a complete blood count, serum ferritin, transferrin saturation, and C-reactive protein should be used. For patients in remission or mild disease, measurements are suggested every 6–12 months. In those with active disease, it is suggested to repeat the laboratory screening every 3 months.[63] In the presence of iron deficiency, iron supplementation is advised. Intravenous iron is considered more effective, showing a faster response, and is often better tolerated than oral iron. Oral iron repletion is reasonable in mild anemia, or in those whose disease is clinically inactive. Dosing is based on baseline hemoglobin and body weight.[64] A detailed review and care pathway addressing anemia and iron deficiency in IBD has been published by the Crohn's and Colitis Foundation.[65]

Underdiagnosis of vitamin B12 deficiency in patients with IBD is common because serum blood measurements may overestimate body stores.[66] Prevalence of vitamin B12 deficiency in patients with CD ranges from 5.6% to 38%.[66,67] Vitamin B12 homeostasis involves complex absorption of dietary animal protein, requiring adequate salivary R protein, intrinsic factor from gastric parietal cells, and exocrine pancreatic function. The primary uptake site for vitamin B12 is in the terminal ileum. Patients with extensive ileal disease or terminal ileal resection of $>$30 cm are at an increased risk of vitamin B12 deficiency. Patients with an ileoanal pouch are also at increased risk of vitamin B12 deficiency due to bacterial overgrowth. Patients with active ileal inflammation experience increased metabolism of vitamin B12. Clinical features of vitamin B12 deficiency include fatigue, anemia, loss of appetite, weight loss, glossitis, and neuropathy (typically numbness or tingling in hands and feet). Neuropathy due to vitamin B12 deficiency can progress to chronic neuropathic pain and lead to proprioception defects. Yearly screening is warranted in patients at high risk or with clinical features of vitamin B12 deficiency.[67] Repletion with 1000 $\mu$g of vitamin B12 injections (intramuscular or subcutaneous) at 1- to 4-week intervals for life is suggested.[68] Intramuscular injection results in more rapid uptake, but subcutaneous injection is typically more comfortable and readily self-administered. Compared with sublingual vitamin B12 supplementation, intramuscular or subcutaneous supplementation remains the current preferred route for long-term repletion in patients with documented deficiency.

**Best Practice Advice 11: All outpatients and inpatients with complicated IBD warrant co-management with a registered dietitian, especially those who have malnutrition, small bowel syndrome, enterocutaneous fistula, and/or are requiring more complex nutrition therapies (eg, parenteral nutrition, enteral nutrition, or exclusive enteral nutrition), or those on a Crohn's disease exclusion diet. We suggest that all newly diagnosed patients with IBD have access to a registered dietitian.**

Historically, RDs have played a minor role in the routine management of patients with IBD due to the lack of outpatient access and payor reimbursement. Patients often

feel that nutrition is either not being prioritized in their care or is being overlooked, and often report that dietary advice from non-RD practitioners is heterogenous and conflicting.[69] This results in self-directed nutrition changes, resulting in unnecessary dietary restriction and increased risk of developing malnutrition.[57] RDs are fundamental members of the multidisciplinary IBD care team, as they have expertise in diagnosis and management of malnutrition, including specific protein, macronutrient, vitamin, and micronutrient requirements, which vary in different phases of illness.[70] Ideally, referral to an RD should not be deferred until the consequences of uncontrolled disease, such as malnutrition, become unmanageable. RDs can also play a key role in prevention of extraintestinal complications of IBD, including dietary modification to prevent enteric hyperoxaluria and development of kidney stones.

PN and EN support requires a specialized practice that necessitates the expertise of an RD. The role of the RD is to assist the multidisciplinary team with appropriate nutrition support route selection; prescribing adequate energy, protein, and micronutrient needs; monitoring patients throughout the duration of the treatment; adjusting the nutrition prescription when indicated; educating the patient on safe administration and compliance with EN and PN support, as well as guiding the patients and their care team on the appropriate transition back to a regular oral intake.

**Best Practice Advice 12: Breastfeeding is associated with a lower risk for diagnosis of IBD during childhood. A healthy, balanced, Mediterranean diet rich in a variety of fruits and vegetables and decreased intake of ultraprocessed foods have been associated with a lower risk of developing IBD.**

Numerous studies have investigated potential predisposing and protective factors for developing IBD. Such studies focus on early life exposures, including maternal health, in utero exposures, mode of delivery, breastfeeding, different diets, and antibiotic exposure, among many other factors. Breastfeeding has been associated with a decreased risk of developing both CD and UC and the protective effect was strongest for the group who breastfed for at least 12 months.[71,72] Regarding diet, results have been conflicting and controversial. The healthy, balanced, Mediterranean diet is the preferred diet for almost all individuals. Consumption of high levels of ultraprocessed foods and low intake of dietary fiber from fruits and vegetables have been associated with an increased risk of developing CD.[68,73,74]

## Conclusions

There have been significant advances in our understanding of the importance of diet and nutrition in IBD, not only in disease etiopathogenesis, but more recently as a disease-modifying factor and treatment. A healthy, balanced Mediterranean-style diet rich in fruits and vegetables, complex carbohydrates, and monounsaturated fats and low in added sugar, salt, red meats, and ultraprocessed foods can be tolerated by many patients and may improve symptoms in some. A Mediterranean-style diet can be introduced when patients are asymptomatic or when having mild to moderate symptoms. Due to the stricturing damage and intestinal remodeling resulting from gut inflammation, patients with IBD can be instructed to modify the texture of fibrous foods by cooking, blending, and thoroughly chewing fruits and vegetables, which will allow them to better tolerate a healthy diet over the lifespan.

When there is active inflammation and/or stricturing complications of CD, liquid nutrition formulas have demonstrated efficacy. Complete dietary modification with EEN using commercially available liquid nutrition formulas may induce remission in CD, with the strongest evidence in children. The complete avoidance of regular food for a prolonged time period is challenging for many patients with IBD, but clinical remission can be maintained with a staged reintroduction of foods. In patients with CD and obstructive complications necessitating surgery, preoperative therapy with liquid nutrition can improve nutritional status and improve operative outcomes.

Intravenous nutrition with fluids, macronutrients, vitamins, and minerals maintains an important, lifesaving role in the short-term management of patients with IBD during acute inflammatory and obstructive complications when the gut is no longer functioning and able to safely handle oral intake. Patients with IBD with SBS will benefit from home fluid and nutritional support and treatment with glucagon-like peptide-2 medications, which enhance intestinal adaptation, and weaning from PN should be considered in long-term management.

Dietary advice needs to be tailored to an individual IBD patient's nutritional status and goals, which will vary over time. Implementing the more complex nutritional strategies for IBD management will be best achieved by means of collaborative interdisciplinary practice between gastroenterologists and RDs.

## References

1. Lewis JD, Sandler RS, Brotherton C, et al. A randomized trial comparing the specific carbohydrate diet to a Mediterranean diet in adults with Crohn's disease. Gastroenterology 2021;161:837–852.e9.
2. Chicco F, Magri S, Cingolani A, et al. Multidimensional impact of Mediterranean diet on IBD patients. Inflamm Bowel Dis 2021;27:1–9.
3. Cox SR, Linday JO, Fromentin S, et al. Effects of low FODMAP diet on symptoms, fecal microbiome, and markers of inflammation in patients with quiescent inflammatory bowel disease in a randomized trial. Gastroenterology 2020;158:176–188.e7.
4. Ng SC, Benjamin JL, McCarthy NE, et al. Relationship between human intestinal dendritic cells, gut microbiota, and disease activity in Crohn's disease. Inflamm Bowel Dis 2011;17:2027–2037.
5. Sokol H, Pigneur B, Watterlot L, et al. *Faecalibacterium prausnitzii* is an anti-inflammatory commensal bacterium identified by gut microbiota analysis of Crohn disease patients. Proc Natl Acad Sci U S A 2008;105:16731–16736.
6. Varela E, Manichanh C, Gallart M, et al. Colonisation by *Faecalibacterium prausnitzii* and maintenance of clinical remission in patients with ulcerative colitis. Aliment Pharmacol Ther 2013;38:151–161.

7. Chen J, Wellens J, Kalla R, et al. Intake of ultra-processed foods is associated with an increased risk of Crohn's disease: a cross-sectional and prospective analysis of 187 154 participants in the UK Biobank. J Crohns Colitis 2023;17:535–552.
8. Lo CH, Khandpur N, Rossato SL, et al. Ultra-processed foods and risk of Crohn's disease and ulcerative colitis: a prospective cohort study. Clin Gastroenterol Hepatol 2022;20:e1323–e1337.
9. Fu T, Chen H, Chen X, et al. Sugar-sweetened beverages, artificially sweetened beverages and natural juices and risk of inflammatory bowel disease: a cohort study of 121,490 participants. Aliment Pharmacol Ther 2022;56:1018–1029.
10. Ahsan M, Koutroumpakis F, Ramos Rivers C, et al. High sugar-sweetened beverage consumption is associated with increased health care utilization in patients with inflammatory bowel disease: a multiyear, prospective analysis. J Acad Nutr Diet 2022;122:1488–1498.e1.
11. Crohn's and Colitis Canada. Diet and nutrition. Available at: https://crohnsandcolitis.ca/About-Crohn-s-Colitis/IBD-Journey/Diet-and-Nutrition-in-IBD. Accessed September 2, 2023.
12. Crohn's and Colitis Foundation. Diet and nutrition. Available at: https://www.crohnscolitisfoundation.org/diet-and-nutrition. Accessed September 2, 2023.
13. Serrano Fernandez V, Palomino MS, Laredo-Aguilera JA, et al. High-fiber diet and Crohn's disease: systematic review and meta-analysis. Nutrients 2023;15(14):3114.
14. Heaton KW, Thornton JR, Emmett PM. Treatment of Crohn's disease with an unrefined-carbohydrate, fibre-rich diet. Br Med J 1979;2(6193):764–766.
15. Lamb CA, Kennedy NA, Raine T, et al. British Society of Gastroenterology consensus guidelines on the management of inflammatory bowel disease in adults. Gut 2019;68(Suppl 3):s1–s106.
16. Forbes A, Escher J, Hébuterne X, et al. ESPEN guideline: clinical nutrition in inflammatory bowel disease. Clin Nutr 2017;36:321–347.
17. Whitten KE, Rogers P, Ooi CKY, et al. International survey of enteral nutrition protocols used in children with Crohn's disease. J Dig Dis 2012;13:107–112.
18. Heuschkel RB. Enteral nutrition in children with Crohn's disease. J Pediatr Gastroenterol Nutr 2000;31:575.
19. Melton SL, Fitzpatrick JA, Taylor KM, et al. Lessons from an audit of exclusive enteral nutrition in adult inpatients and outpatients with active Crohn's disease: a single-centre experience. Frontline Gastroenterol 2023;14:6–12.
20. Rigaud D, Cosnes J, Le Quintrec Y, et al. Controlled trial comparing two types of enteral nutrition in treatment of active Crohn's disease: elemental versus polymeric diet. Gut 1991;32:1492–1497.
21. Kakkadasam Ramaswamy P. Exclusive enteral nutrition with oral polymeric diet helps in inducing clinical and biochemical remission in adults with active Crohn's disease. JPEN J Parenter Enteral Nutr 2022;46:423–432.
22. Wall CL, Gearry RB, Day AS. Treatment of active Crohn's disease with exclusive and partial enteral nutrition: a pilot study in adults. Inflamm Intest Dis 2018;2:219–227.
23. Royall D, Jeejeebhoy KN, Baker JP, et al. Comparison of amino acid v peptide based enteral diets in active Crohn's disease: clinical and nutritional outcome. Gut 1994;35:783–787.
24. Takagi S, Utsunomiya K, Kuriyama S, et al. Effectiveness of an 'half elemental diet' as maintenance therapy for Crohn's disease: a randomized-controlled trial. Aliment Pharmacol Ther 2006;24:1333–1340.
25. Johnson T, Macdonald S, Hill SM, et al. Treatment of active Crohn's disease in children using partial enteral nutrition with liquid formula: a randomised controlled trial. Gut 2006;55:356–361.
26. Yanai H, Levine A, Hirsch A, et al. The Crohn's disease exclusion diet for induction and maintenance of remission in adults with mild-to-moderate Crohn's disease (CDED-AD): an open-label, pilot, randomised trial. Lancet Gastroenterol Hepatol 2022;7:49–59.
27. Niseteo T, Sila S, Trivić I, et al. Modified Crohn's disease exclusion diet is equally effective as exclusive enteral nutrition: real-world data. Nutr Clin Pract 2022;37:435–441.
28. Herrador-López M, Martín-Masot R, Navas-López VM. EEN yesterday and today . . . CDED today and tomorrow. Nutrients 2020;12(12):3793.
29. Levine A, Wine E, Assa A, et al. Crohn's disease exclusion diet plus partial enteral nutrition induces sustained remission in a randomized controlled trial. Gastroenterology 2019;157:440–450.e8.
30. Sigall Boneh R, Sarbagili Shabat C, Yanai H, et al. Dietary therapy with the Crohn's disease exclusion diet is a successful strategy for induction of remission in children and adults failing biological therapy. J Crohns Colitis 2017;11:1205–1212.
31. Triantafillidis JK, Vagianos C, Papalois AE. The role of enteral nutrition in patients with inflammatory bowel disease: current aspects. Biomed Res Int 2015;2015:197167.
32. Meade S, Patel KV, Luber RP, et al. A retrospective cohort study: pre-operative oral enteral nutritional optimisation for Crohn's disease in a UK tertiary IBD centre. Aliment Pharmacol Ther 2022;56:646–663.
33. Impact of malnutrition on early outcomes after cancer surgery: an international, multicentre, prospective cohort study. Lancet Glob Health 2023;11:e341–e349.
34. Costa-Santos MP, Palmela C, Torres J, et al. Preoperative enteral nutrition in adults with complicated Crohn's disease: effect on disease outcomes and gut microbiota. Nutrition 2020;70s:100009.
35. Rocha A, Bessa I, Lago P, et al. Preoperative enteral nutrition and surgical outcomes in adults with Crohn's disease: a systematic review. GE Port J Gastroenterol 2019;26:184–195.
36. Detsky AS, Baker JP, O'Rourke K, et al. Predicting nutrition-associated complications for patients undergoing gastrointestinal surgery. JPEN J Parenter Enteral Nutr 1987;11:440–446.
37. Heyland DK, Montalvo M, MacDonald S, et al. Total parenteral nutrition in the surgical patient: a meta-analysis. Can J Surg 2001;44:102–111.
38. Nelson AD, Elkins JR, Stocchi L, et al. Use and misuse of parenteral nutrition in patients with inflammatory bowel disease. Inflamm Bowel Dis 2022;28:1592–1602.

39. Braunschweig CL, Levy P, Sheean PM, et al. Enteral compared with parenteral nutrition: a meta-analysis. Am J Clin Nutr 2001;74:534–542.
40. Mueller C. The ASPEN Adult Nutrition Support Core Curriculum. 3rd ed. American Society for Parenteral and Enteral Nutrition; 2017.
41. Worthington P, Balint J, Bechtold M, et al. When is parenteral nutrition appropriate? JPEN J Parenter Enteral Nutr 2017;41:324–377.
42. Guglielmi FW, Boggio-Bertinet D, Federico A, et al. Total parenteral nutrition-related gastroenterological complications. Dig Liver Dis 2006;38:623–642.
43. Luman W, Shaffer JL. Prevalence, outcome and associated factors of deranged liver function tests in patients on home parenteral nutrition. Clin Nutr 2002;21:337–343.
44. Iyer K, DiBaise JK, Rubio-Tapia A. AGA clinical practice update on management of short bowel syndrome: expert review. Clin Gastroenterol Hepatol 2022; 20:2185–2194.e2.
45. Massironi S, Cavalcoli F, Rausa E, et al. Understanding short bowel syndrome: current status and future perspectives. Dig Liver Dis 2020;52:253–261.
46. Gajendran M, Umapathy C, Loganathan P, et al. Analysis of hospital-based emergency department visits for inflammatory bowel disease in the USA. Dig Dis Sci 2016;61:389–399.
47. Pulley J, Todd A, Flatley C, et al. Malnutrition and quality of life among adult inflammatory bowel disease patients. JGH Open 2020;4:454–460.
48. Ananthakrishnan AN, McGinley EL. Infection-related hospitalizations are associated with increased mortality in patients with inflammatory bowel diseases. J Crohns Colitis 2013;7:107–112.
49. Ananthakrishnan AN, McGinley EL, Binion DG, et al. A novel risk score to stratify severity of Crohn's disease hospitalizations. Am J Gastroenterol 2010;105:1799–1807.
50. Nguyen GC, Munsell M, Harris ML. Nationwide prevalence and prognostic significance of clinically diagnosable protein-calorie malnutrition in hospitalized inflammatory bowel disease patients. Inflamm Bowel Dis 2008;14:1105–1111.
51. Evans DC, Corkins MR, Malone A, et al. The use of visceral proteins as nutrition markers: an ASPEN position paper. Nutr Clin Pract 2021;36:22–28.
52. Yeh DD, Johnson E, Harrison T, et al. Serum levels of albumin and prealbumin do not correlate with nutrient delivery in surgical intensive care unit patients. Nutr Clin Pract 2018;33:419–425.
53. Marcason W. Should albumin and prealbumin be used as indicators for malnutrition? J Acad Nutr Diet 2017; 117:1144.
54. Fuhrman MP, Charney P, Mueller CM. Hepatic proteins and nutrition assessment. J Am Diet Assoc 2004; 104:1258–1264.
55. White JV, Guenter P, Jensen G, al. Consensus statement: Academy of Nutrition and Dietetics and American Society for Parenteral and Enteral Nutrition: characteristics recommended for the identification and documentation of adult malnutrition (undernutrition). JPEN J Parenter Enteral Nutr 2012;36:275–283.
56. Bischoff SC, Escher J, Hébuterne X, et al. ESPEN practical guideline: clinical nutrition in inflammatory bowel disease. Clin Nutr 2020;39:632–653.
57. Casanova MJ, Chaparo M, Molina B, et al. Prevalence of malnutrition and nutritional characteristics of patients with inflammatory bowel disease. J Crohns Colitis 2017; 11:1430–1439.
58. Cederholm T, Jensen GL, Correia MITD, et al. GLIM criteria for the diagnosis of malnutrition - a consensus report from the global clinical nutrition community. Clin Nutr 2019;38:1–9.
59. Taylor LM, Eslamparast T, Farhat K, et al. Using patient completed screening tools to predict risk of malnutrition in patients with inflammatory bowel disease. Crohns Colitis 360 2021;3(3):otab043.
60. Gold SL, Manning L, Kohler D, et al. Micronutrients and their role in inflammatory bowel disease: function, assessment, supplementation, and impact on clinical outcomes including muscle health. Inflamm Bowel Dis 2023;29:487–501.
61. MacMaster MJ, Damianopoulou S, Thomson C, et al. A prospective analysis of micronutrient status in quiescent inflammatory bowel disease. Clin Nutr 2021;40:327–331.
62. Abraham BP, Prasad P, Malaty HM. Vitamin D deficiency and corticosteroid use are risk factors for low bone mineral density in inflammatory bowel disease patients. Dig Dis Sci 2014;59:1878–1884.
63. Dignass AU, Gasche C, Bettenworth D, et al. European consensus on the diagnosis and management of iron deficiency and anaemia in inflammatory bowel diseases. J Crohns Colitis 2015;9:211–222.
64. Evstatiev R, Marteau P, Iqbal T, et al. FERGIcor, a randomized controlled trial on ferric carboxymaltose for iron deficiency anemia in inflammatory bowel disease. Gastroenterology 2011;141:846–853.e1–e2.
65. Hou JK, Gasche C, Drazin NZ, et al. Assessment of gaps in care and the development of a care pathway for anemia in patients with inflammatory bowel diseases. Inflamm Bowel Dis 2017;23:35–43.
66. Ward MG, Kariyawasam VC, Mogan SB, et al. Prevalence and risk factors for functional vitamin B12 deficiency in patients with Crohn's disease. Inflamm Bowel Dis 2015;21:2839–2847.
67. Battat R, Kopylov U, Szilagyi A, et al. Vitamin B12 deficiency in inflammatory bowel disease: prevalence, risk factors, evaluation, and management. Inflamm Bowel Dis 2014;20:1120–1128.
68. Stabler SP. Clinical practice. Vitamin B12 deficiency. N Engl J Med 2013;368:149–160.
69. Holt DQ, Strauss BJ, Moore GT. Patients with inflammatory bowel disease and their treating clinicians have different views regarding diet. J Hum Nutr Diet 2017;30:66–72.
70. Levine A, Rhodes JM, Lindsay JO, et al. Dietary guidance from the International Organization for the Study of Inflammatory Bowel Diseases. Clin Gastroenterol Hepatol 2020;18:1381–1392.
71. Agrawal M, Sabino J, Frías-Gomes C, et al. Early life exposures and the risk of inflammatory bowel disease: systematic review and meta-analyses. EClinicalMedicine 2021;36:100884.

72. Xu L, Lochhead P, Ko Y, et al. Systematic review with meta-analysis: breastfeeding and the risk of Crohn's disease and ulcerative colitis. Aliment Pharmacol Ther 2017;46:780–789.
73. Ananthakrishnan AN, Khalili H, Konijet GG, et al. A prospective study of long-term intake of dietary fiber and risk of Crohn's disease and ulcerative colitis. Gastroenterology 2013;145:970–977.
74. Narula N, Chang NH, Mohammad D, et al. Food processing and risk of inflammatory bowel disease: a systematic review and meta-analysis. Clin Gastroenterol Hepatol 2023;21:2483–2495.e1.

**Received April 23, 2023. Accepted November 5, 2023.**

**Correspondence**
Address correspondence to: Jana G. Hashash, MD, MSc, Division of Gastroenterology and Hepatology, Mayo Clinic, 4500 San Pablo Road, Jacksonville, Florida 32224. e-mail: AlHashash.Jana@mayo.edu.

**CRediT Authorship Contributions**
Jana G. Hashash (Conceptualization: Lead; Data curation: Equal; Writing – original draft: Equal; Project administration: Lead; Supervision: Equal; Visualization: Equal)
Jaclyn Elkins (Data curation: Equal; Writing – original draft: Equal)
James D. Lewis (Writing – review & editing: Equal; Supervision: Equal)
David G. Binion (Writing – original draft: Supporting; Writing – review & editing: Lead; Supervision: Equal; Visualization: Equal)

**Conflicts of interest**
These authors disclose the following: James D. Lewis consulted/served on an advisory board for Eli Lilly and Company, Samsung Bioepis, UCB, Bristol-Myers Squibb, Nestlé Health Science, Merck, Celgene, Janssen Pharmaceuticals, Bridge Biotherapeutics, Entasis Therapeutics, AbbVie, Pfizer, Gilead, Arena Pharmaceuticals, Protagonist Therapeutics, Amgen, Sanofi, and Scipher Medicine. He has had research funding from Nestlé Health Science, Takeda, Janssen Pharmaceuticals, and AbbVie. He has received educational grants from Takeda and Janssen. He has performed legal work on behalf of generic manufacturers of ranitidine, including L. Perrigo Company, Glenmark Pharmaceuticals Inc, Amneal Pharmaceuticals LLC, Aurobindo Pharma Switzerland, Inc, Dr. Reddy's Laboratories, Inc, Novitium Pharma, Ranbaxy Inc, Sun Pharmaceutical Industries, Inc, Strides Pharma, Inc, and Wockhardt Switzerland LLC. He owns stock in Dark Canyon Labs. David G. Binion has received research funding from AbbVie, Merck, and Takeda. The remaining authors disclose no conflicts.