Carol Rees Parrish, MS, RDN, Series Editor

The Specific Carbohydrate Diet in Inflammatory Bowel Disease: The Evidence and Execution

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Nutrition, specifically exclusive enteral nutrition, has long been considered a therapeutic option in patients with inflammatory bowel disease; less is known, however, about the specific carbohydrate diet (SCD). The SCD supports avoidance of certain complex carbohydrates (thought to be pro-inflammatory in nature), thus promoting intestinal healing. Traditionally, a step-wise or staged approach has been used for SCD initiation, with progression from the most easily digestible foods to more complex foods over time. Close monitoring of laboratory parameters and anthropometrics is recommended. A multidisciplinary approach to the SCD is ideal, with access to a registered dietitian who is trained in, or has experience with, the SCD.

INTRODUCTION

Inflammatory bowel diseases (IBD) such as Crohn's disease (CD) and ulcerative colitis (UC) are chronic, and in some, debilitating conditions that can affect any portion of the gastrointestinal (GI) tract in CD and the length of the colon in UC, and can be associated with disease relapse and progression. While many providers take a multidisciplinary approach to the care and treatment of patients with IBD, the focus of therapy for patients with IBD, particularly in the adult IBD population, remains largely based on pharmacologic options. Even so, many patients are eager to try alternative and complementary medicine as a therapeutic option for IBD.

Exclusive enteral nutrition (EEN) can be used for inducing and maintaining remission in both the pediatric and adult IBD populations, but adherence remains very challenging.[1,2,3,4] and relapse becomes likely upon resumption of a normal diet.[5] The specific carbohydrate diet (SCD) remains one such alternative, which allows for patients to eat "real food" and thus has piqued the interest of both patients and researchers. Fear of long-term consequences, lack of efficacy, and adverse reactions to medical therapy are often cited

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as reasons for patients to pursue the SCD; some perceive a greater benefit of the SCD compared to medical therapy.[6,7]

Nutritional books and the internet are filled with successful anecdotes of how the SCD has changed the lives of patients and has resulted in symptomatic remission, often in children, but results from large-scale clinical trials are lacking.[2] For example, one online survey of 51 IBD patients revealed that 84% of patients experienced symptomatic remission on the SCD, with 61% of all patients off of all medical therapy.[8] To date, only seven clinical trials researching the SCD subject are registered with ClinicalTrials.gov.

Table 1. Foods Allowable on the Specific Carbohydrate Diet

- Meats, poultry, fish, shellfish and eggs without additives
- Certain legumes, including but not limited to dried navy beans, lentils, peas, split peas, and lima beans
- Dairy limited to cheeses such as cheddar, Colby, Swiss, dry curd cottage cheese, and homemade yogurt fermented for at least 24 hours
- Most fresh, frozen, raw or cooked vegetables and string beans (canned fruits/vegetables not included as canned foods still are not advised on a regular basis on the SCD)
- Fresh, raw, cooked, frozen or dried fruits with no added sugar
- Most nuts and nut flours, including unroasted cashews and peanuts, all-natural peanut butter, almond, and cashew butters, almond flour, and coconut flour
- Most oils, weak and plain tea and coffee, mustard, cider or white vinegar and juices with no additives or sugars
- Honey as a sweetener

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The "*Specific Carbohydrate Diet*" was published by Drs. Sidney and Merrill Haas in 1951, who found that taking a dietary approach to celiac disease and cystic fibrosis with pancreatic insufficiency resulted in complete disappearance of GI symptoms in their patients suffering from these conditions.[9] However, Dr. Sidney Haas had been using the SCD to treat his patients for decades before this. The parent of one of his patients with ulcerative colitis, Elaine Gottschall, became a proponent of the diet as a treatment option for patients suffering from intestinal diseases, and popularized the SCD in her book, *Breaking the Vicious Cycle: Intestinal Health Through Diet*.

The SCD can be well balanced, but is very specific in the types of sugars and starches that are allowed (Table 1). The natural SCD aims to permit single sugars, or monosaccharides, such as those found in some fruits, certain vegetables, and honey, as opposed to disaccharides (sucrose, for example) and complex polysaccharides (starches) as shown in Table 2. Even so, certain starches such as those found in dried beans and lentils may be consumed as they have been tolerated by many patients.[9] Research is ongoing as to what foods on the SCD are permissible and not permissible and the mechanism of action as to why these foods may be beneficial or harmful.

Carbohydrate intolerance is central to the basis behind the SCD. The concept of the SCD aims to promote strict avoidance of those foods which trigger gut inflammation by avoiding certain types of carbohydrates, noted above, as these are thought to exert the most influence over the intestinal microbiome.[4,9] By avoidance of these carbohydrates, small bowel mucosal injury and bacterial overgrowth can be reduced, thereby preventing downstream effects such as diarrhea and malabsorption. In addition to the traditionally proposed mechanism of action behind the SCD, researchers are also investigating whether food additives and preservatives may play a role in the inflammatory process.

The Evidence

As previously mentioned, large-scale clinical trial data on the SCD in IBD is lacking,[2] but several studies have explored the role of the SCD in IBD, particularly in pediatric patients.[1,10-13] Suskind and

colleagues conducted a retrospective study of seven pediatric patients with Crohn's disease, excluding those on immunosuppressants, and found that all patients experienced symptom remission within three months of initiating the SCD, with either normalization or improvement in laboratory parameters such as CRP, hemoglobin, albumin, and fecal calprotectin.[11]

The same group conducted an internet-based survey of 417 pediatric and adult respondents with CD, UC, and indeterminate colitis and demonstrated that the majority reported achieving clinical remission of IBD on the SCD, with 33% of patients reporting clinical remission at two months after initiation of the SCD and 42% of patients reporting clinical remission at 6 and 12 months after continuation of the SCD.[6] While this was based on survey data, it highlights the importance of the patient perspective and a perceived benefit for patients trying the SCD, many of whom were having symptoms such as abdominal pain, diarrhea, bloody stools, and limitations in their activity levels prior to initiation.[6]

Burgis and colleagues from Stanford conducted a retrospective study investigating the effects of the SCD in maintenance of remission in pediatric patients with CD over a one-year period.[1] They found significant improvements in lab parameters (hemoglobin, albumin, ESR) with implementation of the SCD in patients who were treated with and without immunomodulatory therapy, and overall patient height and weight also improved. All effects persisted with liberalization of the diet, with the exception of weight gain (50% of patients lost weight when SCD was liberalized). While the study was small (n = 11 patients), this was the first study investigating liberalization of the SCD.

Another survey-based case series of 50 patients with UC, CD, or indeterminate colitis from Rush University Medical Center demonstrated that 66% of patients reported complete resolution of IBD symptoms on the SCD after an average of 9.9 months.[7] The majority of these patients were adults, but pediatric patients were also included. On average, the diet was also rated to be 91.3% effective in controlling acute flare symptoms and 92.1% effective in maintenance of remission of IBD.

Although patients may experience symptomatic remission and improvement in laboratory parameters with dietary changes, the target of anti-inflammatory treatments in IBD remains mucosal healing. Studies investigating mucosal healing on the SCD are limited to the pediatric population, and although only small numbers of patients have been included, results are conflicting. Wahbeh and colleagues demonstrated a lack of mucosal healing in a retrospective study including 7 pediatric patients with Crohn's disease on a modified SCD (e.g. permitting some foods normally restricted on the SCD), with a median duration of 26 months on the diet.[12] Although one patient had mucosal healing on ileocolonoscopy, this patient had persistence of upper GI Crohn's disease.

Table 2. Foods Not Allowed on the Specific Carbohydrate Diet

- Sugar, molasses, maple syrup, sucrose, processed fructose including high-fructose corn syrup or any processed sugar, Stevia, agave nectar, and most artificial sweeteners such as Splenda and Equal
- All grain including corn, wheat, wheat germ, barley, oats, rice and others (this includes bread, pasta and baked goods made with grain-based flour)
- Canned fruits/vegetables
- Some legumes
- Seaweed and seaweed byproducts such as carrageenan
- Starchy tubers such as potatoes, sweet potatoes, and turnips
- Canned and most processed meats
- Canola oil and most commercial mayonnaise
- All milk and milk products high in lactose such as mild cheddar, commercial yogurt, cream, sour cream, and ice cream
- Candy, chocolate and products that contain FOS (fructooligosaccharides)

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In contrast, Cohen and colleagues demonstrated small bowel mucosal healing on capsule endoscopy in a cohort of 10 pediatric patients with active Crohn's disease who were started on the SCD.[13] Interestingly, mucosal healing as measured by the mean Lewis score for capsule endoscopy was seen at 12 weeks, but did not persist at 52 weeks. Only four out of the 10 patients had normal-appearing small bowel at 12 weeks as measured by the Lewis score. Other parameters of clinical disease activity (Harvey-Bradshaw Index, Pediatric Crohn's Disease Activity Index) also improved significantly at 12 weeks, and effects were also noted to persist up to 52 weeks.

Table 3. Resources for Patients on the Specific Carbohydrate Diet

Books

- Breaking the Vicious Cycle: Intestinal Health Through Diet by Elaine Gloria Gottschall (1994)
- Eat Well, Feel Well by Kendall Conrad (2010)
- Recipes for the Specific Carbohydrate Diet by Raman Prasad (2008)
- Two Steps Forward One Step Back by Tucker Sweeney and Carol Thompson (2011)
- Lucy's Specific Carbohydrate Diet Cookbook by Lucy Rosset (2010)
- SCD Lifestyle Surviving to Thriving on SCDLifestyle.com (2009)
- Nutrition in Immune Balance (NIMBAL) Therapy by David L Suskind (2015)

Diet Websites

- breakingtheviciouscycle.info/
- pecanbread.com
- BTVC-SCD discussion group on Yahoo and Facebook group
- PRODUCE study information is located on the Nutrition in Immune Balance (NiMBAL) website (NiMBAL.org).

Cooking Blogs

- Comfy Belly (comfybelly.com)
- Caleb's Cooking Company (calebscookingcompany.com/blog/)

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Results of the DINE-CD study (Trial of Specific Carbohydrate and Mediterranean Diets to Induce Remission of Crohn's Disease), a multicenter randomized, open-label trial headed by researchers at the University of Pennsylvania, should provide more evidence of the utility of the SCD in the adult Crohn's disease population.[14] Both symptomatic remission and reduction of bowel inflammation as measured by fecal calprotectin are the primary outcome measures in this study, which is scheduled to complete in mid-2019 and will be the largest investigation into the application of the SCD in IBD patients to date.

In many instances, nutrition has taken a "backseat" in the care of IBD patients in the United States, particularly in the adult population. In Europe and Asia, EEN is a first-line therapy in many instances. Future research on the SCD may allow dietary modification to come to the forefront of therapy options alongside pharmacologic therapy.

Nutritional Adequacy of the SCD

While the SCD is based on exclusion of carbohydrates, it has been shown to be nutritionally adequate in comparison to healthy peer reference diets; even so, certain deficiencies, particularly calcium and vitamin D, can occur.[10] In a study by Braly and colleagues at the University of Washington which included eight pediatric IBD patients, the majority (64%) exceeded 100% of their recommended daily allowance for energy intake and all individuals consumed approximately three times the RDA for protein. Six out of the eight patients were able to gain weight during the study. However, 100% of patients had intakes below the RDA for vitamin D, and 75% of patients' daily intakes were less than the RDA for calcium.[10]

Background and Diet Implementation

Traditionally, the SCD has been introduced using a step-wise or staged approach. Food introduction

begins with the most easily digestible foods, advancing to more complex foods including raw fruits, vegetables, legumes and specific dairy products over a variable time period. Researchers are looking into expediting food introduction given the diet can be nutritionally lacking until the full SCD is reached (PRODUCE study[15]). Many pediatric GI providers do not currently use the staged approach as the evidence is lacking as to its efficacy over initiation of the full SCD.

For patients with IBD initiating the SCD, a multidisciplinary approach to their care, with access to a registered dietitian, is recommended to ensure adequate micro- and macronutrient content in diet and proper education on the SCD. Without proper nutrition counseling, the diet can be lacking in essential nutrients.[10] Supplementation with an SCD multivitamin and/or vitamin D has also been suggested.[10] A food journal detailing snacks and meals can also be helpful for patients working with dietitians. It is easy for foods with hidden prohibited ingredients to make their way into the diet without close monitoring. These hidden ingredients are typically found in pre-made foods, spices, and seasoning mixes. It is not recommended that patients who follow a vegan diet use the SCD as part of their therapy regimen given the difficulty in achieving adequate caloric and nutrient intake with the combined limited food options; however, vegetarians can have a nutritionally complete diet on the SCD. Additional resources regarding SCD-approved supplements, ingredients to be avoided, and meal/snack ideas can be found on the PRODUCE website (nimbal.org/education/produce-study/produce-documents).

When first presenting the SCD to a patient and family, diet implementation is most successful when the patient is on board with the diet and the whole family participates as much as able. Encourage patients to transition to the full SCD within a two-week time period, as they will need to prepare a pantry of new food items and purge foods that are not allowed on the SCD. In order to prevent inadequate nutritional intake, it is important to discuss and adhere to a timeline over which the full SCD can be initiated.

All diets can alter the microbiome; however, the ideal composition of beneficial versus harmful bacteria is yet to be determined. Research on microbiome modulation through diet in IBD is ongoing.[15,16] An important aspect of the SCD is restoration of "good gut bacteria" in the form of a varied diet and the addition of probiotics through certain allowable fermented foods, and in particular, the SCD homemade yogurt. This yogurt is fermented for 24 hours, allowing for fermentation of the sugar, lactose. For this reason, many who are lactose intolerant tolerate the SCD yogurt in moderation. Yogurt-making instructions can be found on the PRODUCE website (see above). The SCD yogurt also provides calcium and vitamin D when cow's milk is used and can be an excellent calorie source for patients struggling with low weight. It can be made with whole milk or even a mixture of half and half with whole milk. The SCD yogurt can be made with homemade nut milk or goat's milk as well, but the nutritional content of these vary considerably.[17]

Providing nutritional supplementation when indicated, tips for social situations, weight loss prevention strategies, and resources that patients can reference for meal and snack ideas encourages diet adherence and success (see Tables 1-3).

Clinical Pearls for Frequently Asked Questions

Pre-made foods

SCD patients and families frequently ask about SCD convenience foods that come pre-made in order to save time. While some "convenience" SCD foods exist, the premise of the diet is centered upon more basic, whole foods. Additionally, many companies can change ingredients in their products allowing for proscribed ingredients to make their way into the diet unbeknownst to the patient. Therefore, intake of these foods on a regular basis is discouraged when the diet is being used as a treatment modality.

Probiotics

Families frequently inquire about supplementation with a probiotic. A varied diet with fresh fruits and vegetables, legumes, various proteins and healthy fats is one of the best sources of prebiotics and probiotics, which can help stimulate the growth of the intestinal microbiome. Additionally, on the SCD, the SCD yogurt can be a beneficial source of probiotics. Some patients dislike the taste of

the yogurt alone, so it is recommended to add the SCD yogurt to smoothies, various dishes and baked goods.

Organic and/or Grass-Fed Meats

Patients are encouraged to select organic products whenever possible. Certified organic is a third-party certification that must meet USDA criteria. Organic foods cannot be irradiated, genetically modified or grown using synthetic fertilizers, chemicals, or sewage sludge. The organic label on meat and poultry means that it was not treated with hormones or antibiotics and was fed only organically grown feed (with no animal byproducts). Animals raised for organic meat must have access to the outdoors, and grass-eating animals must have access to pasture. Antibiotic resistance with eating high amounts of meat from non-organic sources remains a concern amongst providers.

Tips for produce include selecting organic options, when available, for foods listed on the "Dirty Dozen," (a list of fruits and vegetables with the highest pesticide residues), published annually by the Environmental Working Group (https://www.ewg.org/foodnews/dirty-dozen.php). Conversely, selecting organic varieties of the produce on the "Clean Fifteen" list is not necessary, as these non-organic fruits and vegetables are least likely to contain pesticide residues according to the Environmental Working Group (ewg.org/foodnews/clean-fifteen.php).

On the SCD, dietitians recommend that patients consume a balance between plant and animal-based proteins.

Monitoring

Like medication therapy, it is essential to monitor symptoms, laboratory parameters and anthropometrics to assess efficacy of the diet.

Labs

Inflammatory markers, stool calprotectin, hemoglobin/hematocrit, and vitamin D should be followed at the provider's discretion.

Anthropometrics

Clinically monitoring weight changes, height velocity in children, and BMI is important in the setting of IBD, and while on an elimination diet. Weight loss or linear growth deceleration can indicate inadequate caloric intake or may suggest ongoing inflammation.

Long-Term Outlook

Prospective studies are underway looking at the possibility of a more liberalized SCD as treatment in comparison to the traditional SCD in hopes that some patients may tolerate a more lenient diet while still maintaining remission of their disease (PRODUCE[15]).

CONCLUSIONS

The SCD has had significant support among patients with IBD and other GI disorders since it was popularized by Elaine Gotschall.[9] While small studies have demonstrated nutritional adequacy, symptomatic remission, and improvement in laboratory parameters among IBD patients on the SCD, the studies have mainly been limited to the pediatric population, and these findings and others (e.g. mucosal healing) remain to be demonstrated in large-scale clinical trials. Increased awareness of SCD among patients, providers and dietitians has fueled an interest in more research into this dietary option, which may become an integral part of a multidisciplinary approach to IBD patient care in the near future. ■

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Answers to this month's crossword puzzle: