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Differences in Nutrient Intake with Homemade versus Chef-Prepared Specific Carbohydrate Diet Therapy in Inflammatory Bowel Disease: Insights into Dietary Research

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ABSTRACT

Purpose: The aim of this study was to evaluate the nutrient content consumed by children and adolescents on home-prepared versus chef-prepared specific carbohydrate diets (SCD) as therapy for inflammatory bowel disease (IBD).
Methods: Dietary intake of two cohorts with active IBD initiating the SCD over 12 weeks was assessed. The home-prepared cohort received detailed guidance from dietitians on implementation of the SCD. The chef in the other cohort was knowledgeable in the SCD and prepared meals from a fixed set of recipes. Data from 3-day diet diaries at 4 different time points were collected. US Recommended Daily Allowances (RDA) were calculated for macronutrients, vitamins, and minerals.
Results: Eight participants on the homemade SCD and 5 participants on the chef-prepared SCD were included in analysis. Mean % RDA for energy intake was 115% and 87% for homemade and chef-prepared groups (p<0.01). Mean % RDA for protein intake was 337% for homemade SCD and 216% for chef-prepared SCD (p<0.01). The homemade SCD group had higher mean % RDA values for vitamin A and iron, while the chef-prepared SCD group had higher intake of vitamins B1, B2, D, phosphorus and zinc (p<0.01 for all).
Conclusion: The SCD implemented homemade versus chef-prepared can result in significantly different intake of nutrients and this may influence efficacy of this dietary therapy. Meal preparation dynamics and the motivation of families who pursue dietary treatment may play an important role on the foods consumed and the outcomes on dietary therapy with the SCD.

Keywords: Diet; Inflammatory bowel diseases; Child; Nutritional therapy

INTRODUCTION

Inflammatory bowel disease (IBD) is a chronic inflammatory condition affecting the gastrointestinal tract. Treatment for IBD typically includes immunosuppressive medications, many of which have significant potential side effects including increased risk of infection and

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Conflict of Interest

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malignancy. Many patients are interested in dietary intervention as part of their treatment for IBD. It has been shown that >75% of patients with IBD restrict food groups on their own, mostly based on subjective intolerance of these food groups [1]. Dietary guidance is important, as malnutrition in IBD is associated with increased morbidity and poor growth and development. Restrictive diets have the potential to increase this risk by causing nutrient, energy, and/or protein deficiencies [2]. Misconceptions about diet can result in the unnecessary avoidance of entire food groups which could lead to the development of nutritional deficiencies due to the perception that elimination of these foods decreases disease activity [3].

Exclusive enteral nutrition (EEN) is the best studied dietary therapy in IBD and has been accepted as first line therapy for pediatric Crohn's disease with efficacy equivalent or superior to steroids, and with fewer side effects [4,5]. There are several hypotheses regarding the mechanism of action of EEN including modulation of the intestinal microbiome, avoidance of deleterious food items, and potential direct anti-inflammatory effect [5-8]. However, EEN is a challenging therapy for many reasons, including resistance to give up conventional foods, poor palatability of formulas, and fear of tube feedings [5]. Though diet therapy as primary or adjunctive treatment for IBD is not yet a part of the standard medical paradigm, data is growing on dietary therapy for IBD, including the specific carbohydrate diet (SCD) [9]. The SCD excludes all grains, refined sugars, processed foods and dairy aside from yogurt fermented >24 hours and some hard cheeses (**Table 1**) [10]. Staples of the diet include fruits, vegetables, legumes, meats, and nut flours [2]. Several smaller studies have shown that the use of SCD as therapy in IBD have resulted in improvements in clinical disease activity and laboratory markers of inflammation [9-12].

Adherence to the dietary intervention is fundamental when evaluating efficacy of a dietary therapy, and a per protocol analysis may have contrasting findings to an intention to treat analysis [13]. Across all pediatric disease groups, the prevalence of nonadherence to treatment regimens is approximately 50% in children and 65–75% in adolescents [14]. Rates of nonadherence specific to therapy for pediatric gastrointestinal diseases has large variations in reported rates, ranging from 5% to 70% due to wide variety of methodology in assessing adherence [14]. Factors contributing to nonadherence in gastroenterology-specific diseases include patient coping, parental education, patient and family dysfunction, and degree of responsibility shared between patients and caregivers in treatment regimens [14].

The SCD is a dietary therapy that gives guidelines on dietary consumption but allows individuals great flexibility on how it is implemented. Because variation can occur within individuals on the SCD, it is essential to consider methodology to evaluate how patients are preparing and consuming foods. In the studies describing the efficacy of SCD in treatment of IBD, most have evaluated patients who follow the SCD as prepared at home by patients

Table 1. The specific carbohydrate diet

Foods allowed	Foods not allowed
Nuts	Grains of any kind
Plant-based milk, yogurt fermented over 24 hours, hard cheeses aged over 90 days	Cow's milk, commercial yogurts, soft cheeses
Dried navy, lima, black, cranberry, green (string) beans, lentils, peas	Garbanzo, pinto peans, canned beans, soy
Honey	Sweeteners aside from honey
Ghee, pastured-cow or grass-fed butter, coconut oil, sunflower oil, olive oil, seed/nut oils	Vegan butter products or soybean oil
All meat/poultry/fish/shellfish that is not processed or with the addition of sugar and additives	Preservatives of any kind
Eggs	

and families. Prior work evaluating nutritional adequacy of the SCD used as therapy in IBD found that, when compared to United States National Health and Nutrition Examination Survey (NHANES) data, there were no significant differences in intake of 20 key nutrients between pediatric patients on the SCD diet and population data from healthy peers of the same age and sex [2]. Our group has evaluated the SCD in active Crohn's disease using both chef-prepared meals provided to families as well as home-prepared meals by family. In both these groups, clinical efficacy and laboratory improvements were seen [9,15]. Though studies of other disease processes have compared home-prepared vs. chef-prepared diets, to date, no studies have evaluated differences in nutritional intake and adequacy in home- vs. chef-prepare meals used to treat IBD [16-18].

The aim of this study is to determine differences in dietary intake on the SCD in family-prepared meals (i.e., 1-on-1 training by dietitian and support in implementation) versus study chef-prepared meals in pediatric patients with IBD. We hypothesize that patterns of nutrient and caloric intake are influenced by meal-preparation dynamics and also the direct energy/effort invested by families to pursue a dietary therapy.

MATERIALS AND METHODS

This is a single-center analysis and comparison of dietary intake in two cohorts of pediatric patients with active Crohn's disease or ulcerative colitis enrolled in studies examining the efficacy of dietary therapy with the SCD. Our group has previously published on two studies: the first describing efficacy of therapy with family-prepared SCD meals, and the second describing efficacy with chef-prepared SCD meals [9,15]. In the two prior published studies, efficacy of therapy with SCD in IBD is evaluated in detail, showing improvements in both clinical disease activity scores and laboratory values after 12 weeks of SCD therapy. Study inclusion criteria, follow-up and assessments were similar for both studies. Participants age 8 to 21 with active IBD were enrolled and received dietary therapy with the SCD as the sole intervention for 12 weeks.

Inclusion criteria in the respective trials included no changes in IBD medication(s) for a minimum of 1 month for immunosuppressive medications and 2 months for biologics. Participants had clinical follow-up at 2, 4, 8, and 12 weeks, including history, physical examination, and laboratory testing, including complete blood count, C-reactive protein, erythrocyte sedimentation rate, albumin, and stool calprotectin. Diet was evaluated by 3-day nutrition logs filled out by patients and families prior to each visit. Food intake records included food, drink, portion size, details on food preparation, and quantity consumed. Participants were followed and in contact with the dietitian and gastroenterologist for questions and problem interventions with the diet over the 12 weeks. The study protocol was approved by the institutional review board at Seattle Children's Hospital: IRB 14956 and 15606. Informed consent was obtained from all young adults and the parents/guardians of children less than 18 years of age.

Dietary intervention

In the cohort with family-preparation of the SCD, patients and families were responsible for purchasing ingredients and preparing meals on their own, and they met with dietitians who counseled on meal planning, recipes, and snack recommendations [9]. In the cohort with chef-preparation of the SCD, patients were randomized into one of three SCD diet

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modifications: 1) Standard SCD as defined by Elaine Gottschall's Breaking the Vicious Cycle, 2) Modified SCD with added oats and rice, and 3) Whole foods diet without added sugars. Foods were prepared by a chef knowledgeable in the SCD and whole food diets. Recipes were predetermined, and families were able to decide food for patients based on pre-set menus. Families were also given a list of "safe foods" that the patient could eat ad lib regardless of which group they were assigned. Patients and families met with dietitians who counseled on meal planning, weight loss prevention, recipes, and snack recommendations. For the chef prepared cohort, only patients on the strict SCD were included in the analysis.

Diet analysis

Diet analysis of all detailed food intake records was completed using The Food Processor version 10.12.0 (ESHA Research, Salem, OR, USA). To ensure accuracy and standardization of nutrient content, families who prepared SCD foods at home provided recipes to the study team for all homemade foods.

All dietary data for patients were included as separate intakes in analyses, representing up to 12 daily intakes per patient. For each participant, mean nutrient intake was calculated from the 3-day diet logs. Dietary reference intake (DRI) values put forth by the Institute of Medicine, the National Academy of Medicine in the United States represent evidence derived recommendations for nutrient needs in healthy populations. DRIs include Recommended daily allowance (RDA) which is the average daily intake sufficient to meet the nutrient requirements of 97–98% healthy people [19]. Percent RDA refers to the percentage intake of the RDA value met. Daily energy requirement estimates were calculated using age, gender, height, weight, and physical activity level. Intake of 21 key nutrients was compared to DRIs and nutrient intake data from NHANES National Youth Fitness Survey [20]. The NHANES survey targets individuals beginning at birth and goes up to adulthood.

Statistical analysis

Analyses were conducted using STATA 12.0 (StataCorp, College Station, TX, USA). Demographic, clinical, and food additive variables were summarized using frequencies and percentages for categorical variables and mean, standard deviation, median, range, and interquartile range for continuous variables, as appropriate. Data from up to 12 days of diet log data were used to calculate mean intake values. After preliminary visualization of daily intake values, nutrients that were markedly skewed right were log-transformed for analyses. Percentage of participants meeting nutritional adequacy (% RDA) was assessed using mean nutrient intakes for each participant.

For comparison to NHANES nutrient intake data, NHANES data were first subset to include only participants in the age range of the SCD patients. Next, NHANES data were summarized to estimate population means and also evaluated to assess percentage of participants meeting RDA. Mean values of nutrient intake for SCD patient data were compared to these population means utilizing one-sample *t*-tests. Chi-square testing was used to compare frequency of achieving mean RDA for intake between groups.

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RESULTS

Participant characteristics

The home-prepared SCD cohort was comprised of 8 participants, 5 with Crohn's disease and 3 with ulcerative colitis, with mean age 13.6±2.1 years, baseline weight z-score −0.34±0.60 and, baseline height z-score of −0.13±0.85 [9]. The chef-prepared SCD cohort included 5 children with Crohn's disease, mean age was 15.2±1.3 years, baseline weight z-score 0.21±1.03 and, baseline height z-score of 0.18±1.06 [15]. In the cohort with chef-preparation of the SCD, only participants consuming the strict definition of the SCD were included in comparative analysis (5 out of 16 participants). Others in this chef-prepared cohort (i.e., modified SCD and also whole foods arms) were not included in this analysis.

Diet analysis

1. Macronutrients

Mean percent intake of RDA values for both energy and protein intake were significantly greater in the SCD homemade group than in the SCD chef-prepared group (**Table 2**). Mean % RDA for energy intake was 115% and 87% for homemade and chef-prepared groups, respectively (p<0.01). Of note, only 63% in the homemade group and 20% in the chef-prepared group met the RDA for total energy intake (**Table 3**). Mean % RDA for protein was 337% for homemade SCD and 216% for chef-prepared SCD, and both groups had all individuals exceeding 100% RDA values for protein intake. Both SCD groups had significantly higher mean % RDA protein intake when compared with NHANES participants, who consumed 184% RDA and had 85% of participants meeting the RDA for protein intake. Of note, NHANES does not include total energy intake data so protein was the only macronutrient able to be compared with national standards.

Table 2. Mean percent RDA intake of nutrients on the specific carbohydrate diet and NHANES participants

Nutrient	(1) SCD Homemade (n=8)	(2) SCD Chef-prepared (n=5)	(3) NHANES (n=605)	*p*-value 1 vs. 2	*p*-value 1 vs. 3	*p*-value 2 vs. 3
Macronutrients						
Energy	114.5	87.1	N/A	<0.01	N/A	N/A
Protein	336.7	216.2	184.3	<0.01	<0.01	0.036
Vitamins						
B1 (thiamin)	85.0	130.3	164.5	<0.01	<0.01	0.014
B2 (riboflavin)	164.3	214.9	199.1	<0.01	<0.01	0.39
B3 (niacin)	156.0	154.5	178.0	0.93	0.03	0.12
B5 (pantothenic acid)	135.5	133.3	N/A	0.86		
B6 (pyridoxine)	303.2	198.6	174.0	0.23	<0.01	0.16
B7 (biotin)	165.5	195.9	N/A	0.23		
B9 (folate)	84.4	84.2	50.8	0.99	<0.01	<0.01
B12 (cobalamin)	231.2	198.4	248.8	0.28	0.43	0.13
C	390.2	321.0	172.1	0.47	<0.01	<0.01
A	807.3	207.9	303.6	<0.01	<0.01	0.017
D	27.2	41.9	36.1	<0.01	0.015	0.30
E	147.7	132.0	59.5	0.49	<0.01	<0.01
K	201.8	163.1	122.1	0.51	0.017	0.39
Minerals						
Calcium	77.9	93.5	78.6	0.11	0.89	0.056
Iron	152.7	89.6	162.4	<0.01	0.38	<0.01
Magnesium	110.1	104.5	86.5	0.67	<0.01	0.013
Phosphorus	93.1	122.9	103.2	<0.01	0.056	0.014
Zinc	110.2	165.2	117.3	<0.01	0.35	<0.01
Selenium	290.0	237.1	121.2	0.20	<0.01	0.55

RDA: recommended daily allowance, NHANES: National Health and Nutrition Examination Survey, SCD: specific carbohydrate diet, N/A: not applicable.

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Table 3. Percent of participants achieving nutritional adequacy (100% RDA)

Nutrient	(1) SCD Homemade (n=8)	(2) SCD Chef-prepared (n=5)	(3) NHANES (n=605)	*p*-value 1 vs. 2	*p*-value 1 vs. 3	*p*-value 2 vs. 3
Macronutrients						
Energy	5 (62.5)	1 (20.0)	N/A	0.14	N/A	N/A
Protein	8 (100)	5 (100)	510 (84.3)	1.0	0.22	0.34
Vitamins						
B1 (thiamin)	3 (37.5)	5 (100)	479 (79.2)	0.024	<0.01	0.25
B2 (riboflavin)	7 (87.5)	5 (100)	506 (83.6)	0.41	0.77	0.32
B3 (niacin)	7 (87.5)	5 (100)	490 (81.0)	0.41	0.64	0.28
B5 (pantothenic acid)	6 (75.0)	5 (100)	N/A	0.22	N/A	N/A
B6 (pyridoxine)	7 (87.5)	5 (100)	468 (77.4)	0.41	0.50	0.23
B7 (biotin)	6 (75.0)	5 (100)	N/A	0.22	N/A	N/A
B9 (folate)	3 (37.5)	1 (20.0)	38 (6.3)	0.51	<0.01	0.21
B12 (cobalamin)	7 (87.5)	5 (100)	480 (79.3)	0.41	0.57	0.25
C	8 (100)	5 (100)	320 (52.9)	1.0	<0.01	0.036
A	8 (100)	5 (100)	506 (83.6)	1.0	0.21	0.32
D	0	0	32 (5.3)	1.0	0.50	0.60
E	6 (75.0)	3 (60.0)	74 (12.2)	0.57	<0.01	<0.01
K	5 (62.5)	3 (60.0)	210 (34.7)	0.93	0.10	0.24
Minerals						
Calcium	1 (12.5)	2 (40.0)	162 (26.8)	0.25	0.36	0.51
Iron	6 (75.0)	2 (40.0)	424 (70.1)	0.21	0.76	0.14
Magnesium	4 (50.0)	2 (40.0)	189 (31.2)	0.73	0.26	0.67
Phosphorus	3 (37.5)	4 (80.0)	283 (46.8)	0.14	0.60	0.14
Zinc	4 (50.0)	5 (100)	317 (52.4)	0.057	0.89	0.034
Selenium	8 (100)	5 (100)	540 (89.2)	1.0	0.33	0.44

Values are presented as number (%).
RDA: recommended daily allowance, SCD: specific carbohydrate diet, NHANES: National Health and Nutrition Examination Survey, N/A: not applicable.

2. Vitamins

Both SCD homemade and chef-prepared groups had similar proportions of participants meeting nutritional adequacy for the 13 vitamins included in the study (**Fig. 1** and **Table 3**), but there were significant differences in mean % RDA intake between groups. The homemade SCD group had higher mean % RDA values for vitamin B6 (303% vs. 199%; p=0.05) and A (807% vs. 208%; p<0.01), while the chef-prepared SCD group had higher values for vitamins B1 (130% vs. 85%; p<0.01), B2 (215% vs. 164%; p<0.01), and D (42% vs.

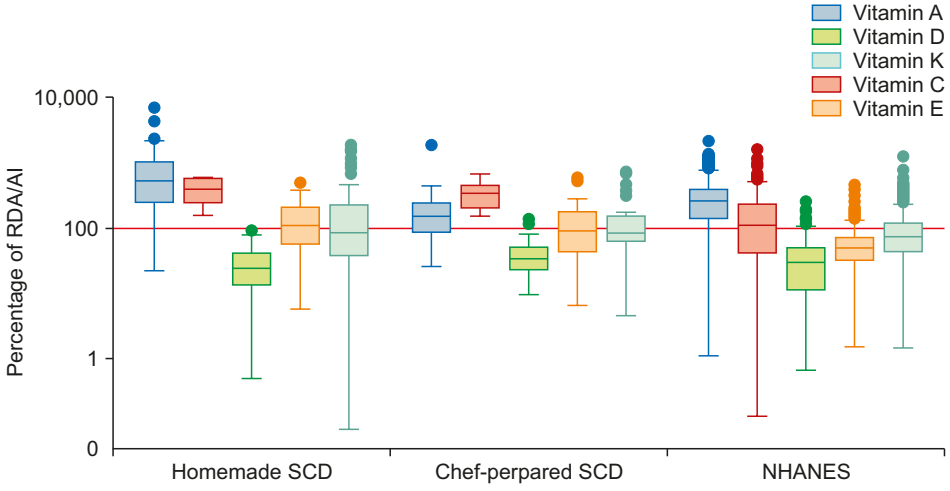

Fig. 1. Mean intake as percent of recommended daily allowance (RDA) for vitamin A, C, D, E, and K in specific carbohydrate diet (SCD) homemade, SCD chef-prepared, and National Health and Nutrition Examination Survey (NHANES) participants.
AI: adequate intake.

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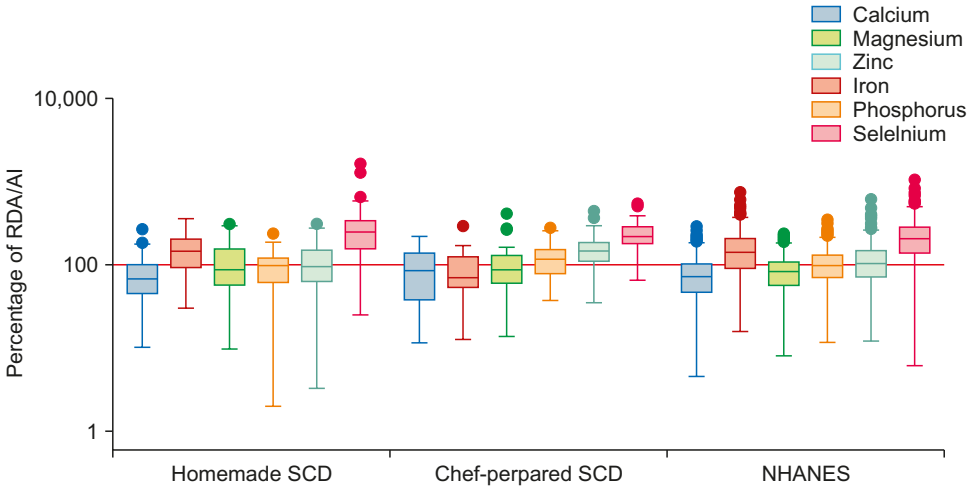

Fig. 2. Mean intake as percent of recommended daily allowance (RDA) for minerals in specific carbohydrate diet (SCD) homemade, SCD chef-prepared, and National Health and Nutrition Examination Survey (NHANES) participants. AI: adequate intake.

27%; $p<0.01$). Both SCD groups had higher percentages of participants meeting nutritional adequacy for vitamins C and E than NHANES participants. All 3 groups had <50% of participants meeting nutritional adequacy for vitamin B9 and vitamin D.

3. Minerals

Mean daily intakes for both SCD homemade and chef-prepared groups exceeded 100% RDA for magnesium, zinc, and selenium (**Table 2** and **Fig. 2**). Mean intake by the homemade group additionally met the RDA for iron (153% RDA) while the chef-prepared group met the RDA for phosphorus (165% RDA). The homemade SCD group had greater mean iron intake than the chef-prepared group ($p<0.01$) while the chef-prepared group had greater mean intake of phosphorus and zinc ($p<0.01$ for both). Both SCD cohorts and the NHANES cohort had <50% of participants meeting the RDA for calcium intake.

DISCUSSION

Dietary therapy for IBD with the SCD adheres to a set of specific principles but our study demonstrates that large variability can occur within the SCD pending the study cohort and meal preparation methodology. Our study demonstrates that total daily energy intake and also protein intake (both age, gender, and weight-adjusted as per DRIs) were significantly greater in the homemade SCD group in comparison to the chef-prepared SCD group. The homemade SCD group consumed greater amounts of iron, while the chef-prepared SCD group consumed greater phosphorus and zinc. Vitamin B1, B2, and D intake were greater in the chef-prepared SCD group. When evaluating percentage of respective group participants meeting RDAs, far fewer differences were appreciated.

Whereas dietary therapy with EEN may be implemented in a more uniform fashion by patients with Crohn's disease, other exclusion diets can be highly variable in their method of implementation and thus impact downstream effects including changes to the gut microbiome and clinical outcomes. Though both homemade and chef-prepared SCD meals are identical in principal, the practical preparation of these meals demonstrates significant

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differences. Anecdotally, we have observed that children often times prefer the foods their parents cook as opposed to set, chef-prepared meals. The mechanism of action by which the SCD can effectively treat inflammation in IBD is yet to be fully elucidated, but differences within the implementation of the SCD may offer unique insights. Our analysis using RDAs and comparison to the NHANES cohort demonstrates differences that may not be appreciated during dietitian evaluation and standard clinical assessment of nutritional intake.

Our study highlights the importance of close partnership with dietitians trained in IBD dietary therapy to guide the practical implementation and ensuring nutritional adequacy on an exclusion diet. Further, opportunities exist to better refine protocols for guidance and support of exclusion diets. Whereas more prescriptive exclusion diets for Crohn's disease such as the Crohn's disease exclusion diet have value in rigorous protocolization, dietary therapy for chronic disease must also consider the sustainability and variability of diets in diverse patient populations [21]. It is possible that individuals in the chef-prepared group were more likely to be non-adherent to the SCD, but regular dietitian follow-up and detailed instructions were given to patients and their families. Our analysis demonstrates that differences in nutritional intake were present dependent upon modality of food preparation. This may suggest that patient/family compliance, motivation, and acceptance of the SCD may have differed by group with the homemade SCD group potentially having greater engagement in the diet. Ongoing research will help guide better understanding of mechanisms of action of dietary therapy and inform therapeutic approaches that may be utilized as primary or adjunctive therapy in the treatment of IBD.

Current literature comparing nutritional adequacy of home-prepared vs. chef-prepared diets is most well established in adult populations using dietary intervention to treat hypertension, dyslipidemia, and type 2 diabetes mellitus. Most have shown that patients consuming chef-prepared meal plans have superior improvements in cardiovascular risk factors, quality of life, dietary compliance, and nutritional adequacy compared to patients following similar home-prepared meals plans [16-18]. However, in the context of pediatrics, it is difficult to extrapolate chef- vs. home-prepared meal success from adult studies since many pediatric patients have supporting parents or caregivers who are invested in their success, and not only participate in much of the meal preparation, but advocate strongly to have their children eat the appropriate SCD foods. It is therefore likely that the commitment required to adhere strictly to SCD guidelines with the anticipation and desire to achieve clinical remission in IBD will compel families to have greater adherence to the diet. In addition, though trained chefs may have superior knowledge about food and nutrients, families preparing meals at home may have an advantage in that caregivers better know their child's likes and dislikes and can cater meals towards preferences, potentially contributing to superior total energy intake in the homemade group.

Dietitian follow-up occurred throughout the 12-week study for both SCD cohorts. While general nutrient guidance was provided, prospective counseling on meeting exact RDA values was not discussed. RDAs for some nutrients were exceeded, but RDAs refer to the average daily intake sufficient to meet nutrient requirements in most individuals and exceeding RDA does not necessarily imply toxicity. For example, B vitamins are water soluble and easily excreted in the urine. Both SCD groups consumed <50% RDA of vitamin B9 (folate), vitamin D, and calcium, suggesting that patients undertaking SCD therapy should be counseled on sources of folate and calcium such as dark leafy vegetables, beans, nuts, and seeds, as well as sources of vitamin D such as fatty fish, mushrooms, or supplements. Furthermore, close dietitian follow-up is imperative, and vitamin supplementation may be considered.

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When evaluating an intervention that relies on adherence as a factor in the success of dietary intervention, it is worth noting special considerations for the pediatric population, particularly during times when caregiver monitoring and meal preparation is not present. In a study by Kurppa et al. [22] evaluating adherence in pediatric and adult patients with celiac disease, a condition where the dietary intervention is the essential component to treatment, nonadherence was associated with younger age at diagnosis and current age of being an adolescent. Furthermore, pediatric patients with celiac disease have been shown to have good adherence at home and school, but low adherence at social events [23]. In a study by Thomas et al. [24] evaluating differences in adherence to insulin-dependent diabetes mellitus regimens in pediatric patients, it showed that with increasing age from childhood to adolescence, there was a clear trend of decreasing adherence in social situations, emphasizing that the role of accommodating peers in adolescence can be a significant barrier to adherence in this population.

There are multiple potential limitations to dietary studies in general, as well as to this study. Under-reporting of energy intake is a known limitation in dietary capture independent of the method of recall used [25]. Gemming et al. [26] found that 20–25% of adults under-report energy intake in studies that involve dietary recording. However, most studies evaluating dietary recall involve adult participants. As Gemming et al. [26] describes, diet culture and psychosocial factors such as social desirability, body dissatisfaction, media presence influencing body image, and increased public awareness of dietary fads tend to influence likelihood of dietary under-reporting in adults. It is possible that in our case, where reporting adequate intake of nutrients is viewed as favorable in the goal towards improving IBD symptoms and preventing weight loss, that under-reporting will be less of an issue. In addition, with many of our pediatric patients' dietary records logged by parents or caregivers, the potential for subconscious bias towards under-reporting for social reasons is likely not present, but both recall bias and observer bias are potential sources of confounding. Aside from admission to an inpatient unit with direct observation of feeding, measures of dietary compliance all have limitations, which is a universal challenge in dietary intervention studies.

Other limitations to this study include small sample size and participant investment in dietary therapy. In both studies, patients and parents that chose to participate in the study likely had strong personal beliefs that SCD would improve symptoms; thus participant bias may account for some of the effect seen on clinical outcomes such as clinical disease activity index scores. In addition, given that the SCD can be a significantly restrictive diet, the type of participants and families willing to undergo such dietary changes as a study intervention are likely to invest more time and energy into meal preparation and reporting accuracy than an average consumer of dietary therapies, which may skew the effect that dietary intervention has on the general population of patients with IBD who may be less rigorous in their methodology. Future studies on dietary interventions for IBD would benefit from detailed assessment of impact on quality of life, which is an important component of global patient well-being.

The SCD requires further refinement as therapy and more rigorous study, but smaller studies thus far have demonstrated improvements in both clinical symptoms and laboratory markers of inflammation. This study demonstrates significant differences that can occur within the SCD when different methods of preparation/implementation are used. This would potentially have implications on larger trials that provide food for people for medical therapy. For example, if both homemade and chef-prepared methods are shown to have similar efficacy, it provides larger generalizability of the SCD diet for patients with IBD. Though the chef-prepared

meals provide greater consistency in the study intervention, the consumption patterns by study participants may render this intended consistency invalid. Moving forward, exploring differences in the SCD and other dietary therapies for IBD may impact the widespread availability and potential for use of the dietary therapy for IBD in patients across the world.

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