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Practitioner viewpoints on diet and inflammatory bowel disease

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Diet is a key factor in the development and progression of Inflammatory Bowel Disease (IBD). A variety of diets have been studied with IBD patients. This cross-sectional survey identified current healthcare practitioner views on different diets and their efficacy with IBD patients. Diets were rated on awareness, compliance, and contributors to success by participants (n = 181). Frequencies were conducted, and ANOVA with Duncan pairwise comparison or chi-square analysis were used to determine significant differences. Most participants (96%) and 98% of registered dietitians (RD) considered using diet to help treat IBD patients. RDs perceived the low fiber or low residue diet easiest for patient compliance (4.2 ± 1.0, $P < .05$), and the specific carbohydrate diet hardest for patient compliance (2.4 ± 1.4). Initial and follow up consultations with a RD significantly contributed to patient success across all diets, and greater involvement from the RD may solve issues with compliance.

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CHAPTER I

INTRODUCTION

Inflammatory bowel disease (IBD) is a set of conditions characterized by chronic inflammation of the gastrointestinal (GI) tract.[1] Inflammation is defined as "how the body reacts to infection, irritation, or injury, characterized by redness, swelling, warmth, and pain. Inflammation is a type of 'non-specific immune response".[2] Bowel is defined as "the part of the alimentary canal below the stomach, the intestine".[3] Disease is defined as "a disorder of structure or function in a human, especially one that produces specific symptoms or that affects a specific location and is not simply a result of a physical injury".[4] Two types of IBD diagnoses currently exist, which are Crohn's disease (CD) and ulcerative colitis (UC).[1] In CD, inflammation presents in patches throughout the entire GI tract, although the terminal ileum is typically affected.[1] In UC, inflammation begins in the anus and extends throughout the large intestine in a continuous, uninterrupted pattern.[1] IBD patients suffer from symptoms that include persistent diarrhea, abdominal pain, rectal bleeding/bloody stools, weight loss, and fatigue.[1]

Both CD and UC are thought to be caused by a patient's abnormal response to his/her own immune system.[5,6] While the exact cause of this abnormal response is not yet known, it is postulated that a patient's genetics, diet, and environment all play a role in the progression of the disease.[5,6]

There are correlations between dietary habits and the initial development of IBD. Many studies show a rise in both the incidence and prevalence of IBD in southern Europe, Asia, and

developing countries where a western lifestyle and dietary habits are becoming increasingly popular.[7] This is particularly seen in first generation immigrant children who show similar IBD prevalence and incidence patterns to the indigenous people.[7]

In humans, gut bacteria are critical to a host of physiological processes including the digestion of nutrients, the development of the immune system, and resistance against pathogens.[8] An alteration in the gut microbiota is associated with IBD.[8] The factors that influence the progression of IBD also influence the gut microbiota and recent studies suggest a critical connection between gut microbiota and chronic intestinal inflammation.[8]

It is clear that diet is an important factor in shaping the microbiome. Foodborne microbes transiently colonize the gut, suggesting that food may not only select for commensal bacterial species, but serve as a reservoir for new bacterial introductions.[9] Intentional introduction of prebiotic food ingredients and foods high in fiber can also change the abundance of bacterial species in the gut. Despite the inherent stability of the gut microbiome over time, diet composition continues to subtly alter its composition, driving the development of the microbiota through adulthood.[9]

Diet is a key factor in the development and progression of IBD.[7] It plays a critical part in gut homeostasis, microbial composition and functioning, the gut barrier, host immunity, and the gut physiology by regulating gut hormone release.[7] The western diet varies greatly from traditional diet of generations prior, with the biggest difference being a switch from a plant-based to animal-based dietary pattern.[7] Western diets typically provide more calories, more sugar, more animal protein, and more ultra-processed foods.[7] Diet may play a key role in the initiation and exacerbation of IBD and its associated symptoms and may be a way to optimize the efficacy of conventional treatment.[7]

Recently, a variety of diets have been studied to determine whether they may have a positive effect on the symptoms suffered by patients with IBD. These diets include the Specific Carbohydrate Diet (SCD), a low fermentable oligo, di, and monosaccharides and polyols (FODMAPs) diet, a low fiber or low residue diet, Immunoglobulin G (IgG) targeted exclusion diet, and a general exclusion diet. All of these modalities have shown promising results with managing IBD symptoms. However, the diets have not undergone rigorous, double-blind, randomized control trials. Unfortunately, the chronic nature of IBD and the length of time required to fully study these diets makes conducting those types of studies difficult. In turn, the researchers were interested in which dietary modalities practitioners are actually using in their practices. With all of these dietary options becoming increasingly popular, it is important to understand practitioners' points of view. There are few currently published articles on practitioners' viewpoints on these diets, and a better understanding of their viewpoints may help to drive future research regarding diet and IBD.

CHAPTER II

LITERATURE REVIEW

After a search of the literature, 20s articles were selected and reviewed as the basis for this study. The focus of these articles is the different types of diets being researched in various settings throughout the world. The terms “Crohn’s disease”, “ulcerative colitis”, “inflammatory bowel disease”, “diet”, “views”, “viewpoints”, “perceptions”, and “nutrition” were searched in the PUBMED, EBSCO, Google Scholar, and the Mississippi State University Library databases.

The Relationship Between Diet and IBD

Diet contributes to gastrointestinal health via a direct effect on gut motility and barrier function or an indirect effect on microbes.[10] The gut microbiome is shaped by genetic and environmental factors, and is comprised of a limited number of phyla that are dominated by bacteroidetes and firmicutes.[10,11] The immune system and gut barrier function are affected by both microbe to microbe and host to microbe interactions, and diet impacts both of these interactions.[10,12] Global increasing incidence of IBD is associated with a western lifestyle.[10,13,14] While there is a clear association between diet and IBD, a cause and effect has not been established[10,15,16] due to research limitations that may greatly affect findings such as inherent variability and variations in methodology.[10,17,18]

Patients with IBD have a reduced diversity in their microbiome that leads to less flexibility and adaptability.[10] This may lead to a negative impact on functional changes. Frequent phylum level observations are observed in patients with IBD.[14,19] Increased Bacteroidetes and

firmicutes and decreased proteobacteria may allow for colonization by Enterobacteriaceae such as E. Coli.[10,20]

These observed changes are mediated by access to nutrients and oxygen carriers.[10,21] The functional capacity of the microbiome is based on which bacteria are present, and functional microbiota dysbiosis is common in IBD patients.[10,22] When comparing IBD patients to controls, decreased levels of the SCFA butyrate and acetate and increased amino acid levels were observed in the IBD patients.[10,23-25] An evaluation of the ability to modify microbiota and effect on disease via dietary intervention is needed.[10]

In rodent models, many dietary components were associated with CD, including increased fat, increased animal or milk fat, increased fat or sugar, gluten, maltodextrin, emulsifiers, titanium dioxide, luminal iron, and aluminum.[10,15,26-36] Increased animal protein leads to an increased risk for UC.[14,37-39] The main issue is that the western diet is not limited to natural components.[10] All of the above mentioned components are common in economically developed countries where a western diet is prominent.[10]

Malnutrition

Malnutrition, an extraintestinal manifestation of IBD, is caused by suboptimal intake or an alteration in caloric requirements and metabolism.[10] Malabsorption, gastrointestinal losses, and medications all contribute to malnutrition.[40] An increased ratio of basal metabolic rate to fat free mass is seen in IBD patients versus healthy controls.[14,41-43] Malabsorption is commonly seen in underweight patients in remission, and impaired gastric acid and pancreatic enzyme secretion is observed in undernourished patients.[44,45]

The assessment of a patient's nutrition status and the prevention and correction of deficits is essential to the multidisciplinary management of IBD.[10] Involuntary weight loss and being

underweight accompanies disease relapse.[10] However, the normalization of body mass index (BMI) at 2 years follow up was not significantly associated with increased fat free mass in CD[46], meaning that BMI may not be a good evaluation of body composition changes in IBD patients.[10]

Practitioners must be cautious when evaluating plasma micronutrient measurements in the presence of systemic inflammatory response (high C-reactive protein).[10] Iron, zinc, selenium, copper, vitamin A, vitamin C, and vitamin E are affected by nutrient carrier protein concentration changes and unlikely reflect total body stores.[10,47-49] Registered dietitians are essential to the care of IBD patients because of their ability to asses anthropometric information and oral intake.[10,50] The diagnosis of malnutrition may help predict IBD outcomes.[10]

Diet Practices and Beliefs of Patients with IBD

A prospective study based on a questionnaire was published in the IBD Journal that targeted practices/beliefs of patients with IBD.[51] Multiple variations in food habits and eating patterns coupled with patient compliance in clinical therapy have led to a lack of robust IBD diet recommendations.[51] Four hundred IBD patients with a confirmed IBD diagnosis responded to a questionnaire composed of two sections, one on demographics and disease characteristics, and one on diet beliefs and food related behavior.[51] Two hundred five UC patients and 156 CD patients fully completed the survey.[51] Forty-eight percent of the patients believed diet initiates disease, and 57% believed diet triggers relapse.[51] Fifty-six percent of patients modified their diet after their initial IBD diagnosis.[51] Only 28% believed that diet was more important than medications regarding their treatment.[51] Sixty-eight percent of patients imposed food restrictions to prevent relapse.[51] Forty-five percent avoided spicy foods, 32% avoided fatty foods, 24% avoided fruits and vegetables, 22% avoided alcohol, 16% avoided soda, and 15% avoided milk.[51] Sixteen percent of patients believed that certain foods improved symptoms during relapse, such

as high fiber foods (5%), low fiber foods (2%) and starch rich foods (1%).[51] Patients also believed that certain foods worsen symptoms, such as spicy foods (45%), fatty foods (29%), alcohol (20%), fruits/vegetables (19%), and milk products (16%).[51] Seventy-five percent of patients shared the same menu as their family, 78% of patients did not refuse outdoor eating, and 66% of patients deprived themselves of their favorite foods to prevent relapse.[51] Furthermore, 50% of patients received no nutrition advice from their healthcare providers, and 67% of patients wanted more advice.[51] Patients shared the sources of their IBD diet information.[51] Thirty-one percent received information from RDs, 17% from gastroenterologists, 12% from IBD nurses, 10% from primary care physicians, 8% from the internet, 5% from the UK Crohn's and Colitis website, and 2% from other IBD patients.[51] Patients preferred sources for future information on IBD was 45% from RDs, 36% from nurses, 29% gastroenterologists, 17% informational leaflets, and 15% from primary care physicians.[51] Seventy-five percent of IBD patients reported a change in appetite and pleasure eating.[51] Appetite was rated on a scale from 1-10, with a higher score reflecting an improved appetite.[51] Appetite was rated as 4.3 during relapses and 8 outside relapses.[51] Significantly more CD patients (87%, $P < .0001$) than UC patients (66%) believed IBD affected their appetite.[51] When separated by disease type, CD patients had a lower mean appetite outside relapse (7.8 vs 8.3, $P = .0009$) and during relapse (3.2 vs 5, $P < .0001$) when compared to UC patients.[51] A significantly greater percent of CD patients (67%) compared to UC patients (53%) believed diet triggered relapse.[51] Lastly, a significantly greater percentage of CD patients (77%) avoided certain foods to prevent relapse compared to UC patients (63%).[51]

Enteral Nutrition

Enteral nutrition (EN) and partial enteral nutrition (PEN) are sometimes used clinically to induce and maintain remission in IBD patients.[10] PEN is defined as less than 100% of calories

come from EN.[10] EN typically induces clinical remission in 80% of patients regardless of formula composition.[10] Current guidelines on EN use with IBD patients from the European Society for Parenteral and Enteral Nutrition are published.[52]

Gut rest is not the primary mechanism for remission[53,54], but it is more likely that anti-inflammatory effects, restoration of the epithelial barrier, and beneficial changes in the composition of gut mircobiota.[10,55] Usually exclusive EN works in 6 – 8 weeks, however if there is no clinical response in 3 weeks, it is medically advised to use an alternative treatment.[10] The efficacy of EN is related to the exclusion of specific dietary components.[10,56] This is indirectly supported by studies.[10,57] PEN with a normal diet does not lead to remission, but PEN with an exclusion diet leads to remission in 70% of children and 69% of adults.[10,56] Exclusive EN either via a feeding tube or by drinking the formula is monotonous and leads to limited compliance and success.[10,58] Multiple PEN studies utilizing anywhere from 35 to 90% using several different study designs have produced varying results.[10]

In one laboratory trial, 37 children with CD showed mucosal healing to be more significant in patients consuming enteral nutrition versus corticosteroids.[52,59] EN is often used as the first line of defense in pediatric cases of IBD.[52] Undernutrition greatly impacts growth in children.[60] Utilizing EN may delay or help the patient to completely avoid using corticosteroids.[52,61] EN is preferred to parenteral nutrition (PN), because PN has not been shown to offer any advantage to patients with CD, and should only be used after surgery to improve nutritional status when other modes of nutrition are not available.[52,62] Overall, not enough research exists to support the use of EN in acute exacerbations of IBD in adults, however, it's use should continue to be studied to determine if adults may receive the same benefits as pediatric patients.[52]

Half Elemental, Half Free Diet

Researchers at Tokohu University Graduate School of Medicine in Japan conducted a RCT with 51 patients to determine whether the maintenance of remission in patients with CD can be achieved through a half elemental, half-free diet.[63] In this study, half of the experimental group's calories came from home enteral elemental nutrition, consumed either orally or via a nocturnal feeding tube, and the other half came from the patients consuming their usual, unrestricted meals.[63] The control group consumed their usual, unrestricted diet without any modifications.[63] The relapse rate was measured over a 2 year period to determine the outcome of the study.[63] A relapse was considered any patient who had a Crohn's Disease Activity Index (CDAI) of greater than 200 at any point during the follow up time frame.[63] At an average follow up of 11.9 months, patients in the experimental group saw a relapse rate of 34% vs a rate of 64% in the control diet.[63] At the fourth analysis, the trial was stopped because the relapse rate of the half-elemental diet was significantly lower than those in the free diet group.[63] The trial was one of the first to demonstrate the effectiveness of a half-elemental diet as maintenance therapy for Crohn's disease.[63] The researchers associated the effectiveness of the half-elemental diet with the possible low content of lipids in the patients' diets, which led to the reduction of pro-inflammatory eicosanoid synthesis.[63]

Elimination Diets

Elimination diets have not been researched adequately to analyze the induction of remission, maintenance of remission, and improved functional symptoms in patients with IBD.[10] Elimination diets include the general exclusion diet[10], low fiber or low residue diet[64,65], lactose-free diet[64,66], gluten-free diet[64], SCD[67], Crohn's Disease Exclusion Diet (CDED)[56], IBD Anti-

Inflammatory Diet (IBD-AID)[68], IgG exclusion diet[69], semi-vegetarian diet[70], low FODMAPS diet[71], and others[64,72-75].

Carbohydrate Focused Diets

Some of the diets patients use in their management of IBD that target the types carbohydrates consumed include the Specific Carbohydrate Diet (SCD), low FODMAPs Diet, and a gluten free diet.[64] All carbohydrate restricted diets put patients at risk for insufficient caloric intake and weight loss.[64] Possible nutrient deficiencies can occur in carbohydrate restricted diets such as folate, B12, B6, calcium, vitamin D, vitamin C, vitamin A, and potassium.[64]

Unrefined Carbohydrate Fiber Rich Diet Versus Exclusion Diet

In a study published in 1985, 20 patients were randomly assigned to either an unrefined carbohydrate fiber rich diet or an exclusion diet.[76] In the exclusion diet, various foods were tested during a 'food testing stage' to determine whether suspected specific foods caused negative symptoms.[76] The erythrocyte sedimentation rate (ESR), a laboratory marker of inflammation, was measured before the diet was started and after 6 months had passed.[76] Patients on the unrefined carbohydrate fiber rich diet had all relapsed by the 6 months point. Patients on the exclusion diet all saw a drop in ESR after 6 months.[76] The study reported that no medical treatment is totally effective for IBD, and that intense cooperation between the patient, gastroenterologist, and registered dietitian (RD) is necessary in order for patients to succeed with this dietary modality.[76]

Low Fiber or Low Residue Diet

Low residue diets (<10 – 15 grams insoluble fiber/day) are typically recommended for patients with severe inflammation or bowel strictures, although one small study showed no significant differences in symptoms when compared to an unrestricted diet.[64,65] In a low residue diet, nuts, seeds, whole grains, corn hull, raw fruits with peels, and vegetables, especially cruciferous, are avoided.[64] This diet is not recommended long term because fiber is necessary for the production of short chain fatty acids and is important in the support of colonocyte function.[64,65] Avoiding fiber long term can also lead to vitamin A, vitamin C, potassium, and folate deficiencies.[64]

Lactose Free Diet

A lactose-free diet was mentioned because CD is associated with an increased rate of malabsorption of lactose.[64,66] Lactose is a disaccharide sugar commonly found in milk and milk-based products. Not all dairy products contain high amounts of lactose, such as cottage cheese, butter, and aged cheese. Yogurt is thought to be tolerated due to the presence of active cultures.[64] Avoiding lactose long term may lead to a vitamin D or calcium deficiency and both should be adequately supplemented by those IBD patients who avoid lactose.[64,77]

Gluten Free Diet

The gluten free diet eliminates the protein gluten, found mostly in wheat, rye, and barley.[64] IBD patients have a 3-8 fold increased risk of celiac disease.[64,78,79] Gluten may cause direct activation of the innate immune system and decrease intestinal barrier function.[64,80-84] However, no evidence supports that the gluten free diet has any effect on disease activity in IBD.[64]

Low FODMAPs Diet

The low FODMAPS diet bases food choices on the chemical structures and absorptive capacities of certain carbohydrates in the small bowel.[10,64,85] The idea is that humans lack the enzymes to breakdown most oligosaccharides.[64,86] When fructose and glucose are present in even amounts, there is equal absorption in the proximal small bowel.[64,78,86] However, if fructose presence is greater than glucose, there tends to be fructose malabsorption that leads to functional bowel symptoms.[64,78,86]

A high percentage of patients with IBD experience functional gastrointestinal symptoms (FGS) during remission, and are less likely to respond to anti-inflammatory medical therapy.[71,87] FODMAPS pass undigested through the small intestine to the colon, where they cause an osmotic effect that brings water into the lumen.[87] This causes intestinal wall distension, bloating, pain, flatulence, constipation, and diarrhea.[10,87] FODMAPs may also be fermented by gut bacteria, causing FGS.[87] Reducing FODMAPs consumption is thought to prevent this fermentation, thus improving GI symptoms.[87] Usually this diet is prescribed to people with irritable bowel syndrome, however some studies have shown symptom improvement in those with IBD.[71,87,88] Unfortunately, evidence is lacking that shows a decrease in inflammation in patients with IBD.[87,89] Long term studies are needed to determine the effect that a low FODMAPS diet has on inflammation, metabolism, and the microbiome.[87]

The Journal of Crohns and Colitis published a study on whether a low FODMAPS diet reduces symptoms in patients with IBD.[71] Seventy-two patients took part in the study.[71] Each patient met with a dietitian to review the low FODMAPS diet protocol, and were offered additional sessions if needed.[71] Patients answered questionnaires regarding gastrointestinal symptoms prior to beginning the diet and 3 months afterwards.[71] Symptoms such as abdominal

pain, diarrhea, bloating, and flatulence all decreased.[71] Constipation actually increased in some UC patients, although the finding was deemed statistically insignificant.[71] When patients were asked about the ease of adhering to the diet, the median response was a 3 on a scale from 1(easy)-10(hard), indicating that patients found it relatively easy to follow the protocol.[71]

Low FODMAPS Diet Perception Among Gastroenterologists

A recent cross-sectional survey study was published by The Journal of Neurogastroenterology and Motility in 2018 assessing the perceptions of dietary therapies for Irritable Bowel Syndrome (IBS) patients among 1500 United States Gastroenterologists.[90] IBS is a chronic functional GI disorder with symptoms such as abdominal pain, bloating, and changes in stool quantity and quality.[90] IBS is prevalent at a rate of 10-20% worldwide.[90] Certain foods are attributed to GI symptoms in IBS patients such as carbohydrates, fruits, vegetables, dairy, beans, and legumes.[90] Several diets have been studied in IBS patients, including the low FODMAPS diet.[90] The study sought to determine whether provider recommendations on diet differ from the pre-consultation behaviors of patients, whether any specific practice patterns warrant additional education and review, and if demographics affect views and recommendations.[90] The survey was composed of 4 sections including questions on demographics, interpretation of patients' perceptions of food and GI symptoms and initial self-management of IBS, gastroenterologists approach to diet and IBS including specific diets, and resources and barriers to the provision of effective diet therapy with IBS patients.[90]

There were more male than female responses and the responses were geographically diverse.[90] The majority of providers practiced in an academic or private GI setting, and 36.7% had greater than 20 years of practice since initial training.[90] Greater than 50% of gastroenterologists responded that patients associate their GI symptoms with food and that

patient's self-manage their IBS symptoms prior to seeking advice from a professional.[90] Seventy percent of practitioners reported IBS patients have rarely or almost never tried a low FODMAPs diet before their initial visit.[90] Three quarters of gastroenterologists recommend diet to greater than 50% of their patients, and 50% of gastroenterologists recommend diet to greater than 75% of their patients.[90] Additionally, half of providers identified diet as a primary management tool for IBS.[90] Greater than 90% of practitioners responded that diet was the same or better than other forms of treatment.[90] Seventy-five percent of gastroenterologists responded that scientific evidence was important or very important in the decision of whether or not to recommend a diet.[90] Seventy-seven percent of gastroenterologists usually or almost always recommended a low FODMAPs diet, and 85% of gastroenterologists found the low FODMAPs diet effective or somewhat effective.[90] Greater than 50% of practitioners were comfortable providing diet counseling.[90] Only 21% of gastroenterologists usually or almost always refer IBS patients to a RD for counseling.[90] Only 31% of practitioners referred patients to a RD with specialty training in GI disease.[90] However, 78% of gastroenterologists believed a RD with an IBS focus would enhance diet therapy for patients.[90] The two most significant barriers identified to providing effective dietary interventions for IBS patients included the complexities of the diets and insurance coverage for a RD.[90] The researchers stated that long term efficacy and safety data is lacking for a low FODMAPs diet and IBS patients, and that there are methodological limitations of current low FODMAPs studies with IBS patients.[90] However, this could be true of all diet studies in this population.[90]

Specific Carbohydrate Diet

The SCD eliminates sugars such as lactose, sucrose, and refined starch and flour, grains (corn, rice, wheat), and legumes.[64,91] Only monosaccharides such as glucose, fructose, and

galactose are allowed.[64,91] The prevailing thought is that more complex carbohydrates are poorly absorbed leading to bacterial overgrowth and fermentation in the small bowel.[64,91,92] Byproducts from this bacterial dysbiosis lead to gut inflammation.[64,91,92] The SCD has shown to increase microbial diversity, compared with a low residue diet that decreases microbial diversity.[10,93] Proponents of the SCD suggest that patients stay on the diet for at least one year, compared to the low FODMAPs diet where the suggestion is strict adherence for 6-8 weeks, and then gradual reintroduction of one high FODMAP food every 4 days.[64]

In 2015, a case series study was published on patients utilizing the SCD.[94] The SCD is not a low-carbohydrate diet, but rather "a diet high in monosaccharides, solid proteins, fats, and a high ratio of amylose to amylopectin containing vegetables, fruits, and nuts".[94] The diet has the ability to provide optimum nutrition for the patient while decreasing the amount of disaccharides that reach the colon, preventing and reversing the dysfunctional microbiota that is present in IBD patients.[94] Fifty patients were recruited for this study.[94] Patients who were currently following the SCD were asked to complete a 3-day diet history, their medical history, and a validated disease activity index.[94] GI symptoms were assessed within one week of filling out the survey.[94] Each symptom was rated on a scale from 1 to 10, with 10 being the most painful.[94] Patients following the SCD who were in remission reported having a high quality of life according to the Short Quality of Life in Inflammatory Bowel Disease Questionnaire, reporting a mean score of 60.9 (range was 35-70).[94] According to the study, the mean time for food preparation per week was 10.8 hours.[94] The study also stated that it took participants an average of 29.2 days to notice some improvement from the SCD.[94] All patients included in this study were in remission, which may have skewed results.[94] However, the strength of this study is strong due to the extensive, confirmed medical review by an experienced gastroenterologist.[94] The study determined that at

least a subgroup of IBD patients see benefits from following the SCD, and that some patients who follow the diet will be able to discontinue immunosuppressive agents.[94]

A retrospective chart review was published in the World Journal of Gastroenterology that focused on pediatric CD patients who began to follow the SCD on their own accord.[95] Eleven patients, 8 males and 3 females, with a mean age of 11.0 ± 3.2 years at diagnosis, were found to meet the inclusion criteria and underwent detailed medical reviews.[95] Only 3 patients practiced a strict SCD without medication or liberalization of diet.[95] Hematocrit values improved significantly for those following the strict version of the SCD, indicating a decrease in anemia among the patients.[95] The ESR, an inflammatory marker mentioned earlier, significantly decreased in patients following the strict SCD.[95] Weight and height percentiles increased with 10 of the 11 patients following the strict SCD, indicating that growth in the pediatric population is still possible even though the diet is quite restrictive.[95] The advantage of the SCD versus EN is that it offers the patient an opportunity to eat conventional, palatable foods as their main source of energy, as opposed to tube feedings, which may disrupt the social dynamic around meals.[95] Finally, the study states, "provider awareness is paramount to maintain a therapeutic alliance with the patient and offer appropriate clinical monitoring".[95] This highlights the important role that providers play in helping to implement dietary modalities as treatments for IBD.[95]

A retrospective study conducted at the Seattle's Children's Hospital sought to determine whether the SCD is able to decrease inflammation by changing the fecal microbiome from a pro-inflammatory to non-inflammatory state.[96] A medical chart review was conducted from 2012 until 2014.[96] Pediatric patients diagnosed with either CD or UC initially had remission induced through medication or diet.[96] The patients pediatric Crohn's disease activity index or pediatric ulcerative colitis activity index was measured prior to beginning the SCD, and evaluated at week

0, week 2, and 6 months.[96] A comparative analysis showed clinical and laboratory improvements in 12 of 26 patients, and an enrichment of microbial diversity was observed.[96] Some patients discontinued their medications.[96] For others, the diet was difficult to maintain, and 9 patients experienced weight loss.[96]

Protein Focused Diets

Semi-Vegetarian Diet

One study that sparked interest among those in the IBD community in Japan was the use of a semi-vegetarian diet to prevent relapse.[70] The semi-vegetarian diet used in the study consisted mostly of fruits, vegetables, and whole grains while limiting animal proteins as much as possible.[70] The study was a prospective, 2-year clinical trial with 22 patients.[70] In order to be a part of the study, patients had to be in remission that was induced either medically or surgically.[70] Fifteen of the 16 patients who finished the 2-year trial did not relapse when following the semi-vegetarian diet.[70] The cumulative relapse rate at 2 years was significantly lower in the semi-vegetarian group compared to the omnivorous group.[70]

Red and Processed Meat Restriction

An intake of a high protein diet or red meat leads to increased production of bacterial metabolites such as ammonia, indoles, phenols, and sulfites that harm the gut.[10,97] Alternatively, bacterial fermentation of non-digestible carbohydrates lead to the production of SCFA that serve as an energy source for host epithelial cells and act as a signaling molecule with anti-inflammatory, antioxidant, and immuno-modulatory properties, which in turn improves mucosal barrier function.[10,98]

A study published in 2019 assessed whether a diet low in red and processed meats would reduce the rate of CD flares and cause a more quiescent disease course.[72] The researchers stated that diet is an attractive target for both prevention and treatment of CD.[72] They used the Food and Crohn's Exacerbation Study, a prospective randomized trial, as a basis for their cohort.[72] The short CDAI was used to measure flares/activity.[72] The participants were split into two groups, high meat consumption and low meat consumption.[72] High meat consumption was defined as greater than two servings of red or processed meat per week and low meat consumption was defined as one or less servings per month of red or processed meat.[72] Red meat was considered meat from livestock, and processed meat was considered any red/white meat that used smoking, salting, curing or the addition of preservatives in its production process.[72] Each group spent 49 weeks on their respective diets.[72] A diet history questionnaire was completed at baseline and at week 20.[72] Two-hundred-thirteen participants completed the study.[72] There were no statistically significant differences in median fecal calprotectin, an intestinal inflammatory laboratory marker, between the two groups.[72] The study determined that the consumption of red/processed meat does not reduce the risk of CD relapse in patients with quiescent disease.[72] In turn, researchers questioned whether the complete elimination of red/processed meat would produce a result that is statistically significant.[72]

Whole Food, Plant Based Diet

In an interesting case report published in 2017, a 25 year old male was diagnosed with moderately severe and active CD confirmed by a colonoscopy and a Harvey Bradshaw Index (HBI) score, an indicator of disease severity, of 17.[73] In January of 2015 after the initial diagnosis, he was prescribed infliximab, which decreased his HBI to 5, indicating moderate disease but not clinical remission.[73] In March 2017, as part of a religious celebration, he gave up

animal protein for 40 days and his HBI score went to 0 indicating clinical remission.[73] The patient decided to switch to a whole food, plant based diet consuming less than one serving of meat per week.[73] The patient followed this diet for all of 2017 and a follow up colonoscopy confirmed complete mucosal healing.[73] He stopped his medications, and continued in clinical remission.[73] According to the case report, only 10% of CD patients achieve long term remission, and 50% of patients require surgery within 10 years of the initial diagnosis of CD.[73]

Fat Focused Diets

Fat restricted diets are also considered for IBD patients.[64] Short chain fatty acids (SCFA) and medium chain fatty acids (MCFA) are absorbed directly across the villi in the small intestine. However, long chain fatty acids (LCFA) need bile salts and micelle formation in order to be absorbed. The Western diet/lifestyle has increased total fat intake, especially saturated fats and omega-6 fatty acids.[64,99-101] Omega-3 fatty acid intake is decreased in the typical western diet.[64,99-101] As the typical western diet has increased internationally, IBD incidence has increased as well.[64,99-101]

The omega-6 polyunsaturated fatty acids (PUFAs) linoleic acid (LA) and arachidonic acid (AA) are pro-inflammatory.[74] The omega-3 PUFAs eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), the major components of fish oil, and alpha-linolenic acid (ALA), regulate inflammation by inhibiting genes that start the process.[74,102,103] Studies have shown that increased LA consumption leads to an increased risk of UC.[74,104,105] Studies have also shown that an increased intake of DHA decreases the chance of developing of CD.[74,106] Eicosanoids, key lipid mediators generated by omega-6 and omega-3 PUFAs, play an important role in immune regulation and inflammation, and are also greatly involved in the IBD inflammation process.[74,107,108]Omega-6 related eicosanoids induce the release of pro-inflammatory cytokines

leading to the production of the chronic inflammatory mediators Interleukin (IL) and Tumor Necrosis Factor (TNF).[74,107,108] Colonic mucosa in active UC is associated with increased intake of omega-6 PUFAs.[74,109] Alternatively, omega-3 PUFAs lead to eicosanoids with little or no inflammatory properties and inhibit cytokine production.[74,110] Omega-3 PUFAs do lead to anti-inflammatory molecules called SPMs that reduce the magnitude and duration of inflammation.[74,,111] Omega-3 PUFAs also alter the gut microbiome by improving dysbiosis through increasing the lactobacillus species and reducing the Bacteroidaceae family.[74,112]

Multiple animal studies show that prolonged increased fat intake promotes colitis and ileitis and decreases barrier function.[64,113,114] A high fat diet also shifts microbiome composition and gene expression.[64,115,116] A diet high in omega-3 fatty acids prevented barrier dysfunction in colitis predisposed mice.[64,117,118] The importance of a fat restricted diet may lay in the ratio of omega-6 to omega-3 fatty acids. Using an omega-6 food exchange guide, patients with IBD who remained in remission had a ratio of 1:1, while those patients who relapsed had a ratio of 20:1 of omega-6 to omega-3 fatty acids.[64,119]

Paleo Diet

A Paleo dietary pattern focuses on meat, fish, and fruits and vegetables.[64] The diet is based on the premise that while the human diet has greatly evolved over time, our basic genetics have not.[64] After the agricultural revolution, increased intake of grains and refined sugar led to chronic diseases of affluence.[64,120,121] In the Paleo Diet, 50-65% of calories come from plant sources, and 35-45% of calories are from fish or meat.[64] The diet restricts carbohydrates such as grains, refined sugars, dairy, and potatoes, refined oils, and processed foods.[64] Total protein, fiber, and omega-3 fatty acid consumption increases while calorie and total fat consumption remains the same.[64,121] In a Paleo Diet, the ratio of these PUFAs are 1:1, but in the Western diet

the ratio is 20:1 in favor of the omega-6 PUFAs.[74] Additionally, the ratio of LA:ALA has increased from 6.4 to 10 from 1909-1999 in the Western diet as a percentage of energy contribution.[74] Recent data show that the Paleo Diet is beneficial for weight loss, cardiovascular disease, and type 2 diabetes.[64,122,123] However, no data suggest its use for IBD, only recommendations based on anecdotal evidence.[64] Further research is needed on how fat intake affects IBD patients and if the restriction of certain fats can assist in IBD management.[64]

Crohn's Disease Exclusion Diet

The CDED is based on decreasing dietary components that impair innate immunity in rodent models, increase gut permeability, cause dysbiosis, or allow bacteria to translocate throughout the intestinal epithelium.[10] The diet is rich in fiber and natural sources of resistance starches.[10] The increased consumption of fiber leads to increased SCFA production in the colon, which have been associated with numerous other health benefits.[73] The CDED limits emulsifiers, flavor enhancers, sources of omega-6 fatty acids, and dairy products.[73] Children who used the CDED coupled with 50% PEN achieved clinical remission in 70% of participants.[10,56] Six of the seven participants only using CDED achieved clinical remission.[10,56] This diet needs to be evaluated in prospective randomized control trials (RCT).[10]

Other Diets

Glutamine Enhanced Diet

An interesting area of research within the realm of IBD is potentially increasing one's intake of glutamine to induce remission.[124] Glutamine is an amino acid that is postulated to maintain the integrity of the intestinal mucosa and prevent gut permeability degradation, help nitrogen balance, and reduce inflammation.[124] In a randomized control trial (RCT), 18 children

with CD received either a standard diet, or glutamine enriched diet.[124] The standard diet contained only 4% glutamine in the amino acid pool, while the enriched diet contained 42% glutamine.[124] The study produced no significant difference between the groups in terms of remission rate.[124] Other studies produced similar results. However, they should be considered with caution due to their low participation numbers.[124] Larger trials are needed to determine if glutamine can help induce remission in patients with IBD.[124]

IgG Targeted Exclusion Diet

A retrospective study from China was published in 2019 on the IgG targeted exclusion diet.[69] When a person has an allergic reaction, such as to peanuts or shellfish, Immunoglobulin E (IgE) antibodies are produced by the body. In turn, it is suspected that when a person has a food intolerance, IgG antibodies are produced. The thought is that classic food intolerances caused by food allergies are based on an IgE mediated response. However, immediate reactions to foods are rare in the IBD population.[69] A delayed response by IgG antibodies may account for the adverse reactions present in IBD. However, IgG antibodies can also be found in healthy people.[69] The purpose of the study was to analyze IgG/IgE serum levels against food antigens in IBD patients to determine clinical relevance in the IBD population.[69] Patients were included using the diagnostic criteria established by the European Crohn's and Colitis Organization, and were excluded if they had bowel surgery within the past 3 months.[69] One hundred thirty seven IBD patients, 40 with UC and 97 with CD, and 50 healthy controls had their serum IgG and IgE assays analyzed for 14 unique food antigens.[69] Many CD patients (90.7%) had a positive IgG rate ($P < .0001$), compared with 57.5% of UC patients and 42% of healthy controls.[69] When compared to the unique antigens, CD patients developed IgG antibodies to 3.8 foods, compared to 2.56 foods for UC patients, and 1.57 foods for healthy controls.[69] The total serum IgG for CD

patients was 138.6 U/mL, was 115.6 U/mL for UC patients, and 105.9 U/mL for healthy controls.[69] When analyzing the unique antigens, both IBD patients and healthy controls had increased IgG antibodies to eggs.[69] This highlights how the healthy controls also produced IgG antibodies.[69] For CD patients, there were higher levels of IgG antibodies to tomatoes, corn, rice, soy, wheat, and cod when compared to healthy control serum levels.[69] In UC patients, there were higher levels of IgG antibodies to tomatoes, corn, and rice when compared to healthy control serum levels.[69] There were only significant increases in IgG serum levels in CD vs UC patients/healthy controls.[69] When comparing food antigens in CD patients, patients with 3 or more food antigens producing IgG antibodies increased the CDAI score versus only 2 antigens.[69] In UC patients, 2 or more food antigens producing IgG antibodies increased the Mayo score versus only 1 antigen.[69] However, no significant differences were found between positive/negative IgG antibodies in terms of CDAI and Mayo scores.[69] Interestingly, females were twice as likely to develop food intolerances, although again the finding was not significant.[69] The authors concluded that more research with the IgG targeted exclusion diet is warranted.[69]

Auto-Immune Protocol

One other approach to dietary modification for IBD is the Auto-Immune Protocol (AIP).[75] The AIP is an extension of the Paleo Diet that incorporates changes that were previously studied in the IBD population.[75] The protocol is split into three phases.[75] The initial elimination phase removes grains, legumes, night shades such as tomatoes and potatoes (not sweet potatoes), dairy products, eggs, coffee, alcohol, nuts, seeds, refined/processed sugars, oils, and additives from the patient's diet.[75] Additionally, foods, additives, and medications (NSAIDs) that trigger inflammation, dysbiosis, or symptomatic food intolerance are avoided.[75] The consumption of

fresh, nutrient-dense foods, bone broth, and fermented foods are emphasized.[75] The patients are also told to focus on sleep hygiene, stress management, their support system, and physical activity.[75] The next phase, the maintenance phase, is varied in duration and lasts until there is a measurable increase in symptoms/wellbeing.[75] The maintenance phase can last between 30-90 days and sometimes longer.[75] The last phase is the staged reintroduction of food groups.[75] During this phase, patients identify unique food groups that cause symptoms while liberalizing their diet.[75] Patients were chosen for a prospective, uncontrolled observational study based on symptomatic CD (HBI >= 5) and UC (Mayo>=3) confirmed by colonoscopy or video capsule endoscopy, or a fecal calprotectin of 50 or higher.[75] Each patient had access to a certified health coach and RD for 1:1 counseling and education. Additionally, each patient received 2 AIP books.[75] Clinical remission was defined as having a HBI less than 5 for CD patients and a partial Mayo score less than 2 for UC patients.[75] Nine CD patients and 6 UC patients were included in this study.[75] Eleven patients achieved clinical remission by week 6, 6 CD patients and 5 UC patients.[75] All 11 patients who achieved clinical remission maintained it through week 11.[75] Significant decreases were seen in the short IBD questionnaire, HBI scores, and Mayo scores.[75] There were no significant changes in weight, C-reactive protein, and fecal calprotectin among the patients.[75] The study showed preliminary efficacy for IBD patients using the AIP.[75] The authors noted that achieving clinical remission by week 6 rivals conventional medical drug therapies, and proposed that the AIP can be used as an adjunct to medicine even in patients with moderate to severe disease.[75] Limitations of this study include the fact that the researchers did not determine how non-dietary aspects of the AIP contributed to effectiveness.[75] This small study suggests that dietary modification has the potential to decrease inflammation based on fecal

calprotectin and endoscopy.[75] Large RCTs are needed to better determine the efficacy of the AIP on IBD patients.[75]

Clinician and Patient Perspective on Diet and IBD

A cross-sectional study published in the Journal of Human Nutrition and Dietetics in 2017 explained there is a lack of clear, evidence based guidelines regarding diet and IBD due to a lack of RCTs and the blinding of subjects not being possible.[125] The aim of the study was to determine the attitudes of IBD patients and clinicians regarding the role of diet in pathogenesis and symptomology of IBD.[125] An anonymous survey was sent to the Crohn's and Colitis of Australia mailing list, the Australian IBD Association, and the Dietetic Association of Australia.[125] The survey was open to participants for 4 months.[125] Nine hundred twenty-eight patients responded to the survey with a mean age of 39.5 years old.[125] Sixty-four percent of patients had CD and 36% had UC.[125]

The results showed that 76% of patients believed that diet affects IBD, 27.3% lost weight, 46.1% gained weight, 20% used a multivitamin, 7.8% used probiotics, and 6% used a B12 supplement.[125] Twenty-six percent of patients reported receiving diet advice from an IBD specialist compared to 98% of gastroenterologists who reported giving dietary advice.[125] Ninety-one percent of patients referred to a RD by their primary care physician or gastroenterologist saw an RD versus only 46% of total patients.[125] Fifty-six percent of CD patients saw a RD compared with 40.8% of UC patients ($P < .001$).[125] There was no difference in the perception of their diet as healthy or needing improvement between patients who did or did not see a RD.[125] Patients who saw a RD were more likely to consider that the diet affected IBD (81.4% versus 72.4%, $P = .002$).[125] Half of IBD patients in this cohort followed dietary advice from a clinician.[125]

Supplement and vitamin use increased among patients who had seen a RD (76.2% versus 69.1%, $P = .025$).[125] Thirty-eight percent of patients were familiar with a low FODMAPS diet, but the percentage doubled in patients who had seen a RD.[125] Half of patients felt symptoms worsened after eating spicy, high fiber, and dairy foods and nuts.[2125] Sixty-one percent of patients felt clinicians didn't place importance on the role of diet in IBD.[125]

Clinicians (n=136) also filled out a similar survey on diet and IBD. Forty-six gastroenterologists, 12 surgeons, and 73 RDs completed the survey.[125] Forty-nine percent of clinicians reported spending less than 10% of their time treating IBD patients, 24% worked with IBD patients between 25% to 50% of their time, and 39% worked with IBD patients approximately 50% their time.[125] Ninety-four percent of total clinicians and 99% of RDs stated that diet was a factor in symptoms, and 73% of total clinicians and 52% of RDs state that diet affected a patients intestinal microbiota.[125] However, only 44% of gastroenterologists stated that diet played a role in the pathogenesis of IBD, and only 17% of RDs reported this ($P = .003$).[125] Sixty percent of clinicians stated they provided diet education on a low FODMAPs diet.[125] Only 42% of clinicians thought that they had similar views to patients regarding diet and IBD.[125]

The only distinctions between CD and UC patients in this study were that an increased rate of CD patients associated weight change as a result of IBD treatment compared with UC patients, fewer UC patients saw an RD compared to CD patients, and more CD patients thought specialists placed emphasis on the role of diet and IBD compared with UC patients.[125] Overall, the study found adherence to dietary advice was poor, and that this may reflect a lack of efficacy or lack of evidence.[125]

CHAPTER III

METHODS

Study design

This study was cross-sectional in nature and designed to answer the following questions:

1. Which dietary modalities do healthcare practitioners provide to patients with IBD, and why do they provide them?
2. What drives patient success or failure with these dietary modalities?

Modality Selection

This study focused on which whole food based dietary modalities healthcare practitioners use in the management of IBD symptoms. The dietary modalities were chosen based on the current body of evidence on the many being investigated for IBD. The 5 dietary modalities this study focused on were a low fiber or low residue diet, a general exclusion diet, the low FODMAPs diet, an IgG targeted exclusion diet, and the Specific Carbohydrate Diet.

Table 3.1 Comparison of Three Defined Exclusion Diets*

	Low Fiber or Low Residue Diet[64]	**Low FODMAPs Diet[126]**	**Specific Carbohydrate Diet[91]**
Food Group			
Fruits	No raw fruits with peel, berries, dried fruit Canned fruit and fresh fruit without peel allowed	No apple, pear, mango, cherries, fig, watermelon, blackberries, peach, plum, dried fruit, canned fruit Other fruits allowed	All fresh, dried, and frozen fruit allowed No fruit canned with sugar
Non-Starchy Vegetables	No cruciferous allowed	No artichoke, asparagus, cauliflower, garlic, leek, onion, spring onion, mushrooms, snow peas Eggplant, green beans, bok choy, bell pepper, carrot, cucumber, lettuce, tomato, zucchini allowed	Allowed
Starchy Vegetables	Without peels allowed	Potatoes allowed	Not allowed
Grains	White rice allowed No whole grains	No wheat, barley, rye Oats, quinoa, rice, corn allowed	None allowed
Nuts and Seeds	None allowed	All allowed except pistachios and cashews	No seeds All nuts allowed
Milk	All allowed	Only lactose free allowed	None allowed
Cheese	All cheese allowed	Aged cheese allowed	Aged cheese allowed
Yogurt	All allowed	Only lactose free allowed	Only home-made allowed
Beans and Legumes	Not allowed	Only soy allowed	No soy allowed Certain beans allowed if prepared properly
Red Meat	Allowed	Allowed	Allowed
Poultry	Allowed	Allowed	Allowed
Fish	Allowed	Allowed	Allowed
Eggs	Allowed	Allowed	Allowed
Pork	Allowed	Allowed	Allowed
Processed Meats	Allowed	Not allowed	Not allowed
Butter	Allowed	Allowed	Allowed
Oils	Allowed	Allowed	All allowed except soybean
Sweeteners	Allowed	No honey or high fructose corn syrup Sugar or maple syrup allowed	No sugar, maple syrup, or high fructose corn syrup Honey allowed

*General exclusion diet and IgG targeted exclusion diet not included because of specificity to individual

Participants

Practitioners were recruited from multiple areas in the United States through email correspondence with both individuals and groups. The largest cohort of participants were from the Dietitians in Integrative and Functional Medicine (DIFM) dietary practice group (DPG), a member group that is part of the Academy of Nutrition and Dietetics (AND). Participants were asked to fill out a 15-minute online survey to completion. Participants had to be at least 18 years old, able to read and write in English, and be willing to attempt all parts of the survey. This thesis project was reviewed and approved by the university's Institutional Review Board (IRB); however, it was declared exempt as it did not involve the collection of any identifying data that could put the participants at risk. The IRB-18-088 letter of exemption and approved email sent to participants can be found in Appendix A. The target population was healthcare practitioners who see patients with IBD. The sample for the study was the practitioners who chose to partake in the survey. We aimed to reach 250 clinicians working with patients with IBD. Participants were selected as a convenient sample as anyone who the survey was distributed to was allowed to respond to the survey.

Survey Composition

The survey was created by the student investigator with the help of the thesis committee. The survey was created on the Qualtrics Experience Management XM survey platform (Qualtrics, Provo, UT, USA). Qualtrics XM is an online survey software that enables the user with powerful logic, 100 plus question types, and the ability to reach participants on both mobile devices and computers. A total of 53 questions were created for the five dietary modalities (Appendix B). The order for the questions for each dietary modality was as follows:

1. Do you currently recommend (therapeutic) diet?

2. Approximately what percentage of IBD patients do you recommend (therapeutic) diet to?
3. When you recommend (therapeutic) diet, on average, how would you rate your patients' ability (self-efficacy) to comply with your recommendation?
4. Among patients who are noncompliant, what are some common barriers?
5. Among the patients who are compliant with diet, when it has been successful, what do you feel has contributed to its success?
6. For patients who may be eligible, but for whom you don't recommend the diet, please rate the following:
    a. Diet is too restrictive.
    b. Diet involves too many changes at once.
    c. Cost of food/ingredients is too expensive.
    d. Perceived lack of patient interest.
    e. Expectation of patient non-adherence.
7. What best represents the reasons you do not recommend (therapeutic) diet?

The survey was a combination of dichotomous, multiple choice, Likert-scale, comment box open ended, matrix table, and demographic questions. The survey allowed the participant to input his/her own dietary modality if it was not one of the 5 initially listed. The same 7 questions were then asked of the participant's input modality. Participants were encouraged to include any further comments on IBD and diet prior to answering demographic questions. The survey was sent to multiple external reviewers for validation including two gastroenterologists and the Academy of Nutrition and Dietetics thesis review board. Modifications were made based on their feedback.

Survey Collection

The research team formed a list of contacts who would be helpful in disseminating the survey. The list of contacts can be found in Appendix C. The list consisted of healthcare practitioners who the primary researcher and thesis committee believed would fill out the survey, and also distribute it to their constituents. The list included the president of the Mississippi Academy of Nutrition and Dietetics, the Chairperson for the Department of Nutrition at Montclair State University, and the Executive Assistant of the Dietitians in Integrative and Functional Medicine DPG. The research team reached out to approximately 12 contacts. The team first contacted the participants via an approved email that can be found in Appendix D. The email contained a brief explanation of the research and survey, a link to fill out the survey, and an attached consent form, all which may also be found in Appendix A. The email described both the nature of the study and the length of the survey. The survey was left open for a period of 9 months. The survey was distributed among the participants from July 1, 2018 to February 14, 2019. One hundred ninety-nine responses were recorded during this time period, however, some participants were not included in the data analysis due to missing responses.

Data Analysis

Survey responses were coded and entered into the database. Dichotomous variables were created to determine whether a dietary modality was or was not recommended. The variable incorporated "have not heard of" and "do not recommend" into one response, and "recommend occasionally" and "recommend often" into the other. Frequencies were conducted for the population's demographics based on this variable and chi-square tests were used to determine significance. Means ± standard deviations were conducted for the questions targeting participants' responses on their patients' perceived ability to comply with a dietary modality, and

ANOVA with Duncan's pairwise comparisons were used to determine significance. Frequencies were then conducted for the questions targeting participants' opinions on behavior for each dietary modality. Chi-square tests were used to determine significant differences among these opinions about behavior. Results for continuous data are expressed as means ± standard deviations. Statistical analysis of data was conducted using IBM SPSS statistical software version 26.0 (SPSS, Chicago, IL, USA) and Microsoft Excel for Mac Version 16.37. All reported *P* values were two-tailed and *P* values of .05 and less were considered statistically significant.

CHAPTER IV

RESULTS

Characteristics of the Study Population

The participants' mean age was 45.1 ± 13.5 years (age range was 24 to 74 years, 115 responses). Females (86.2%) made up most of the sample of the participants who reported their gender (n = 116). Sixty-five participants did not report their gender. Overall, there were 98 RDs who responded to the survey (Table 4.1). Other respondents included 8 gastroenterologist medical doctors, 1 physician's assistant, 2 nurse practitioners, 1 certified diabetes education, 1 dietetics student, 1 surgeon, and 1 nutrition professional. Sixty-eight participants did not report their profession. Participants were primarily Caucasian (n = 100, 87.7%). Participants practiced in a variety of settings including office based solo practices (n = 36, 29.8%), teaching hospitals/clinics (n = 25, 20.7%), and office based multi-specialty group practices (n = 19, 15.7%). Participants were split between 5 years or less practicing in gastroenterology (n = 46, 46%) and 6 years or more of practice (n = 54, 54%). Participants responded from all regions throughout the United States, including the south (n = 40, 36.7%) and northeast (n = 37, 33.9%). There were 181 participants after 18 participants were omitted from the dataset. These 18 participants opened the survey but did not respond to any of the items. Overall, 113 participants completed every question in the survey. Participant characteristics and their recommendations for dietary modalities are presented in Tables 4.1 and 4.2.

Table 4.1 Participants characteristics and the recommendation of general exclusion, low FODMAPs, and low fiber or low residue diets for IBD.

Characteristics[a]	Recommend or prescribe general exclusion diet occasionally or often	Do not recommend or have not heard of general exclusion diet	Recommend or prescribe low FODMAPS diet occasionally or often	Do not recommend or have not heard of low FODMAPS diet	Recommend or prescribe low fiber or low residue diet occasionally or often	Do not recommend or have not heard of low fiber or low residue diet
Age ≤ 35 (n=37)	25	12	23	14	27	10
Age ≥ 36 (n=72)	42	30	56	16	53	19
Women (n=100)	97	3	74	23	70	27
Men (n=16)	13	3	5	8	10	3
Registered dietitians (n=98)	63	33	75	21	70	26
Gastroenterologist medical doctors (n=8)	7	1	5	2	5	2
Practiced 5 years or less in gastroenterology (n=46)	26	20	33	13	35	11
Practiced 6 years or more in gastroenterology (n=54)	34	20	41	13	39	15
Geographical Region:						
Northeast (n=37)	22	14	28	8	25	11
Midwest (n=8)	4	4	4	4	5	3
South (n=40)	22	17	28	11	33	6
West (n=24)	17	6	18	5	16	7

[a]Numbers of participants differs due to participants not responding to all items.

Table 4.2 Participants characteristics and the recommendation of IgG diet and Specific Carbohydrate Diet

Characteristics[a]	Recommend or prescribe IgG targeted exclusion diet occasionally or often	Do not recommend or have not heard of IgG targeted exclusion diet	Recommend or prescribe Specific Carbohydrate Diet occasionally or often	Do not recommend or have not heard of Specific Carbohydrate Diet
Age ≤ 35 (n=37)	8	29	9	28
Age ≥ 36 (n=72)	18	54	28	44
Women (n=100)	22	75	30	67
Men (n=16)	5	8	8	5
Registered dietitians (n=98)	25	71	31	65
Gastroenterologist medical doctors (n=8)	0	7	5	2
Practiced 5 years or less in gastroenterology (n=46)	13	33	15	31
Practiced 6 years or more in gastroenterology (n=54)	13	41	22	32
Geographical Region: Northeast (n=37) Midwest (n=8) South (n=40) West (n=24)	 7 3 10 6	 29 5 29 17	 17 1 10 9	 19 7 29 14

[a]Numbers of participants differs due to participants not responding to all items.

Dietary Modality Recommendations

Most participants (96.7% of all participants who responded, n = 175) and 98% of RDs (n = 96) considered using dietary modalities to help treat patients with IBD ($P < .001$). Significant differences were found for all participants, and when examining participants who indicated they were RDs, between recommending or not recommending a dietary modality for all five dietary modalities ($P < .01$) Participants in aggregate and "only RDs" were significantly more likely to recommend the general exclusion diet ($P < .01$), the low FODMAPs diet ($P < .001$), and the low fiber or low residue diet rather than not recommend them to treat patients with IBD ($P < .001$). Participants in aggregate and "only RDs" were more likely to not recommend the IgG targeted exclusion diet or the specific carbohydrate diet rather than recommend them ($P < .01$). There was

not a significant difference for recommending or not recommending other "whole-food" based dietary modalities (P > .05) (Table 4.3).

Table 4.3 Dietary modality recommendations

Dietary modality	All participants[a]	Registered dietitians	P value
Have you considered using dietary modalities or modifications to help treat patients with IBD? Yes No	175 6	96 2	*P* < .001
General exclusion diet: Recommend occasionally or often Do not recommend or have not heard of it	105 63	63 33	*P* < .01
Low FODMAPS diet: Recommend occasionally or often Do not recommend or have not heard of it	83 37	75 21	*P* < .001
Low fiber or low residue diet: Recommend occasionally or often Do not recommend or have not heard of it	95 37	70 26	*P* < .001
IgG mediated exclusion diet: Recommend occasionally or often Do not recommend or have not heard of it	40 100	25 71	**P* < .001
Specific carbohydrate diet: Recommend occasionally or often Do not recommend or have not heard of it	39 73	31 65	**P* < .01
Do you currently recommend other "whole-food" based dietary modalities/ modifications to help treat patients with IBD? Yes No	52 60	46 50	*P* > .05

[a]Numbers of participants differs due to some participants not responding to all items.
*Significant for "diet is not recommended"
Significant at a P value of .05 or less between the variables of recommend or do not recommend/have not heard of the specific diet using chi-square analysis.

Ability to Comply with Diets

Registered dietitians perceived that it would be somewhat easy to easy for patients to comply with the low fiber or low residue diet (mean = 4.2 ± 1.0); none of the dietitians responded that the low fiber or low residue diet was "very difficult to comply" (Table 4.4). In comparison, the low FODMAPS and specific carbohydrate diets were rated as somewhat difficult or difficult to comply (2.7 ± 1.1 and 2.4 ± 1.4, respectively) Overall, the dietitians perceived that the low fiber/low residue diet was easiest for patients to comply with compared to the other four diets ($P < 0.05$). In addition, RDs reported the IgG exclusion diet and the general exclusion diets were easier to comply with ($P<0.05$) than the FODMAPS and the specific carbohydrate diet.

Table 4.4 Registered dietitians' responses for patients ability to comply with diets.

Variable	Mean ± SD (range of responses*)
When you recommend a **low fiber or low residue diet**, how would you rate your patients' ability (or self-efficacy) to comply?	4.2 ± 1.1[a] (2 – 6)
When you recommend an **IgG targeted exclusion diet**, how would you rate your patients' ability (or self-efficacy) to comply?	3.3 ± 1.1[b] (2 – 6)
When you recommend a **general exclusion diet**, how would you rate your patients' ability (or self-efficacy) to comply?	3.2 ± 1.1[b] (1 – 5)
When you recommend a **low FODMAPS diet**, how would you rate your patients' ability (or self-efficacy) to comply?	2.7 ± 1.1[c] (1 – 6)
When you recommend the **specific carbohydrate diet**, how would you rate your patients' ability (or self-efficacy) to comply?	2.4 ± 1.1[c] (1 – 6)

*Responses: 1 = very difficult to comply, 2 = difficult to comply, 3 = somewhat difficult to comply, 4 = somewhat easy to comply, 5 = easy to comply, 6 = very easy to comply.
[abc]Means with different letters are significantly different ($P < .05$) as determined by ANOVA using Duncan pairwise comparison

What Drives Failure/Success

Participants were asked to rate common barriers to patients' compliance with a diet, contributors to success with a diet, and why a participant would not recommend a diet for both eligible and non-eligible patients. Only RDs' responses were used in the analysis of this data due to their representing an overwhelming majority of the responses.

Registered dietitians rated several significant notable barriers for patients' non-compliance to the general exclusion diet including not enough foods to satisfy hunger, unpalatability of diet, feeling conspicuous among others, and no desire to change ($P < .05$, Table 4.5). Dietitians did not perceive that the instructions were too difficult (lack of self-efficacy) for the patients, in addition to the price of food/ingredients, or lack of cooking skills ($P > .05$). Items that contributed to success of the general exclusion diet when patients were compliant included initial consultation with a RD and follow up consultation ($P < .001$) and that changes were effective early on and in the long run ($P < .001$). Dietitians did not feel that changes being inexpensive or the diet being palatable significantly contributed to its success ($P > .05$). When patients were eligible for the general exclusion diet, but the participant did not recommend it, dietitians agreed that the diet was too restrictive, involved too many changes, or expected patient non-adherence ($P < .001$). When participants never recommended the general exclusion diet, dietitians disagreed that the cost of food was too expensive ($P < .001$) and disagreed that they did not have time to cover the diet with their patients ($P < .01$).

Table 4.5 Registered dietitians' barriers, successes, and reasons for not recommending the **general exclusion diet**.

Variable	n (%)	*P* value
Among your patients who are not compliant with a general exclusion diet, what are some common barriers?		
No desire to change Not a barrier or a slight barrier Moderate or extreme barrier	 40 (63.5) 23 (36.5)	 .032*
Instructions are too difficult (lack of self-efficacy) Not a barrier or a slight barrier Moderate or extreme barrier	 38 (60.3) 25 (39.7)	 .101
Price of food/ingredients Not a barrier or a slight barrier Moderate or extreme barrier	 36 (57.1) 27 (42.9)	 .257
Unpalatability of diet Not a barrier or a slight barrier Moderate or extreme barrier	 42 (66.7) 21 (33.3)	 .008**
Not enough foods to satisfy hunger Not a barrier or a slight barrier Moderate or extreme barrier	 45 (71.4) 18 (28.6)	 .001***
Lack of willpower Not a barrier or a slight barrier Moderate or extreme barrier	 28 (45.2) 34 (54.8)	 .446
Requires lengthy preparation Not a barrier or a slight barrier Moderate or extreme barrier	 28 (45.2) 34 (54.8)	 .446
Lack of cooking skills Not a barrier or a slight barrier Moderate or extreme barrier	 32 (51.6) 30 (48.4)	 .799
Feeling conspicuous among others Not a barrier or a slight barrier Moderate or extreme barrier	 42 (66.7) 21 (33.3)	 .008**
Taste preferences among family and friends Not a barrier or a slight barrier Moderate or extreme barrier	 36 (58.1) 26 (41.9)	 .204
Among the patients who are compliant with a general exclusion diet, when it has been successful, what do you feel has contributed to its success?		
Changes were easy or simple to make Did not contribute or slightly contributed Moderately or strongly contributed	 19 (30.6) 43 (69.4)	 .002**
Changes were inexpensive Did not contribute or slightly contributed Moderately or strongly contribute	 30 (47.6) 33 (52.4)	 .705

Table 4.5 (continued)

Variable	n (%)	*P* value
Changes were effective early on Did not contribute or slightly contributed Moderately or strongly contributed	 8 (12.7) 55 (87.3)	 < .001***
Changes were effective in the long run Did not contribute or slightly contributed Moderately or strongly contributed	 7 (11.1) 56 (88.9)	 < .001***
Palatability of diet Did not contribute or slightly contributed Moderately or strongly contributed	 29 (46.0) 34 (54.0)	 .529
Instructions were sent home with patient Did not contribute or slightly contributed Moderately or strongly contributed	 10 (15.9) 53 (84.1)	 < .001***
Patient had initial consultation with a registered dietitian Did not contribute or slightly contributed Moderately or strongly contributed	 2 (3.2) 61 (96.8)	 < .001***
Patient had follow up consultation(s) with a registered dietitian Did not contribute or slightly contributed Moderately or strongly contributed	 2 (3.2) 61 (96.8)	 < .001***
For patients who may be eligible, but for whom you don't recommend a general exclusion diet, please rate the following reasons.		
Diet is too restrictive Strongly disagree or disagree Agree or strongly agree	 17 (27.0) 46 (73.0)	 < .001***
Diet involves too many changes at once Strongly disagree or disagree Agree or strongly agree	 17 (27.0) 46 (73.0)	 < .001***
Cost of food/ingredients is too expensive Strongly disagree or disagree Agree or strongly agree	 44 (69.8) 19 (30.2)	 .002**
Perceived lack of patient interest Strongly disagree or disagree Agree or strongly agree	 18 (28.6) 45 (71.4)	 .001***
Expectation of patient non-adherence Strongly disagree or disagree Agree or strongly agree	 17 (27.0) 46 (73.0)	 < .001***
What best represents the reasons you do not recommend a general exclusion diet? Please rate the following reasons.		
I don’t have enough knowledge or training Strongly disagree or disagree Agree or strongly agree	 16 (66.7) 8 (33.3)	 .102

Table 4.5 (continued)

Variable	n (%)	*P* value
I don't believe the diet has efficacy Strongly disagree or disagree Agree or strongly agree	 14 (58.3) 10 41.7)	.414
I don't have time to cover with patients Strongly disagree or disagree Agree or strongly agree	 19 (79.2) 5 (20.8)	.004**
Lack of evidence or randomized control trials Strongly disagree or disagree Agree or strongly agree	 11 (47.8) 12 (52.2)	.835
Diet is too restrictive Strongly disagree or disagree Agree or strongly agree	 9 37.5) 15 (62.5)	.221
Diet involves too many changes at once Strongly disagree or disagree Agree or strongly agree	 15 62.5) 9 (37.5)	.221
Cost of food/ingredients is too expensive Strongly disagree or disagree Agree or strongly agree	 22 (95.7) 1 (4.3)	< .001***
Perceived lack of patient interest Strongly disagree or disagree Agree or strongly agree	 13 (56.5) 10 (43.5)	.532
Expectation of patient non-adherence Strongly disagree or disagree Agree or strongly agree	 9 (39.1) 14 (60.9)	.297

*$P < .05$, **$P < .01$, ***$P < .001$ as determined by chi-square analysis.

Registered dietitians rated several significant notable barriers for patients' non-compliance to the low fiber or low residue diet including instructions are too difficult (lack of self-efficacy), price of food/ingredients, unpalatability of diet, and requiring lengthy preparation ($P < .001$, Table 4.6). Dietitians did not perceive that patients had no desire to change ($P > .05$). Items that contributed to success of the low fiber or low residue diet when patients were compliant included that changes were easy or simple to make, changes were effective early on, and had an initial consultation and follow up consultation with a registered dietitian ($P < .001$).

Dietitians did not feel that the palatability of the diet significantly contributed to its success ($P > .05$). When patients were eligible for the low fiber or low residue diet, but the participant did not recommend it, dietitians disagreed that the diet involved too many changes at once and that the cost of food/ingredients is too expensive ($P < .001$). When participants never recommend the low fiber or low residue diet, dietitians agreed they did not believe the diet has efficacy ($P < .05$) and disagreed that they did not have enough knowledge or training ($P < .001$).

Table 4.6 Registered dietitians' barriers and reasons for not recommending the **low fiber or low residue diet**.

Variable	n (%)	*P* value
Among your patients who are not compliant with a low fiber or low residue diet, what are some common barriers?		
No desire to change Not a barrier or a slight barrier Moderate or extreme barrier	 37 (52.9) 33 (47.1)	.633
Instructions are too difficult (lack of self-efficacy) Not a barrier or a slight barrier Moderate or extreme barrier	 55 (78.6) 15 (21.4)	< .001***
Price of food/ingredients Not a barrier or a slight barrier Moderate or extreme barrier	 65 (92.9) 5 (7.1)	< .001***
Unpalatability of diet Not a barrier or a slight barrier Moderate or extreme barrier	 50 (71.4) 20 (28.6)	< .001**
Not enough foods to satisfy hunger Not a barrier or a slight barrier Moderate or extreme barrier	 54 (77.1) 16 (22.9)	< .001***
Lack of willpower Not a barrier or a slight barrier Moderate or extreme barrier	 47 (67.1) 23 (32.9)	.004**
Requires lengthy preparation Not a barrier or a slight barrier Moderate or extreme barrier	 60 (85.7) 10 (14.3)	< .001***
Lack of cooking skills Not a barrier or a slight barrier Moderate or extreme barrier	 48 (68.6) 22 (31.4)	.002**
Feeling conspicuous among others Not a barrier or a slight barrier Moderate or extreme barrier	 51 (72.9) 19 (27.1)	< .001***

Table 4.6 (continued)

Variable	n (%)	*P* value
Taste preferences among family and friends Not a barrier or a slight barrier Moderate or extreme barrier	 44 (62.9) 26 (37.1)	 .031*
Among the patients who are compliant with a low fiber or low residue diet, when it has been successful, what do you feel has contributed to its success?		
Changes were easy or simple to make Did not contribute or slightly contributed Moderately or strongly contributed	 11 (15.7) 59 (84.3)	 < .001**
Changes were inexpensive Did not contribute or slightly contributed Moderately or strongly contribute	 23 (32.9) 47 (67.1)	 .004**
Changes were effective early on Did not contribute or slightly contributed Moderately or strongly contributed	 10 (14.3) 60 (85.7)	 < .001***
Changes were effective in the long run Did not contribute or slightly contributed Moderately or strongly contributed	 19 (27.1) 51 (72.9)	 < .001***
Palatability of diet Did not contribute or slightly contributed Moderately or strongly contributed	 31 (44.3) 39 (55.7)	 .339
Instructions were sent home with patient Did not contribute or slightly contributed Moderately or strongly contributed	 15 (21.4) 55 (78.6)	 < .001***
Patient had initial consultation with a registered dietitian Did not contribute or slightly contributed Moderately or strongly contributed	 3 (4.3) 67 (95.7)	 < .001***
Patient had follow up consultation(s) with a registered dietitian Did not contribute or slightly contributed Moderately or strongly contributed	 6 (8.6) 64 (91.4)	 < .001***
For patients who may be eligible, but for whom you don't recommend a low fiber or low residue diet, please rate the following reasons.		
Diet is too restrictive Strongly disagree or disagree Agree or strongly agree	 49 (70.0) 21 (30.0)	 .001***
Diet involves too many changes at once Strongly disagree or disagree Agree or strongly agree	 51 (72.9) 19 (27.1)	 < .001***
Cost of food/ingredients is too expensive Strongly disagree or disagree Agree or strongly agree	 63 (90.0) 7 (10.0)	 < .001***

Table 4.6 (continued)

Variable	n (%)	*P* value
Perceived lack of patient interest Strongly disagree or disagree Agree or strongly agree	 34 (48.6) 36 (51.4)	.811
Expectation of patient non-adherence Strongly disagree or disagree Agree or strongly agree	 34 (48.6) 36 (51.4)	.811
What best represents the reasons you do not recommend a low fiber or low residue diet? Please rate the following reasons.		
I don't have enough knowledge or training Strongly disagree or disagree Agree or strongly agree	 21 (87.5) 3 (12.5)	< .001***
I don't believe the diet has efficacy Strongly disagree or disagree Agree or strongly agree	 6 (25.0) 18 (75.0)	.014*
I don't have time to cover with patients Strongly disagree or disagree Agree or strongly agree	 23 (100) 0 (0)	n/a
Lack of evidence or randomized control trials Strongly disagree or disagree Agree or strongly agree	 11 (47.8) 12 (52.2)	.835
Diet is too restrictive Strongly disagree or disagree Agree or strongly agree	 13 (56.5) 10 (43.5)	.532
Diet involves too many changes at once Strongly disagree or disagree Agree or strongly agree	 17 (73.9) 6 (26.1)	.022*
Cost of food/ingredients is too expensive Strongly disagree or disagree Agree or strongly agree	 22 (95.7) 1 (4.3)	< .001***
Perceived lack of patient interest Strongly disagree or disagree Agree or strongly agree	 18 (78.3) 5 (21.7)	.007**
Expectation of patient non-adherence Strongly disagree or disagree Agree or strongly agree	 17 (73.9) 6 (26.1)	.022*

*$P < .05$, **$P < .01$, ***$P < .001$ as determined by chi-square analysis. n/a (not available), test cannot be performed with 0 cases.

Registered dietitians rated several significant notable barriers for patients' non-compliance to the low FODMAPS diet including instructions are too difficult (lack of self-

efficacy) and not enough foods to satisfy hunger ($P < .01$, Table 4.7), as well as unpalatability of diet and price of food/ingredients ($P < .001$). Dietitians did not perceive lack of cooking skills or feeling conspicuous among others as notable barriers to compliance with the low FOMDMAPS diet. Items that contributed to success of the low FODMAPS diet when patients were compliant included instructions were sent home with the patient, an initial and follow up consultation with a registered dietitian, and changes were effective early on and in the long run ($P < .001$). When patients were eligible for the low FODMAPS diet, but the participant did not recommend it, dietitians agreed that the diet involved too many changes at once ($P < .001$) and the diet was too restrictive ($P < .01$). Dietitians did not feel the expense of food or ingredients influenced their recommendation. When participants never recommended the low FODMAPS diet, the only significant reason participants disagreed with was not having time to cover the diet with the patients ($P < .001$).

Table 4.7 Registered dietitians' barriers, successes, and reasons for not recommending the **low FODMAPS diet.**

Variable	n (%)	*P* value
Among your patients who are not compliant with a low FODMAPS diet, what are some common barriers?		
No desire to change Not a barrier or a slight barrier Moderate or extreme barrier	 45 (60.8) 29 (39.2)	.063
Instructions are too difficult (lack of self-efficacy) Not a barrier or a slight barrier Moderate or extreme barrier	 24 (32.0) 51 (68.0)	.002**
Price of food/ingredients Not a barrier or a slight barrier Moderate or extreme barrier	 53 (71.6) 21 (28.4)	< .001***
Unpalatability of diet Not a barrier or a slight barrier Moderate or extreme barrier	 52 (70.3) 22 (29.7)	< .001**
Not enough foods to satisfy hunger Not a barrier or a slight barrier Moderate or extreme barrier	 48 (64.9) 26 (35.1)	.011*

Table 4.7 (continued)

Variable	n (%)	*P* value
Lack of willpower Not a barrier or a slight barrier Moderate or extreme barrier	 33 (45.2) 40 (54.8)	 .413
Requires lengthy preparation Not a barrier or a slight barrier Moderate or extreme barrier	 33 (45.2) 40 (54.8)	 .413
Lack of cooking skills Not a barrier or a slight barrier Moderate or extreme barrier	 38 (51.4) 36 (48.6)	 .816
Feeling conspicuous among others Not a barrier or a slight barrier Moderate or extreme barrier	 38 (51.4) 36 (48.6)	 .816
Taste preferences among family and friends Not a barrier or a slight barrier Moderate or extreme barrier	 34 (45.9) 40 (54.1)	 .485
Among the patients who are compliant with a low FODMAPS diet, when it has been successful, what do you feel has contributed to its success?		
Changes were easy or simple to make Did not contribute or slightly contributed Moderately or strongly contributed	 37 (49.3) 38 (50.7)	 .908
Changes were inexpensive Did not contribute or slightly contributed Moderately or strongly contribute	 45 (60.8) 29 (39.2)	 .063
Changes were effective early on Did not contribute or slightly contributed Moderately or strongly contributed	 9 (12.2) 65 (87.8)	 < .001***
Changes were effective in the long run Did not contribute or slightly contributed Moderately or strongly contributed	 9 (12.2) 65 (87.8)	 < .001***
Palatability of diet Did not contribute or slightly contributed Moderately or strongly contributed	 36 (48.0) 39 (52.0)	 .729
Instructions were sent home with patient Did not contribute or slightly contributed Moderately or strongly contributed	 7 (9.3) 68 (90.7)	 < .001***
Patient had initial consultation with a registered dietitian Did not contribute or slightly contributed Moderately or strongly contributed	 2 (2.7) 73 (97.3)	 < .001***

Table 4.7 (continued)

Variable	n (%)	*P* value
Patient had follow up consultation(s) with a registered dietitian		
Did not contribute or slightly contributed	2 (2.7)	< .001***
Moderately or strongly contributed	73 (97.3)	
For patients who may be eligible, but for whom you don't recommend a low FODMAPS diet, please rate the following reasons.		
Diet is too restrictive		
Strongly disagree or disagree	24 (32.9)	.003**
Agree or strongly agree	49 (67.1)	
Diet involves too many changes at once		
Strongly disagree or disagree	15 (20.3)	< .001***
Agree or strongly agree	59 (79.7)	
Cost of food/ingredients is too expensive		
Strongly disagree or disagree	57 (77.0)	< .001***
Agree or strongly agree	17 (23.0)	
Perceived lack of patient interest		
Strongly disagree or disagree	28 (37.8)	.036*
Agree or strongly agree	46 (62.2)	
Expectation of patient non-adherence		
Strongly disagree or disagree	26 (35.1)	.011*
Agree or strongly agree	48 (64.9)	
What best represents the reasons you do not recommend a low FODMAPS diet? Please rate the following reasons.		
I don’t have enough knowledge or training		
Strongly disagree or disagree	11 (61.1)	.346
Agree or strongly agree	7 (38.9)	
I don’t believe the diet has efficacy		
Strongly disagree or disagree	11 (61.1)	.346
Agree or strongly agree	7 (38.9)	
I don’t have time to cover with patients		
Strongly disagree or disagree	16 (88.9)	.001***
Agree or strongly agree	2 (11.1)	
Lack of evidence or randomized control trials		
Strongly disagree or disagree	6 (33.3)	.157
Agree or strongly agree	12 (66.7)	
Diet is too restrictive		
Strongly disagree or disagree	7 (38.9)	.346
Agree or strongly agree	11 (61.1)	
Diet involves too many changes at once		
Strongly disagree or disagree	7 (38.9)	.346
Agree or strongly agree	11 (61.1)	

Table 4.7 (continued)

Variable	n (%)	*P* value
Cost of food/ingredients is too expensive Strongly disagree or disagree Agree or strongly agree	 11 (61.1) 7 (38.9)	.346
Perceived lack of patient interest Strongly disagree or disagree Agree or strongly agree	 10 (55.6) 8 (44.4)	.637
Expectation of patient non-adherence Strongly disagree or disagree Agree or strongly agree	 6 (33.3) 12 (66.7)	.157

*$P < .05$, **$P < .01$, ***$P < .001$ as determined by chi-square analysis.

Registered dietitians rated several significant notable barriers for patients' non-compliance to the IgG targeted exclusion diet including unpalatability of diet ($P < .01$, Table 4.8) and not enough foods to satisfy hunger ($P < .05$). Dietitians did not perceive taste preferences among family and friends or no desire to change as significant barriers ($P > .05$). Items that contributed to success of the IgG targeted exclusion diet when patients were compliant included instructions being sent home with the patient, changes being effective early on, and changes being effective in the long run ($P < .001$). One hundred percent of participants felt an initial and follow up consultation contributed moderately or strongly to the success of the diet. When patients were eligible for the IgG targeted exclusion diet, but the participant did not recommend it, dietitians agreed there was a perceived lack of patient interest ($P < .01$). When participants never recommended the IgG targeted exclusion diet, participants agreed there was a lack of evidence or randomized control trials ($P < .001$).

Table 4.8 Registered dietitians' barriers, successes, and reasons for not recommending the **IgG targeted exclusion diet**.

Variable	n (%)	*P* value
Among your patients who are not compliant with an IgG targeted exclusion diet, what are some common barriers?		
No desire to change Not a barrier or a slight barrier Moderate or extreme barrier	 12 (48.0) 13 (52.0)	 .841
Instructions are too difficult (lack of self-efficacy) Not a barrier or a slight barrier Moderate or extreme barrier	 16 (64.0) 9 (36.0)	 .162
Price of food/ingredients Not a barrier or a slight barrier Moderate or extreme barrier	 17 (68.0) 8 (32.0)	 .072
Unpalatability of diet Not a barrier or a slight barrier Moderate or extreme barrier	 19 (76.0) 6 (24.0)	 .009**
Not enough foods to satisfy hunger Not a barrier or a slight barrier Moderate or extreme barrier	 18 (72.0) 7 (28.0)	 .028*
Lack of willpower Not a barrier or a slight barrier Moderate or extreme barrier	 8 (32.0) 17 (68.0)	 .072
Requires lengthy preparation Not a barrier or a slight barrier Moderate or extreme barrier	 15 (60.0) 10 (40.0)	 .317
Lack of cooking skills Not a barrier or a slight barrier Moderate or extreme barrier	 15 (60.0) 10 (40.0)	 .317
Feeling conspicuous among others Not a barrier or a slight barrier Moderate or extreme barrier	 17 (68.0) 8 (32.0)	 .072
Taste preferences among family and friends Not a barrier or a slight barrier Moderate or extreme barrier	 13 (52.0) 12 (48.0)	 .841
Among the patients who are compliant with an IgG targeted exclusion diet, when it has been successful, what do you feel has contributed to its success?		
Changes were easy or simple to make Did not contribute or slightly contributed Moderately or strongly contributed	 7 (28.0) 18 (72.0)	 .028*
Changes were inexpensive Did not contribute or slightly contributed Moderately or strongly contribute	 12 (48.0) 13 (52.0)	 .841

Table 4.8 (continued)

Variable	n (%)	*P* value
Changes were effective early on Did not contribute or slightly contributed Moderately or strongly contributed	 1 (4.0) 24 (96.0)	 < .001***
Changes were effective in the long run Did not contribute or slightly contributed Moderately or strongly contributed	 2 (8.0) 23 (92.0)	 < .001***
Palatability of diet Did not contribute or slightly contributed Moderately or strongly contributed	 9 (36.0) 16 (64.0)	 .162
Instructions were sent home with patient Did not contribute or slightly contributed Moderately or strongly contributed	 1 (4.0) 24 (96.0)	 < .001***
Patient had initial consultation with a registered dietitian Did not contribute or slightly contributed Moderately or strongly contributed	 0 (0) 25 (100)	 n/a
Patient had follow up consultation(s) with a registered dietitian Did not contribute or slightly contributed Moderately or strongly contributed	 0 (0) 25 (100)	 n/a
For patients who may be eligible, but for whom you don't recommend an IgG targeted exclusion diet, please rate the following reasons.		
Diet is too restrictive Strongly disagree or disagree Agree or strongly agree	 11 (44.0) 14 (56.0)	 .549
Diet involves too many changes at once Strongly disagree or disagree Agree or strongly agree	 10 (40.0) 15 (60.0)	 .317
Cost of food/ingredients is too expensive Strongly disagree or disagree Agree or strongly agree	 20 (80.0) 5 (20.0)	 .003**
Perceived lack of patient interest Strongly disagree or disagree Agree or strongly agree	 6 (24.0) 19 (76.0)	 .009**
Expectation of patient non-adherence Strongly disagree or disagree Agree or strongly agree	 8 (32.0) 17 (68.0)	 .072
What best represents the reasons you do not recommend an IgG targeted exclusion diet? Please rate the following reasons.		
I don’t have enough knowledge or training Strongly disagree or disagree Agree or strongly agree	 30 (65.2) 16 (34.8)	 .039*

Table 4.8 (continued)

Variable	n (%)	*P* value
I don't believe the diet has efficacy Strongly disagree or disagree Agree or strongly agree	 12 (28.6) 30 (71.4)	.005**
I don't have time to cover with patients Strongly disagree or disagree Agree or strongly agree	 38 (90.5) 4 (9.5)	< .001***
Lack of evidence or randomized control trials Strongly disagree or disagree Agree or strongly agree	 9 (21.4) 33 (78.6)	< .001***
Diet is too restrictive Strongly disagree or disagree Agree or strongly agree	 29 (69.0) 13 (31.0)	.014*
Diet involves too many changes at once Strongly disagree or disagree Agree or strongly agree	 30 (71.4) 12 (28.6)	.005**
Cost of food/ingredients is too expensive Strongly disagree or disagree Agree or strongly agree	39 (92.9) 3 (7.1)	< .001***
Perceived lack of patient interest Strongly disagree or disagree Agree or strongly agree	 34 (81.0) 8 (19.0)	< .001***
Expectation of patient non-adherence Strongly disagree or disagree Agree or strongly agree	 31 (73.8) 11 (26.2)	.002**

*$P < .05$, **$P < .01$, ***$P < .001$ as determined by chi-square analysis. n/a: not able to calculate due to zero cases in one category.

Registered dietitians rated several significant notable barriers for patients' non-compliance to the SCD including instructions are too difficult (lack of self-efficacy) and taste preferences among family and friends ($P < .05$, Table 4.9). Dietitians did not perceive lack of willpower or unpalatability of diet as significant barriers ($P > .05$). Items that contributed to success of the SCD when patients were compliant included changes being effective early on and in the long run, and initial and follow up consultations with a registered dietitian ($P < .001$). When patients were eligible for the SCD but the participant did not recommend it, dietitians

agreed that the diet is too restrictive ($P < .001$), the diet involved too many changes at once ($P = .001$), and there was a perceived lack of patient interest ($P = .001$). When participants never recommended the SCD, participants disagreed that the cost of food/ingredients was too expensive or that they did not have enough time to cover the diet with their patients ($P < .001$).

Table 4.9 Registered dietitians' barriers, successes, and reasons for not recommending the **Specific Carbohydrate Diet**.

Variable	n (%)	*P* value
Among your patients who are not compliant with the specific carbohydrate diet, what are some common barriers?		
No desire to change Not a barrier or a slight barrier Moderate or extreme barrier	 17 (56.7) 13 (43.3)	.465
Instructions are too difficult (lack of self-efficacy) Not a barrier or a slight barrier Moderate or extreme barrier	 9 (30.0) 21 (70.0)	.028*
Price of food/ingredients Not a barrier or a slight barrier Moderate or extreme barrier	 18 (60.0) 12 (40.0)	.273
Unpalatability of diet Not a barrier or a slight barrier Moderate or extreme barrier	 13 (43.3) 17 (56.7)	.465
Not enough foods to satisfy hunger Not a barrier or a slight barrier Moderate or extreme barrier	 12 (40.0) 18 (60.0)	.273
Lack of willpower Not a barrier or a slight barrier Moderate or extreme barrier	 13 (43.3) 17 (56.7)	.465
Requires lengthy preparation Not a barrier or a slight barrier Moderate or extreme barrier	 10 (33.3) 20 (66.7)	.068
Lack of cooking skills Not a barrier or a slight barrier Moderate or extreme barrier	 12 (40.0) 18 (60.0)	.273
Feeling conspicuous among others Not a barrier or a slight barrier Moderate or extreme barrier	 11 (36.7) 19 (63.3)	.144
Taste preferences among family and friends Not a barrier or a slight barrier Moderate or extreme barrier	 9 (30.0) 21 (70.0)	.028*

Table 4.9 (continued)

Variable	n (%)	*P* value
Among the patients who are compliant with the specific carbohydrate diet, when it has been successful, what do you feel has contributed to its success?		
Changes were easy or simple to make Did not contribute or slightly contributed Moderately or strongly contributed	 16 (53.3) 14 (46.7)	 .715
Changes were inexpensive Did not contribute or slightly contributed Moderately or strongly contribute	 19 (63.3) 11 (36.7)	 .144
Changes were effective early on Did not contribute or slightly contributed Moderately or strongly contributed	 5 (16.7) 25 (83.3)	 < .001***
Changes were effective in the long run Did not contribute or slightly contributed Moderately or strongly contributed	 3 (10.0) 27 (90.0)	 < .001***
Palatability of diet Did not contribute or slightly contributed Moderately or strongly contributed	 14 (46.7) 16 (53.3)	 .715
Instructions were sent home with patient Did not contribute or slightly contributed Moderately or strongly contributed	 4 (13.3) 26 (86.7)	 < .001***
Patient had initial consultation with a registered dietitian Did not contribute or slightly contributed Moderately or strongly contributed	 1 (3.3) 29 (96.7)	 < .001***
Patient had follow up consultation(s) with a registered dietitian Did not contribute or slightly contributed Moderately or strongly contributed	 2 (6.7) 28 (93.3)	 < .001***
For patients who may be eligible, but for whom you don't recommend the specific carbohydrate diet, please rate the following reasons.		
Diet is too restrictive Strongly disagree or disagree Agree or strongly agree	 5 (16.7) 25 (83.3)	 < .001***
Diet involves too many changes at once Strongly disagree or disagree Agree or strongly agree	 6 (20.0) 24 (80.0)	 .001***
Cost of food/ingredients is too expensive Strongly disagree or disagree Agree or strongly agree	 17 (56.7) 13 (43.3)	 .465
Perceived lack of patient interest Strongly disagree or disagree Agree or strongly agree	 6 (20.0) 24 (80.0)	 .001***

Table 4.9 (continued)

Variable	n (%)	*P* value
Expectation of patient non-adherence Strongly disagree or disagree Agree or strongly agree	 8 (26.7) 22 (73.3)	 .011*
What best represents the reasons you do not recommend the specific carbohydrate diet? Please rate the following reasons.		
I don't have enough knowledge or training Strongly disagree or disagree Agree or strongly agree	 23 (46.0) 27 (54.0)	 .572
I don't believe the diet has efficacy Strongly disagree or disagree Agree or strongly agree	 28 (57.1) 21 (42.9)	 .317
I don't have time to cover with patients Strongly disagree or disagree Agree or strongly agree	 46 (93.9) 3 (6.1)	 < .001***
Lack of evidence or randomized control trials Strongly disagree or disagree Agree or strongly agree	 20 (41.7) 28 (58.3)	 .248
Diet is too restrictive Strongly disagree or disagree Agree or strongly agree	 26 (53.1) 23 (46.9)	 .668
Diet involves too many changes at once Strongly disagree or disagree Agree or strongly agree	 21 (43.8) 27 (56.3)	 .386
Cost of food/ingredients is too expensive Strongly disagree or disagree Agree or strongly agree	 38 (79.2) 10 (20.8)	 < .001***
Perceived lack of patient interest Strongly disagree or disagree Agree or strongly agree	 27 (55.1) 22 (44.9)	 .475
Expectation of patient non-adherence Strongly disagree or disagree Agree or strongly agree	 22 (44.9) 27 (55.1)	 .475

*$P < .05$, **$P < .01$, ***$P < .001$ as determined by chi-square analysis.

Differences in Geographical Location, Age, and Years of Practice

Statistical analysis was conducted comparing geographical locations for each diet. When separated by highest populated vs lowest populated states in the United States according to worldatlas.com, significant differences were only found when recommending a general exclusion

diet (37 participants vs 28, $P = .022$). Participants in the highest populated states tended to recommend a general exclusion diet more often than participants in the lowest populated states. Statistical analysis was also conducted comparing the age of the participants who were between ages 18 and 35 and those who were 36 and older. No significant differences were observed across each diet. Similarly, no significant differences were found when comparing participants who practiced for 5 years or less vs greater than 5 years.

Diet Mentioned By Multiple Practitioners

Participants had the option of inputting any diet into the survey and answering the same set of questions that were asked of the 5 previous diets. One diet that was suggested by 11 participants was the Lifestyle Eating and Performance (LEAP) protocol. Seven of the 11 participants believed compliance with the LEAP protocol was either easy or somewhat easy. Only 3 of the 11 participants felt a notable barrier to the LEAP protocol was a lack of self-efficacy. Ten of the 11 participants did not feel the LEAP protocol lacked foods to satisfy hunger. All 11 participants felt that changes being effective early on and in the long run contributed to its success, and all 11 participants felt an initial and follow up consultation strongly contributed as well. Eight of 11 participants felt that instructions being sent home with the participants contributed strongly to its success. When participants were eligible for the LEAP, protocol but participants did not recommend it, 9 agreed they did not recommend it based on the expectation of patient non-adherence or the perceived lack of patient interest.

Practitioner Opinions on Diet and IBD

Participants were offered the option of providing additional information or opinions about the role of diet and nutrition as a treatment for IBD. Many provided interesting answers.

An RD practicing at a teaching hospital uses pureed foods with fiber included in the IBD-AID based on the fact that it is a prebiotic, an important source of nutrients for the immune system, and is tolerated well by a sensitive gut. An RD at an office based solo practice states that nutrition interventions should be considered as a primary intervention. A gastroenterologist at an office based single specialty group practice stated that a low residue diet is preferred for patients with strictures who are at a high risk for obstruction, and not to treat inflammation. Another RD at an office based solo practice stated that diet recommendations based on hypersensitivity reactions determined through a blood test seem to have the best results.

A gastroenterologist at a teaching hospital/clinic self-identified barriers as lack of time to teach patients about diet, lack of access to a RD, and a lack of convincing clinical trial data to motivate the use of these diets. The gastroenterologist does enroll patients in a clinical SCD trial. A RD at a non-profit specialty clinic for behavioral health and eating disorders identified the need for more collaboration/communication between the primary care physician, RD, and gastroenterologist for patients with IBD. The RDs clients complain of mixed messaging from the various providers. The RD states that the RD should always ask for a Release of Information and try to collaborate with other health professionals since the RD is most likely to see the patient most often. The RD can then offer feed back to the other professionals to reduce time, frustration, and cost for all involved.

An RD at a non-profit hospital recommends including omega-3 and antioxidant rich foods with an emphasis on food sources of healthy bacteria, and a high protein/low fiber diet with a calorie goal to limit or avoid weight loss for patients in a flare. A nurse practitioner at an office based single specialty practice group states more research is needed in the area and is excited to see more data on diet-based therapy outcomes in IBD. A physician's assistant states

that diet therapy should be considered a compliment to the patient's medical therapy, and that patients with moderate to severe IBD need to be encouraged to continue medical therapy while exploring diet modifications. The physician's assistant also states that IBD practices need RDs to help educate and reinforce therapy because there is not enough time for other providers to properly educate their patients.

CHAPTER V

DISCUSSION

There are many different types of dietary interventions available to help manage symptoms or induce clinical remission in patients with IBD, and several are becoming increasingly popular. These diets generally restrict certain foods or food groups that are proposed to cause either IBD or its symptoms. The five diets chosen for this study all show initial efficacy in a variety of research designs, however large RCTs are needed to develop firm and convincing recommendations. The challenge with RCTs is the required length of participation for IBD patients due to the chronic nature of the disease.

The most thoroughly studied intervention is EN. Unfortunately, while this method holds efficacy[52], it severely restricts IBD patient's ability to live a normal lifestyle as it pertains to consuming regular meals. While enteral nutrition is commonly used as a first line of treatment for patients with IBD[52], it was not mentioned by any of the participants as their input was requested on "whole-food" based diets, not supplements or non-oral nutrition.

In this study healthcare practitioners were surveyed on their viewpoints of different dietary modalities used in the management of IBD. The 5 initial diets included in the survey were the general exclusion diet, low fiber or low residue diet, low FODMAPs diet, IgG targeted exclusion diet, and SCD. Gastroenterologists, physician's assistants, nurse practitioners, registered dietitians and other healthcare practitioners were included in the survey.

One hundred eighty-one participants at least partially completed the survey. Most participants did not respond to every item, especially the questions about some specific diets. Perhaps they were not familiar with some of the diets and were not comfortable responding. Participants represented a wide variety of geographical locations, areas of practice, and experience. The vast majority of participants (96.7%) considered using dietary modalities to help treat patients with IBD.

A previous study found that 48% of IBD patients believed diet initiates disease, 57% believed diet triggers relapse, 50% of patients received no nutrition advice from their healthcare providers, and 67% wanted more advice.[51] Forty-five percent of IBD patients wanted this advice to be from a RD.[51] This aligns with the data collected in our survey, since across all 5 diets RDs believed that an initial and follow up consultation from a RD greatly contributed to a patient's success with a diet. Greater involvement from RDs is key to helping patients modify their diet successfully.

Low Fiber or Low Residue Diet

Low fiber or low residue diets are recommended for IBD patients with severe inflammation and bowel strictures, although significant differences may not exist.[64] Significantly more health care practitioners recommended a low fiber/low residue diet occasionally or often compared to those who do not. A low fiber/low residue diet was also rated as easiest in terms of compliance in the present study. Registered dietitians did not feel that a lack of self-efficacy was a barrier. Most dietitians (84.3%) agreed that changes being easy to make contributed moderately or strongly to the success with the diet. Changes being effective early on, changes being effective in the long run, and instructions being sent home with the patient all also moderately or strongly contributed to patient success with the diet according to RDs. A majority of RDs (85.7%) did not

feel lengthy preparation was a moderate or extreme barrier to compliance. This all most likely contributed to the ease of compliance. Lower consumption of insoluble fiber and residue most likely decreases the incidence of functional bowel symptoms in IBD patients, and a quick resolution of this contributes to the diet's perceived success. One significant reason RDs did not recommend a low fiber diet was because they did not believe the diet had efficacy. While RDs do recommend this diet, there is risk associated with not consuming fiber due to its impact on gut heatlh.[64,65] A low fiber/ low residue diet may not be the answer as a lifelong modality to follow for IBD patients, however with proper guidance from a RD, it may help to manage the symptoms of patients with a severe flare. More in-depth RCTs are warranted with the low fiber/low residue and IBD patients.

General Exclusion Diet

A general exclusion diet is commonly used to identify foods that exacerbate symptoms, especially during flares.[76] In total, a significant number of participants (105) recommend the general exclusion diet occasionally or often. The diet had a mean response of 3.2 ± 1.1 for the patients' ability to comply with the diet, indicating it was between 'somewhat difficult' to 'somewhat easy' to comply. Several common barriers that achieved significance for the general exclusion diet were reported by participants. Most RDs (71.4%) felt not enough foods to satisfy hunger was either not a barrier or only a slight barrier, and 66.7% thought unpalatability of the diet was not a barrier or only a slight barrier. Significant contributors to patient success with the diet include changes being effective early on and in the long run, and an initial and follow up consultation with a RD. This data supports the conclusion drawn when comparing the carbohydrate, fiber rich diet to a general exclusion diet, that intense cooperation between patients, doctors, and dietitians is necessary for patient success.[76] The general exclusion diet

seems to be one that shows promise because of its ability to be adapted on a case by case basis for each patient. Since specific foods are being identified that exacerbate symptoms, any foods that do not exacerbate symptoms are allowed. This would seem to allow enough foods to satisfy hunger. The number of foods that are allowed also fuel the palatability of the diet. Twenty-two of the 23 registered dietitians who rated cost of food being too expensive disagreed or strongly disagreed with this notion as a basis for not recommending the diet. All of these reasons indicate that the general exclusion diet has potential in IBD patients and warrants further study.

Low FODMAPS Diet

The low FODMAPS diet attempts to eliminate certain oligosaccharides that cause functional bowel symptoms.[64] While symptom improvement may occur, there is a lack of convincing evidence on the diet decreasing inflammation in IBD patients. A significant number of total participants (83) and RDs (75) recommended a low FODMAPS diet occasionally or often. However, RDs rated their patients' ability to comply with the diet as somewhat difficult to difficult. Sixty-eight percent of RDs rated the instructions as too difficult (lack of self-efficacy) and was a significant barrier to patient compliance. When the diet was successful, RDs rated changes being effective early on and in the long run as significant contributors, as well as initial and follow up consultations with a RD, and instructions being sent home with the patient. When patients were eligible, but the diet was not recommended, 79.7% of dietitians felt the diet involved too many changes at once, 67.1% felt the diet was too restrictive, and 64.9% suspected significant patient non-adherence. The low FODMAPS dietary modality shows promise in resolving IBD patients' symptoms. Compliance with the diet is the number one issue, and some dietitians do not recommend this diet because it is too restrictive or too involved. It seems imperative that a RD is involved when attempting the low FODMAPS diet, especially since a

carbohydrate restricted diet may lead to certain vitamin and mineral deficiencies, as well as insufficient calorie intake and weight loss.[64] It will be interesting to further understand how much the resolution of symptoms can drive patient compliance, and future studies on the low FODMAPS diet in the IBD population is needed. Interestingly, a national survey reported that 505 of 1,468 gastroenterologists "usually recommended" a low FODMAPS diet for their IBS patients.[90] The study also indicated that only 21% of the doctors "usually" or "almost always" referred their IBS patients to a RD.[90]

IgG Targeted Exclusion Diet

The IgG targeted exclusion diet attempts to identify foods that should be avoided based on the production of IgG antibodies via blood testing.[69] Only 40 out of 140 participants recommended an IgG targeted exclusion diet occasionally or often. This is interesting considering the patients' ability to comply with the diet as rated as 3.4 ± 1.0, indicating that compliance with the diet is between somewhat difficult to somewhat easy. This also makes it the second easiest diet in regard to perceived patient compliance. Twenty-four percent of RDs felt the unpalatability of the diet was a significant barrier to patient compliance and 28% felt there were not enough foods to satisfy hunger. Reasons that contributed to the success of the diet include changes being effective early on and in the long run, as well as instructions being sent home with the patient. When patients were eligible, but the diet was not recommended, the only significant reason dietitians agreed with was perceived lack of patient interest. Most RDs (71.4%) who did not recommend the diet did not believe the diet had efficacy, and 78.6% believed there was a lack of evidence or RCTs to support its use. The participants viewpoints of the IgG targeted exclusion diet present interesting results. A large number of participants did not recommend the diet, however, ones who did evaluated compliance as the second easiest among

the diets surveyed. Since compliance was perceived as relatively easy, and the reason for not recommending the diet was due to a lack of evidence, well-designed RCTs on patients with IBD and the IgG targeted exclusion diet is warranted.

Specific Carbohydrate Diet

The Specific Carbohydrate Diet is a carbohydrate restricted diet that is high in protein, fat, fruits, amylose containing vegetables, and nuts, while eliminating grains, lactose, and processed sugar.[94] Only 39 participants recommended the Specific Carbohydrate Diet occasionally or often. The diet was also rated lowest in terms of ease of compliance at 2.4 ± 1.4, indicating it is somewhat difficult to difficult. The perceived compliance matches well with the previous literature on the diet, since proponents of the diet recommended using it for at least one year.[64] Seventy percent of dietitians felt that instructions being too difficult and taste preferences among family and friends are moderate or extreme barriers to patient compliance. However, when the diet was successful, changes being effective early on and in the long run moderately or strongly contributed to its success. Similar to the other 5 diets, initial and follow up consultations significantly contributed to patient success with the diet. When patients were eligible, but dietitians did not recommend the diet, 83.3% significantly agreed the diet was too restrictive, 80% agreed it involved too many changes at once, and 80% agreed there was a perceived lack of patient interest. The Specific Carbohydrate Diet has a limited but increasing body of evidence supporting its use in IBD patients. Pediatric patients especially may benefit from a diet that can provide both symptomatic and clinical relief.[75,96] The difficulty with compliance might be solved by greater involvement from a RD. Randomized control trials are necessary to better determine the efficacy of the Specific Carbohydrate Diet.

Further Provider Input on Diet and IBD

The information provided when answering the question about anything else the participants wanted to state about diet and IBD helped to shed light on what needs to be done to advance the use of diet as a management tool in patients with IBD. Besides the 5 diets surveyed in this study, other diets were either entered by participants, such as the LEAP protocol, or discovered in the literature review, such as the AIP, IBD-AID, and CDED. According to one dietitian's response, diet should be considered as the primary intervention for IBD. A nurse practitioner expressed the need for more research in the area of IBD and diet and was excited for future studies. A gastroenterologist identified a lack of time, lack of access to a dietitian, and lack of convincing clinical data to motivate the use of these diets. Combining these thought processes offer a view into what needs to be done in this field. Large RCTs need to be completed in order to truly determine the efficacy of these diets in the IBD population. A multi-disciplinary approach, including a RD, is essential to ensuring both accurate data and better patient outcomes. Initially, the researchers wanted to understand provider viewpoints on diet and IBD in terms of the awareness to acceptance model. However, in depth research revealed that more robust data and recommendations are needed before being applied to this model. The researchers were able to better understand what drives patient success or failure with some of the current diets, in addition to what drives practitioner recommendations. Ultimately, more research is needed overall on diet and IBD.

Limitations and Strengths of the Study

Limitations

Typical limitations for a cross-sectional study design existed within this study. The study sample was a convenience sample that may or may not represent a random sample of health care

providers that provide dietary advice to IBD patients. Males, gastroenterologists, primary care physicians, physician's assistants, nurse practitioners, nurses, and participants from the Midwest were all underrepresented. RDs made up the majority of responses, and this may have influenced the statistical findings for certain questions. Most participants (86.2%) were female, which is likely representative of the RD profession. Future studies should attempt to gather responses from a more diverse group of clinicians who work with IBD patients. Including professional groups besides the DIFM DPG may help improve this limitation.

Some questions were not answered by all participants. One hundred eighty-one participants at least partially filled out the survey, which did not meet the goal of 250 clinicians. The length of the survey was also a significant limitation. The survey took approximately 15 minutes to complete, however could take longer or shorter based on the responses the participant entered. This may have caused fewer participants to completely fill out the survey. In the future, a survey like this should be shorter in length, anywhere from 5 to 10 minutes, to increase the completion rate.

Only 5 diets were chosen for this study, but many modalities are available. Although clinicians had the option of entering his/her own diet into the survey, the selection of these diets influenced the results. The lack of reliable prior research studies limited the diets chosen for this study. Future large RCTs on certain diets will help to hone the focus on a couple diets that have efficacy with IBD patients, rather than many different diets currently being researched. This will help drive more accurate results on provider viewpoints on diet and IBD.

Lastly, the ANOVA statistical analysis on the question regarding perceived compliance with dietary modalities assumes independence among groups, but there were overlapping participants between the groups. This may have skewed results. An increased sample size, both

in terms of number and diversity, will help provide more reliable statistics in any future studies by being able to compare groups across demographics like profession and gender.

Strengths

There were several strengths of this study. The first strength of the study is the area of research that was investigated as there appears be a lack of research on practitioner viewpoints on diet and IBD. A second strength of the study was that 98 RDs responded to the survey. RDs focus on diet manipulation to help treat disease, and their input is especially valuable as it may help identify and advocate proper nutrition protocols in the IBD population. A third strength of the study was the ability of the participant to input his/her own diet and answer the same set of questions as the initial 5 diets. Various diets were identified that may help drive future research on dietary modalities for patients with IBD. Additionally, participants were allowed to input additional thoughts on diet and IBD via an open-ended question. Many different ideas were provided that may also aid in future research. Lastly, participants were able to respond to the survey using any electronic device that would open the link. This may have helped drive the participation rate.

CHAPTER VI

CONCLUSION

The study aimed to evaluate current healthcare practitioner viewpoints and recommendations on the many whole food-based diets available to patients with IBD. The researchers surveyed participants on questions regarding awareness, compliance, barriers, successes, and reasons for not recommending the 5 diets identified in the literature review. The researchers also surveyed participants on their general diet recommendations for IBD patients.

The vast majority of participants believed in modifying diet to help IBD patients. A significant number of both all participants and only RDs recommended a general exclusion diet, the low FODMAPs diet, and a low fiber or low residue diet. Alternatively, a significant number of both all participants and only RDs did not recommend an IgG targeted exclusion diet or the SCD. The low fiber or low residue diet was rated easiest in terms of compliance, compared with both the low FODMAPs diet and SCD that were rated most difficult.

This study helped identify some of the principal driving factors for success and failure with certain diets and IBD patients. Clinicians believed a diet being successful early on, a diet being successful in the long run, an initial consultation with a RD, and a follow-up consultation with a RD contributed towards perceived success with all 5 diets. Clinicians rated instructions being too difficult (lack of self-efficacy) as a significant barrier to compliance with both the low FODMAPs diet and SCD. Significant reasons certain diets were not recommended included the practitioner belief that the diet did not have efficacy, the belief that there was a lack of evidence

or RCTs, the belief the diet was too restrictive, and the belief the diet involved too many changes at once.

Further studies are needed that recruit a larger cohort of participants to help strengthen the research on healthcare practitioners' viewpoints on whole food-based diets and IBD. Inflammatory Bowel Disease is a complex disease with many factors that influence its progression, remission, and flares. Diet is one factor that is able to be manipulated in many different ways. Consistent recommendations on diet and IBD should be developed and supported by large RCTs. Healthcare practitioner viewpoints will help to shape these recommendations.

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APPENDIX A

IRB APPROVAL LETTER

IRB-18-088

MISSISSIPPI STATE UNIVERSITY

Office of Research Compliance

Institutional Review Board for the Protection of Human Subjects in Research
P.O. Box 6223
53 Morgan Avenue
Mississippi State, MS 39762
P. 662.325.3294

www.orc.msstate.edu

NOTICE OF DETERMINATION FROM THE HUMAN RESEARCH PROTECTION PROGRAM

DATE:	May 02, 2018
TO:	Terezie Mosby, Food Sci Nutrition Hlth Promo, Diane Tidwell;Marion Evans;Mark Schilling
PROTOCOL TITLE:	Doctors Viewpoints on Dietary Modalities as Treatments for Inflammatory Bowel Disease
PROTOCOL NUMBER:	IRB 18 088
	Approval Date: May 02, 2018 Expiration Date: May 01, 2023

EXEMPTION DETERMINATION

The review of your research study referenced above has been completed. The HRPP had made an Exemption Determination as defined by 45 CFR 46.101(b)2. Based on this determination, and in accordance with Federal Regulations, your research does not require further oversight by the HRPP.

Employing best practices for Exempt studies are strongly encouraged such as adherence to the ethical principles articulated in the Belmont Report, found at www.hhs.gov/ohrp/regulations-and-policy/belmont-report/# as well as the MSU HRPP Operations Manual. found at www.orc.msstate.edu/humansubjects. Additionally, to protect the confidentiality of research participants, we encourage you to destroy private information which can be linked to the identities of individuals as soon as it is reasonable to do so.

Based on this determination, this study has been inactivated in our system. This means that recruitment, enrollment, data collection, and/or data analysis **CAN** continue, yet personnel and procedural amendments to this study are no longer required. **If at any point, however, the risk to participants increases, you must contact the HRPP immediately. If you are unsure if your proposed change would increase the risk, please call the HRPP office and they can guide you.**

If this research is for a thesis or dissertation, this notification is your official documentation that the HRPP has made this determination.

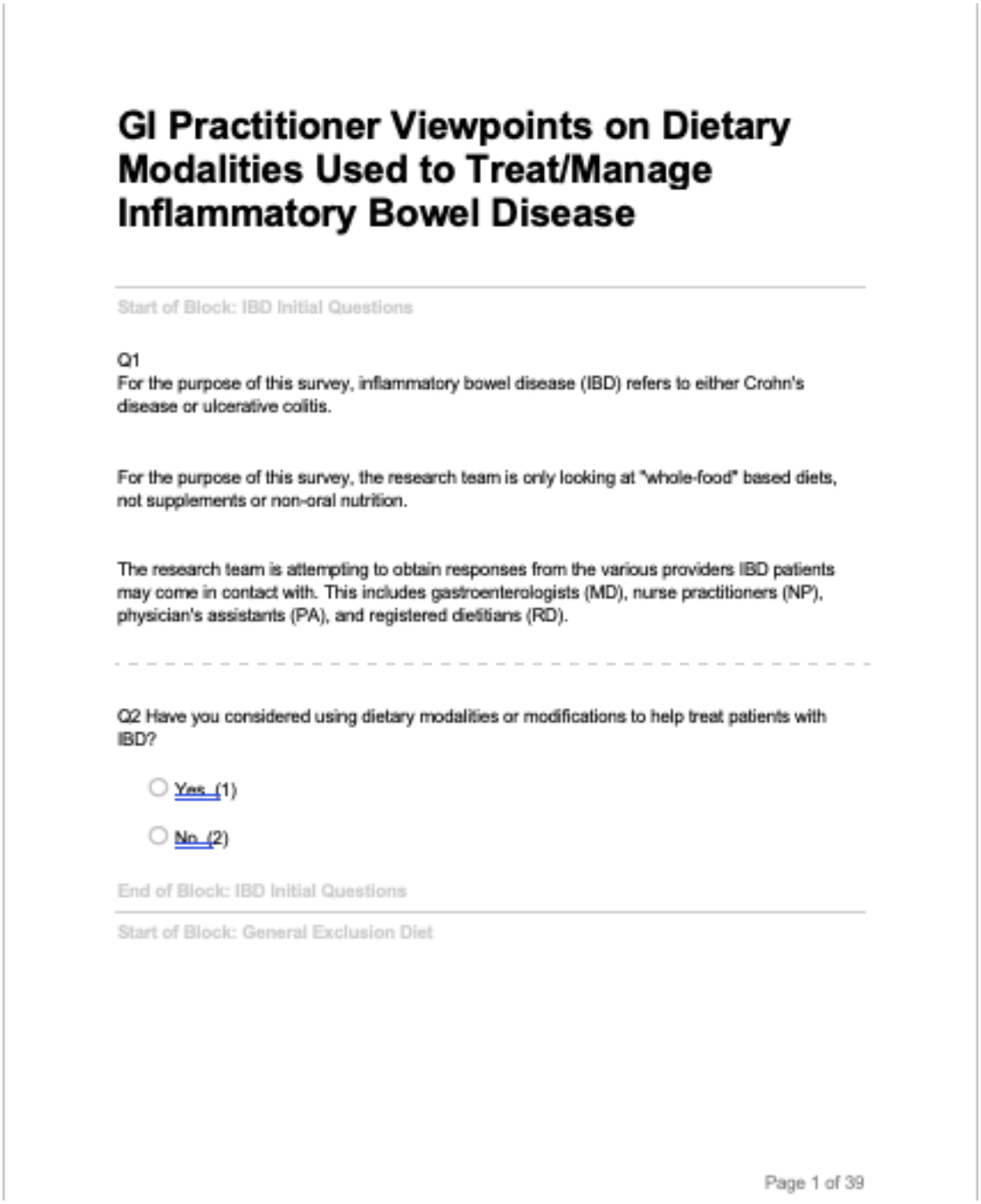
If you have any questions relating to the protection of human research participants, please contact the HRPP Office at irb@research.msstate.edu. We wish you success in carrying out your research project.

Review Type:	EXEMPT
IRB Number:	IORG0000467

Figure A.1 IRB Approval Letter

APPENDIX B

SURVEY



GI Practitioner Viewpoints on Dietary Modalities Used to Treat/Manage Inflammatory Bowel Disease

Start of Block: IBD Initial Questions

Q1
For the purpose of this survey, inflammatory bowel disease (IBD) refers to either Crohn's disease or ulcerative colitis.

For the purpose of this survey, the research team is only looking at "whole-food" based diets, not supplements or non-oral nutrition.

The research team is attempting to obtain responses from the various providers IBD patients may come in contact with. This includes gastroenterologists (MD), nurse practitioners (NP), physician's assistants (PA), and registered dietitians (RD).

Q2 Have you considered using dietary modalities or modifications to help treat patients with IBD?

- Yes (1)
- No (2)

End of Block: IBD Initial Questions

Start of Block: General Exclusion Diet

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Figure B.1 Survey Pages 1 - 39

Q3 Among the dietary modalities/modifications being researched for IBD, do you currently recommend a general exclusion diet?

	Never Heard Of / Do Not Recommend (1)	Heard Of But Do Not Recommend (2)	Recommend / Prescribe Occasionally (3)	Recommend / Prescribe Often (4)
General Exclusion Diet- one new food is introduced daily, and symptoms are tracked (1)	○	○	○	○

Skip To: End of Block If Among the dietary modalities/modifications being researched for IBD, do you currently recommend a... = General Exclusion Diet- one new food is introduced daily, and symptoms are tracked

Skip To: Q9 If Among the dietary modalities/modifications being researched for IBD, do you currently recommend a... =

Q4 Approximately what percent of IBD patients do you recommend a general exclusion diet to?

▼ 5% (1) ... 100% (20)

Q5 When you do recommend a general exclusion diet to your patients, on average, how would you rate your patients' ability (or self-efficacy) to comply with your recommendation?

- ○ Very difficult to comply (1)
- ○ Difficult to comply (2)
- ○ Somewhat difficult to comply (3)
- ○ Somewhat easy to comply (4)
- ○ Easy to comply (5)
- ○ Very easy to comply (6)

Figure B.1 (continued)

Q6 Among your patients who are not compliant with a general exclusion diet, what are some common barriers? Please rate the following.

	Not A Barrier (1)	Slight Barrier (2)	Moderate Barrier (3)	Extreme Barrier (4)
No desire to change (1)	○	○	○	○
Instructions are too difficult (lack of self-efficacy) (2)	○	○	○	○
Price of foods/ingredients (3)	○	○	○	○
Unpalatability of diet (4)	○	○	○	○
Not enough foods to satisfy hunger (5)	○	○	○	○
Lack of willpower (6)	○	○	○	○
Requires lengthy preparation (7)	○	○	○	○
Lack of cooking skills (8)	○	○	○	○
Feeling conspicuous among others (9)	○	○	○	○
Taste preferences among family and friends (10)	○	○	○	○

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Figure B.1 (continued)

Q7 Among the patients who are compliant with a general exclusion diet, when it has been successful, what do you feel has contributed to its success? Please rate the following.

	Did Not Contribute (1)	Slightly Contributed (2)	Moderately Contributed (3)	Strongly Contributed (4)
Changes were easy or simple to make (1)	○	○	○	○
Changes were inexpensive (2)	○	○	○	○
Changes were effective early on (3)	○	○	○	○
Changes were effective in the long run (4)	○	○	○	○
Palatability of diet (5)	○	○	○	○
Instructions were sent home with patient (6)	○	○	○	○
Patient had initial consultation with a registered dietitian (7)	○	○	○	○
Patient had follow up consultation(s) with a registered dietitian (8)	○	○	○	○

Figure B.1 (continued)

Q8 For patients who may be eligible, but for whom you don't recommend a general exclusion diet, please rate the following.

	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
Diet is too restrictive (5)	○	○	○	○
Diet involves too many changes at once (6)	○	○	○	○
Cost of food/ingredients is too expensive (7)	○	○	○	○
Perceived lack of patient interest (8)	○	○	○	○
Expectation of patient non-adherence (9)	○	○	○	○

Display This Question:

If Among the dietary modalities/modifications being researched for IBD, do you currently recommend a... = Heard Of But Do Not Recommend

Page 5 of 39

Figure B.1 (continued)

Q9 What best represents the reasons you do not recommend a general exclusion diet? Please rate the following.

	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
I don't have enough knowledge or training (1)	○	○	○	○
I don't believe the diet has efficacy (2)	○	○	○	○
I don't have time to cover with patients (3)	○	○	○	○
Lack of evidence or randomized control trials (4)	○	○	○	○
Diet is too restrictive (5)	○	○	○	○
Diet involves too many changes at once (6)	○	○	○	○
Cost of food/ingredients is too expensive (7)	○	○	○	○
Perceived lack of patient interest (8)	○	○	○	○
Expectation of patient non-adherence (9)	○	○	○	○

End of Block: General Exclusion Diet

Start of Block: IgG Targeted Exclusion Diet

Figure B.1 (continued)

Q10 Among the dietary modalities/modifications being researched for IBD, do you currently recommend an IgG targeted exclusion diet?

	Never Heard Of / Do Not Recommend (1)	Heard Of But Do Not Recommend (2)	Recommend / Prescribe Occasionally (3)	Recommend / Prescribe Often (4)
IgG Targeted Exclusion Diet - identify and eliminate foods that trigger an IgG mediated antibody response (1)	○	○	○	○

Skip To: End of Block If Among the dietary modalities/modifications being researched for IBD, do you currently recommend a... = IgG Targeted Exclusion Diet - identify and eliminate foods that trigger an IgG mediated antibody response

Skip To: Q16 If Among the dietary modalities/modifications being researched for IBD, do you currently recommend a... =

Q11 Approximately what percent of IBD patients do you recommend an IgG targeted exclusion diet to?

▼ 5% (1) ... 100% (20)

Figure B.1 (continued)

Q12 When you do recommend an IgG targeted exclusion diet to your patients, on average, how would you rate your patients' ability (or self-efficacy) to comply with your recommendation?

- ○ Very difficult to comply (1)
- ○ Difficult to comply (2)
- ○ Somewhat difficult to comply (3)
- ○ Somewhat easy to comply (4)
- ○ Easy to comply (5)
- ○ Very easy to comply (6)

Figure B.1 (continued)

Q13 Among your patients who are not compliant with an IgG targeted exclusion diet, what are some common barriers? Please rate the following.

	Not A Barrier (1)	Slight Barrier (2)	Moderate Barrier (3)	Extreme Barrier (4)
No desire to change (1)	○	○	○	○
Instructions are too difficult (lack of self-efficacy) (2)	○	○	○	○
Price of foods/ingredients (3)	○	○	○	○
Unpalatability of diet (4)	○	○	○	○
Not enough foods to satisfy hunger (5)	○	○	○	○
Lack of willpower (6)	○	○	○	○
Requires lengthy preparation (7)	○	○	○	○
Lack of cooking skills (8)	○	○	○	○
Feeling conspicuous among others (9)	○	○	○	○
Taste preferences among family and friends (10)	○	○	○	○

Figure B.1 (continued)

Q14 Among the patients who are compliant with an IgG targeted exclusion diet, when it has been successful, what do you feel has contributed to its success? Please rate the following.

	Did Not Contribute (1)	Slightly Contributed (2)	Moderately Contributed (3)	Strongly Contributed (4)
Changes were easy or simple to make (1)	○	○	○	○
Changes were inexpensive (2)	○	○	○	○
Changes were effective early on (3)	○	○	○	○
Changes were effective in the long run (4)	○	○	○	○
Palatability of diet (5)	○	○	○	○
Instructions were sent home with patient (6)	○	○	○	○
Patient had initial consultation with a registered dietitian (7)	○	○	○	○
Patient had follow up consultation(s) with a registered dietitian (8)	○	○	○	○

Figure B.1 (continued)

Q15 For patients who may be eligible, but for whom you don't recommend an IgG targeted exclusion diet, please rate the following.

	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
Diet is too restrictive (5)	○	○	○	○
Diet involves too many changes at once (6)	○	○	○	○
Cost of food/ingredients is too expensive (7)	○	○	○	○
Perceived lack of patient interest (8)	○	○	○	○
Expectation of patient non-adherence (9)	○	○	○	○

Display This Question:

If Among the dietary modalities/modifications being researched for IBD, do you currently recommend a... = Heard Of But Do Not Recommend

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Figure B.1 (continued)

Q16 What best represents the reasons you do not recommend an IgG targeted exclusion diet? Please rate the following.

	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
I don't have enough knowledge or training (1)	○	○	○	○
I don't believe the diet has efficacy (2)	○	○	○	○
I don't have time to cover with patients (3)	○	○	○	○
Lack of evidence or randomized control trials (4)	○	○	○	○
Diet is too restrictive (5)	○	○	○	○
Diet involves too many changes at once (6)	○	○	○	○
Cost of food/ingredients is too expensive (7)	○	○	○	○
Perceived lack of patient interest (8)	○	○	○	○
Expectation of patient non-adherence (9)	○	○	○	○

End of Block: IgG Targeted Exclusion Diet

Start of Block: Low Fiber / Low Residue

Figure B.1 (continued)

Q17 Among the dietary modalities/modifications being researched for IBD, do you currently recommend a low fiber or low residue diet?

	Never Heard Of / Do Not Recommend (1)	Heard Of But Do Not Recommend (2)	Recommend / Prescribe Occasionally (3)	Recommend / Prescribe Often (4)
Low Fiber or Low Residue Diet- restrict amount/types of fiber or residue in diet (1)	○	○	○	○

Skip To: End of Block If Among the dietary modalities/modifications being researched for IBD, do you currently recommend a... = Low Fiber or Low Residue Diet- restrict amount/types of fiber or residue in diet

Skip To: Q23 If Among the dietary modalities/modifications being researched for IBD, do you currently recommend a... =

Q18 Approximately what percent of IBD patients do you recommend a low fiber or low residue diet to?

▼ 5% (1) ... 100% (20)

Q19 When you do recommend a low fiber or low residue diet to your patients, on average, how would you rate your patients' ability (or self-efficacy) to comply with your recommendation?

- ○ Very difficult to comply (1)
- ○ Difficult to comply (2)
- ○ Somewhat difficult to comply (3)
- ○ Somewhat easy to comply (4)
- ○ Easy to comply (5)
- ○ Very easy to comply (6)

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Figure B.1 (continued)

Q20 Among your patients who are not compliant with a low fiber or low residue diet, what are some common barriers? Please rate the following.

	Not A Barrier (1)	Slight Barrier (2)	Moderate Barrier (3)	Extreme Barrier (4)
No desire to change (1)	○	○	○	○
Instructions are too difficult (lack of self-efficacy) (2)	○	○	○	○
Price of foods/ingredients (3)	○	○	○	○
Unpalatability of diet (4)	○	○	○	○
Not enough foods to satisfy hunger (5)	○	○	○	○
Lack of willpower (6)	○	○	○	○
Requires lengthy preparation (7)	○	○	○	○
Lack of cooking skills (8)	○	○	○	○
Feeling conspicuous among others (9)	○	○	○	○
Taste preferences among family and friends (10)	○	○	○	○

Figure B.1 (continued)

Q21 Among the patients who are compliant with a low fiber or low residue diet, when it has been successful, what do you feel has contributed to its success? Please rate the following.

	Did Not Contribute (1)	Slightly Contributed (2)	Moderately Contributed (3)	Strongly Contributed (4)
Changes were easy or simple to make (1)	○	○	○	○
Changes were inexpensive (2)	○	○	○	○
Changes were effective early on (3)	○	○	○	○
Changes were effective in the long run (4)	○	○	○	○
Palatability of diet (5)	○	○	○	○
Instructions were sent home with patient (6)	○	○	○	○
Patient had initial consultation with a registered dietitian (7)	○	○	○	○
Patient had follow up consultation(s) with a registered dietitian (8)	○	○	○	○

Figure B.1 (continued)

Q22 For patients who may be eligible, but for whom you don't recommend a low fiber or low residue diet, please rate the following.

	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
Diet is too restrictive (5)	○	○	○	○
Diet involves too many changes at once (6)	○	○	○	○
Cost of food/ingredients is too expensive (7)	○	○	○	○
Perceived lack of patient interest (8)	○	○	○	○
Expectation of patient non-adherence (9)	○	○	○	○

Display This Question:

If Among the dietary modalities/modifications being researched for IBD, do you currently recommend a... = Heard Of But Do Not Recommend

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Figure B.1 (continued)

Q23 What best represents the reasons you do not recommend a low fiber or low residue diet? Please rate the following.

	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
I don't have enough knowledge or training (1)	○	○	○	○
I don't believe the diet has efficacy (2)	○	○	○	○
I don't have time to cover with patients (3)	○	○	○	○
Lack of evidence or randomized control trials (4)	○	○	○	○
Diet is too restrictive (5)	○	○	○	○
Diet involves too many changes at once (6)	○	○	○	○
Cost of food/ingredients is too expensive (7)	○	○	○	○
Perceived lack of patient interest (8)	○	○	○	○
Expectation of patient non-adherence (9)	○	○	○	○

End of Block: Low Fiber / Low Residue

Start of Block: Low FODMAPS

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Figure B.1 (continued)

Q24 Among the dietary modalities/modifications being researched for IBD, do you currently recommend a low FODMAPS diet?

	Never Heard Of / Do Not Recommend (1)	Heard Of But Do Not Recommend (2)	Recommend / Prescribe Occasionally (3)	Recommend / Prescribe Often (4)
Low FODMAPS Diet - diet low in fermentable oligo, di, and monosaccharides and polyols (1)	○	○	○	○

Skip To: End of Block If Among the dietary modalities/modifications being researched for IBD, do you currently recommend a... = Low FODMAPS Diet - diet low in fermentable oligo, di, and monosaccharides and polyols

Skip To: Q30 If Among the dietary modalities/modifications being researched for IBD, do you currently recommend a... =

Q25 Approximately what percent of IBD patients do you recommend a low FODMAPS diet to?

▼ 5% (1) ... 100% (20)

Q26 When you do recommend a low FODMAPS diet to your patients, on average, how would you rate your patients' ability (or self-efficacy) to comply with your recommendation?

- ○ Very difficult to comply (1)
- ○ Difficult to comply (2)
- ○ Somewhat difficult to comply (3)
- ○ Somewhat easy to comply (4)
- ○ Easy to comply (5)
- ○ Very easy to comply (6)

Figure B.1 (continued)

Q27 Among your patients who are not compliant with a low FODMAPS diet, what are some common barriers? Please rate the following.

	Not A Barrier (1)	Slight Barrier (2)	Moderate Barrier (3)	Extreme Barrier (4)
No desire to change (1)	○	○	○	○
Instructions are too difficult (lack of self-efficacy) (2)	○	○	○	○
Price of foods/ingredients (3)	○	○	○	○
Unpalatability of diet (4)	○	○	○	○
Not enough foods to satisfy hunger (5)	○	○	○	○
Lack of willpower (6)	○	○	○	○
Requires lengthy preparation (7)	○	○	○	○
Lack of cooking skills (8)	○	○	○	○
Feeling conspicuous among others (9)	○	○	○	○
Taste preferences among family and friends (10)	○	○	○	○

Figure B.1 (continued)

Q28 Among the patients who are compliant with a low FODMAPS diet, when it has been successful, what do you feel has contributed to its success? Please rate the following.

	Did Not Contribute (1)	Slightly Contributed (2)	Moderately Contributed (3)	Strongly Contributed (4)
Changes were easy or simple to make (1)	○	○	○	○
Changes were inexpensive (2)	○	○	○	○
Changes were effective early on (3)	○	○	○	○
Changes were effective in the long run (4)	○	○	○	○
Palatability of diet (5)	○	○	○	○
Instructions were sent home with patient (6)	○	○	○	○
Patient had initial consultation with a registered dietitian (7)	○	○	○	○
Patient had follow up consultation(s) with a registered dietitian (8)	○	○	○	○

Figure B.1 (continued)

Q29 For patients who may be eligible, but for whom you don't recommend a low FODMAPS diet, please rate the following.

	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
Diet is too restrictive (5)	○	○	○	○
Diet involves too many changes at once (6)	○	○	○	○
Cost of food/ingredients is too expensive (7)	○	○	○	○
Perceived lack of patient interest (8)	○	○	○	○
Expectation of patient non-adherence (9)	○	○	○	○

Display This Question:

If Among the dietary modalities/modifications being researched for IBD, do you currently recommend a... = Heard Of But Do Not Recommend

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Figure B.1 (continued)

Q30 What best represents the reasons you do not recommend a low FODMAPS diet? Please rate the following.

	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
I don't have enough knowledge or training (1)	○	○	○	○
I don't believe the diet has efficacy (2)	○	○	○	○
I don't have time to cover with patients (3)	○	○	○	○
Lack of evidence or randomized control trials (4)	○	○	○	○
Diet is too restrictive (5)	○	○	○	○
Diet involves too many changes at once (6)	○	○	○	○
Cost of food/ingredients is too expensive (7)	○	○	○	○
Perceived lack of patient interest (8)	○	○	○	○
Expectation of patient non-adherence (9)	○	○	○	○

End of Block: Low FODMAPS

Start of Block: Specific Carbohydrate Diet

Figure B.1 (continued)

Q31 Among the dietary modalities/modifications being researched for IBD, do you currently recommend the Specific Carbohydrate Diet?

	Never Heard Of / Do Not Recommend (1)	Heard Of But Do Not Recommend (2)	Recommend / Prescribe Occasionally (3)	Recommend / Prescribe Often (4)
Specific Carbohydrate Diet (SCD) - elimination diet that restricts the types of carbohydrates a patients consumes (1)	○	○	○	○

Skip To: End of Block If Among the dietary modalities/modifications being researched for IBD, do you currently recommend t... = Specific Carbohydrate Diet (SCD) - elimination diet that restricts the types of carbohydrates a patients consumes

Skip To: Q37 If Among the dietary modalities/modifications being researched for IBD, do you currently recommend t... =

Q32 Approximately what percent of IBD patients do you recommend the Specific Carbohydrate Diet to?

▼ 5% (1) ... 100% (20)

Figure B.1 (continued)

Q33 When you do recommend the Specific Carbohydrate Diet to your patients, on average, how would you rate your patients' ability (or self-efficacy) to comply with your recommendation?

- ○ Very difficult to comply (1)
- ○ Difficult to comply (2)
- ○ Somewhat difficult to comply (3)
- ○ Somewhat easy to comply (4)
- ○ Easy to comply (5)
- ○ Very easy to comply (6)

Figure B.1 (continued)

Q34 Among your patients who are not compliant with the Specific Carbohydrate Diet, what are some common barriers? Please rate the following.

	Not A Barrier (1)	Slight Barrier (2)	Moderate Barrier (3)	Extreme Barrier (4)
No desire to change (1)	○	○	○	○
Instructions are too difficult (lack of self-efficacy) (2)	○	○	○	○
Price of foods/ingredients (3)	○	○	○	○
Unpalatability of diet (4)	○	○	○	○
Not enough foods to satisfy hunger (5)	○	○	○	○
Lack of willpower (6)	○	○	○	○
Requires lengthy preparation (7)	○	○	○	○
Lack of cooking skills (8)	○	○	○	○
Feeling conspicuous among others (9)	○	○	○	○
Taste preferences among family and friends (10)	○	○	○	○

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Figure B.1 (continued)

Q35 Among the patients who are compliant with the Specific Carbohydrate Diet, when it has been successful, what do you feel has contributed to its success? Please rate the following.

	Did Not Contribute (1)	Slightly Contributed (2)	Moderately Contributed (3)	Strongly Contributed (4)
Changes were easy or simple to make (1)	○	○	○	○
Changes were inexpensive (2)	○	○	○	○
Changes were effective early on (3)	○	○	○	○
Changes were effective in the long run (4)	○	○	○	○
Palatability of diet (5)	○	○	○	○
Instructions were sent home with patient (6)	○	○	○	○
Patient had initial consultation with a registered dietitian (7)	○	○	○	○
Patient had follow up consultation(s) with a registered dietitian (8)	○	○	○	○

Figure B.1 (continued)

Q36 For patients who may be eligible, but for whom you don't recommend the Specific Carbohydrate Diet, please rate the following.

	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
Diet is too restrictive (5)	○	○	○	○
Diet involves too many changes at once (6)	○	○	○	○
Cost of food/ingredients is too expensive (7)	○	○	○	○
Perceived lack of patient interest (8)	○	○	○	○
Expectation of patient non-adherence (9)	○	○	○	○

Display This Question:

If Among the dietary modalities/modifications being researched for IBD, do you currently recommend t... = Heard Of But Do Not Recommend

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Figure B.1 (continued)

Q37 What best represents the reasons you do not recommend the Specific Carbohydrate Diet? Please rate the following.

	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
I don't have enough knowledge or training (1)	○	○	○	○
I don't believe the diet has efficacy (2)	○	○	○	○
I don't have time to cover with patients (3)	○	○	○	○
Lack of evidence or randomized control trials (4)	○	○	○	○
Diet is too restrictive (5)	○	○	○	○
Diet involves too many changes at	○	○	○	○
food/ingredients is too expensive (7)	○	○	○	○
Perceived lack of patient interest (8)	○	○	○	○
Expectation of patient non-adherence (9)	○	○	○	○

Double-click to hide white space

End of Block: Specific Carbohydrate Diet

Start of Block: Other Diet

Figure B.1 (continued)

Q38 Do you currently recommend any other "whole-food" based dietary modalities/modifications to help treat patients with IBD?

- ○ Yes (1)
- ○ No (2)

Skip To: End of Block If Do you currently recommend any other "whole-food" based dietary modalities/modifications to help... = No

Q39 What is the name of this dietary modality/modification?

_____

Q40 Approximately what percent of IBD patients do you recommend a ${Q39/ChoiceTextEntryValue} diet to?

▼ 5% (1) ... 100% (20)

Q41 When you do recommend a ${Q39/ChoiceTextEntryValue} diet to your patients, on average, how would you rate your patients' ability (or self-efficacy) to comply with your recommendation?

- ○ Very difficult to comply (1)
- ○ Difficult to comply (2)
- ○ Somewhat difficult to comply (3)
- ○ Somewhat easy to comply (4)
- ○ Easy to comply (5)
- ○ Very easy to comply (6)

Figure B.1 (continued)

Q42 Among your patients who are not compliant with a ${Q39/ChoiceTextEntryValue} diet, what are some common barriers? Please rate the following.

	Not A Barrier (1)	Slight Barrier (2)	Moderate Barrier (3)	Extreme Barrier (4)
No desire to change (1)	○	○	○	○
Instructions are too difficult (lack of self-efficacy) (2)	○	○	○	○
Price of foods/ingredients (3)	○	○	○	○
Unpalatability of diet (4)	○	○	○	○
Not enough foods to satisfy hunger (5)	○	○	○	○
Lack of willpower (6)	○	○	○	○
Requires lengthy preparation (7)	○	○	○	○
Lack of cooking skills (8)	○	○	○	○
Feeling conspicuous among others (9)	○	○	○	○
Taste preferences among family and friends (10)	○	○	○	○

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Figure B.1 (continued)

Q43 Among the patients who are compliant with a ${Q39/ChoiceTextEntryValue} diet, when it has been successful, what do you feel has contributed to its success? Please rate the following.

	Did Not Contribute (1)	Slightly Contributed (2)	Moderately Contributed (3)	Strongly Contributed (4)
Changes were easy or simple to make (1)	○	○	○	○
Changes were inexpensive (2)	○	○	○	○
Changes were effective early on (3)	○	○	○	○
Changes were effective in the long run (4)	○	○	○	○
Palatability of diet (5)	○	○	○	○
Instructions were sent home with patient (6)	○	○	○	○
Patient had initial consultation with a registered dietitian (7)	○	○	○	○
Patient had follow up consultation(s) with a registered dietitian (8)	○	○	○	○

Figure B.1 (continued)

Q44 For patients who may be eligible, but for whom you don't recommend ${Q39/ChoiceTextEntryValue}, please rate the following.

	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
Diet is too restrictive (5)	○	○	○	○
Diet involves too many changes at once (6)	○	○	○	○
Cost of food/ingredients is too expensive (7)	○	○	○	○
Perceived lack of patient interest (8)	○	○	○	○
Expectation of patient non-adherence (9)	○	○	○	○

End of Block: Other Diet

Start of Block: Additional Information

Q45 Is there anything else you would like to tell us about the role of nutrition and dietetic modalities/modifications as a treatment for IBD?

_____

_____

_____

_____

_____

End of Block: Additional Information

Start of Block: Practitioner Information

Figure B.1 (continued)

Q46 What is your year of birth?

▼ 2000 (1) ... 1921 (91)

Q47 What is your gender?

- ○ Male (1)
- ○ Female (2)

Q48 Which of the following best describes your race?

- ○ White (1)
- ○ Black or African American (2)
- ○ Asian (4)
- ○ Hispanic/Latino (8)
- ○ Native American (3)
- ○ Other (7) _____

Q49 How many years have you practiced in the field of gastroenterology?

▼ 1 (1) ... 75 (75)

Q50 Which state do you currently practice in the majority of the time?

▼ Alabama (6) ... Wyoming (51)

Figure B.1 (continued)

Figure B.1 (continued)

Q51 If you practice in any other states, please select those below.

- [ ] Alabama (6)
- [ ] Alaska (5)
- [ ] Arizona (3)
- [ ] Arkansas (4)
- [ ] California (2)
- [ ] Colorado (1)
- [ ] Connecticut (8)
- [ ] Delaware (9)
- [ ] Florida (10)
- [ ] Georgia (11)
- [ ] Hawaii (12)
- [ ] Idaho (13)
- [ ] Illinois (14)
- [ ] Indiana (15)
- [ ] Iowa (16)
- [ ] Kansas (17)

Figure B.1 (continued)

Figure B.1 (continued)

- [ ] North Carolina (34)
- [ ] North Dakota (35)
- [ ] Ohio (36)
- [ ] Oklahoma (37)
- [ ] Oregon (38)
- [ ] Pennsylvania (39)
- [ ] Rhode Island (40)
- [ ] South Carolina (41)
- [ ] South Dakota (42)
- [ ] Tennessee (43)
- [ ] Texas (44)
- [ ] Utah (45)
- [ ] Vermont (46)
- [ ] Virginia (47)
- [ ] Washington (48)
- [ ] West Virginia (49)

Figure B.1 (continued)

☐ Wisconsin (50)

☐ Wyoming (51)

Q52 Which of the following best describes the setting you practice in? Please select all that apply.

☐ Office-Based Multi-Specialty Group Practice (1)

☐ Office-Based Single Specialty Group Practice (2)

☐ Office-Based Solo Practice (5)

☐ Teaching Hospital or Clinic (6)

☐ Government/Military (9)

☐ Other (10) _____

Figure B.1 (continued)

Q53 Which best describes your profession?

- ☐ Gastroenterologist (MD) (1)
- ☐ Physician's Assistant (2)
- ☐ Nurse Practitioner (3)
- ☐ Registered Dietitian (4)
- ☐ Other (5) _____

End of Block: Practitioner Information

Figure B.1 (continued)

APPENDIX C

LIST OF CONTACTS

Table C.1 List of Contacts

Contact	Title	Affiliation	State
Contact 1	MD	FIFTH AVENUE GI	NY
Contact 2	RD	New York Presbyterian Hospital	NY
Contact 3	PhD	Montclair State University	NJ
Contact 4	RD	Outside In Nutrition	GA
Contact 5	RD	Healthy Regards, LLC	MS
Contact 6	RD	Gulfport Memorial Hospital	MS
Contact 7	PhD	Mississippi State University	MS
Contact 8	RD	Mt. Sinai Hospital	NY
Contact 9	RD	Mt. Sinai Hospital	NY
Contact 10	RD	Valley Hospital	NJ
Contact 11	RD	Saka Diet LLC	NY
Contact 12	Executive Administrator	Dietitians in Integral and Functional Medicine	Washington, DC

APPENDIX D

SAMPLE EMAIL

Dear _____

My name is Eytan Stern, RDN, LDN, and I am currently a graduate student at Mississippi State University. For my thesis research, I am seeking the perspectives of at least 100 participants who treat patients with inflammatory bowel disease (including physicians, nurse practitioners, physicians' assistants, and registered dietitians) regarding certain dietary modalities used in their treatment.

I kindly ask for your participation by clicking on the survey link below. The survey will take approximately 15 minutes to complete, and your response is completely anonymous.

If you agree to fill out this survey, it will serve as your consent for taking part in this study.

https://msudafvm.co1.qualtrics.com/jfe/form/SV_401hANIm3ImMdH7

I greatly appreciate your participation, and hope you have a wonderful day.

Sincerely,

Eytan

Eytan Ish Stern, RDN, LDN
Graduate Assistant - Mississippi State University Health Promotion and Wellness
eis28@msstate.edu
(201) 873-0000

Figure D.1 Sample Email