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The Effects of a Low FODMAP Diet on People with Irritable Bowel Syndrome: A Literature Review

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Abstract

Irritable Bowel Syndrome (IBS) is a very common gastrointestinal disorder around the world. There is no known etiology or cure for the disorder, which leaves researchers to develop coping mechanisms for this prevalent issue. A high percentage (10%-15%) of the general population, mostly in Western, industrialized areas, suffer from IBS. A low FODMAP diet (LFD) is something that has been gaining a following over the past 20 years, which has led to research on its ability to minimize symptoms of IBS. The purpose of this literature review is to see what current research has to offer on the LFD's ability to lessen IBS symptoms, including physical, mental, and quality of life (QoL) aspects. A total of 19 articles that pertained to this topic were selected to see if there is any consensus on the LFD's efficacy. The results of these articles show that the LFD decreases gastrointestinal (GI) symptoms of IBS significantly if followed correctly. The LFD also increases patients' QoL, as well as decreases IBS related anxiety, depression, and fatigue. Decreased visits to a provider for IBS related symptoms were also reported. The LFD should be taught correctly to gastroenterologists, medical professionals, and patients with IBS in order to help those with the disorder cope with symptoms that can be very disruptive to their daily lives.

Introduction

Irritable Bowel Syndrome (IBS) is a prevalent functional bowel disorder that is increasing around the world at an alarming rate. Anywhere from 25 to 45 million people in the United States alone have been diagnosed with IBS (Providence, 2022). Although IBS is nonfatal, the disorder disrupts quality of life (QoL), relationships, and productivity, not to mention the socioeconomic burden on those trying to treat the disorder. Some of the symptoms of IBS are constipation, diarrhea, abdominal pain, bloating, gas, anxiety, depression, and a decreased QoL (Quigley, 2021). These symptoms are very unpredictable and can easily disrupt the daily lives and activities of those who suffer with the disorder. IBS now qualifies as a disability in the United States, which shows just how disruptive and difficult it can be to someone's personal and professional lifestyle. There is no known cure for IBS at this time, which means coping mechanisms and symptom improvement are of huge importance. Some evidence suggests that different diets, exercise, yoga, medications, and lifestyles can help relieve symptoms (Providence, 2022). However, IBS affects everyone differently which makes it hard to determine a singularly effective way to keep symptoms at bay.

A systematic review is necessary to see what current research has to offer, and possibly more importantly, what current research is lacking. There is little concrete evidence on proven ways to lessen the symptoms of IBS. A lot of research is inconclusive or contradicted by other research, partly because IBS is so individualized (Quigley, 2021). Hopefully as more and more research is performed and published, trends will emerge about how to treat IBS symptoms in ways that are effective for the majority of those who suffer from the disorder. The question created to appraise these studies is: In patients with a diagnosis of IBS, how does a low FODMAP diet (LFD) compared with a free reign diet affect the patients' perceived symptoms of

IBS within their normal daily living? Some researchers believe that a low FODMAP diet can help alleviate some of the symptoms associated with IBS. FODMAP stands for Fermentable Oligosaccharides, Disaccharides, Monosaccharides, and Polyols (Quigley, 2021). Researchers from Monash University, the creators of the LFD, describe how the different phases of the diet work in detail. The goal of this diet is to first eliminate all FODMAPs from the diet for two to six weeks. This is called the Restriction Phase. The next eight to 12 weeks is called the Reintroduction Phase. During this phase, the individual begins to reintroduce one type of FODMAP into their diet at a time, for three days in a row. At the end of those three days, they decide if their body can tolerate that type of FODMAP. The participant completes this phase for each type of FODMAP. The last phase is the Personalization Phase. During this phase they decide what FODMAPs they can tolerate and then add them back into their diet. This allows for a more diverse diet and makes it easier to acquire the nutrition the human body needs (Monash, 2019).

Methods

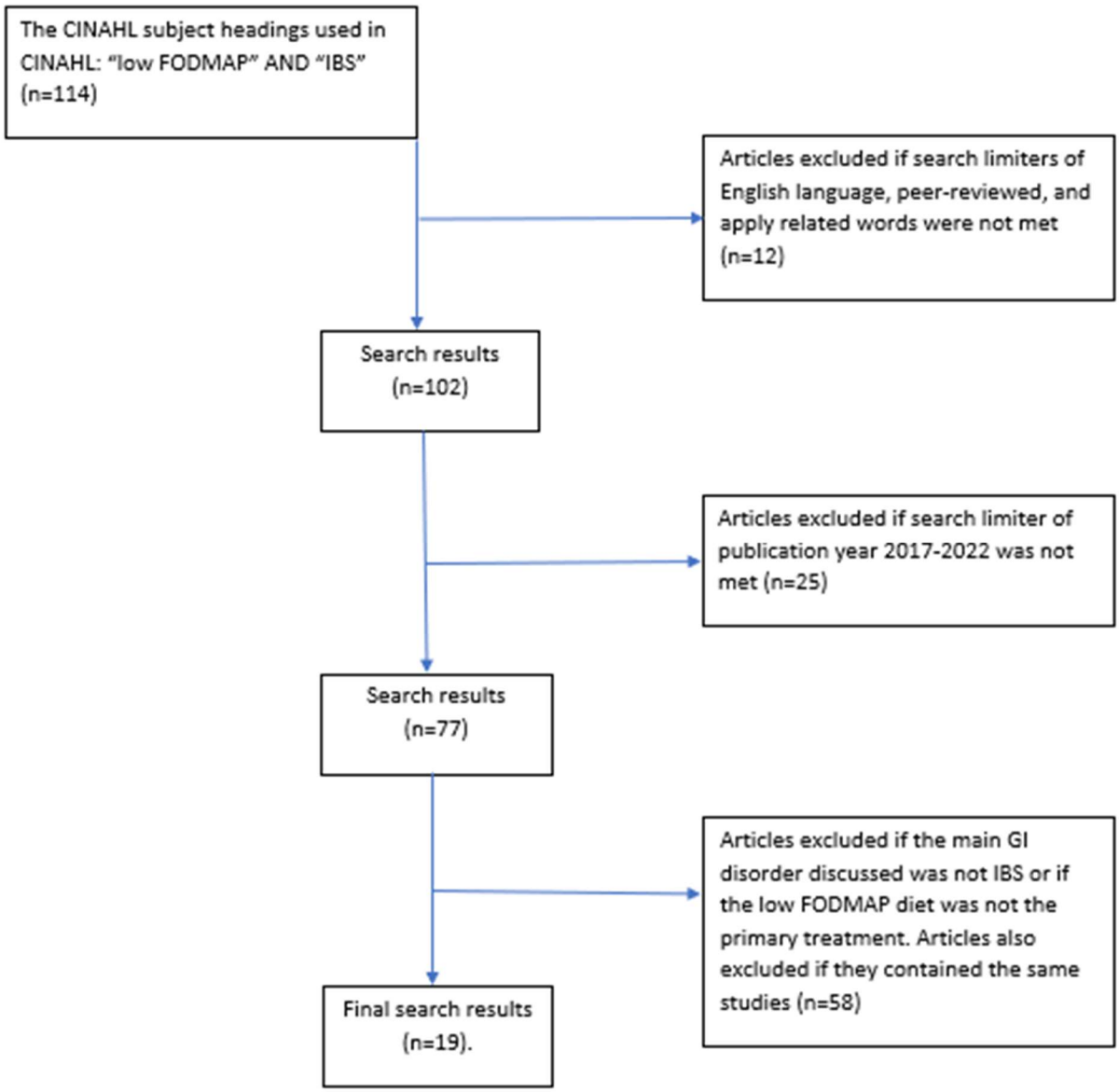
A thorough review of literature was completed using CINAHL. A health sciences librarian at the University of Arkansas provided guidance and expertise for navigating the database and finding relevant research articles that met the inclusion criteria. The keywords used in all searches were: *low FODMAP and IBS.* The inclusion criteria for the CINAHL database search were articles that contained the keywords, English language, and peer reviewed. Excluded from the literature review were articles published before 2017. When searching CINAHL, a total of 114 articles populated based on the keywords. Twelve articles were excluded based on the premise that they were either not written in English, were not peer-reviewed, or did not include both keywords. Twenty-five more articles were excluded due to the fact that they were published

before 2017. Lastly, 58 more articles were excluded since the main gastrointestinal (GI) disorder discussed was not IBS or if the low FODMAP diet was not the primary treatment, as well as any articles that contained the same studies. Once the articles were reviewed, a total of 19 relevant articles were chosen to be included in this expanded literature review.

A wide variety of countries were used to gather research to obtain a diversified worldview of the LFD and IBS treatment. Of the 18 articles, five are from Italy, two are from the United States of America (USA), two are from the United Kingdom, and one article each is from the following countries: Korea, Finland, Thailand, Iran, China, Ireland, Portugal, New Zealand, and Belgium. Although five articles originated from Italy, each article brought different information to the review. Different scales and scoring systems for assessing symptoms were used in each article. Different types of studies, including controlled intervention studies, qualitative studies, and meta-analyses, were used to ensure a diversified view of Italy's research. The two articles originating from the United Kingdom differed from each other in the way that one article dealt with the short-term effects of a LFD, whereas the other article focused on long term effects of a LFD. Lastly, one article from the USA was a systematic review while the other article was a meta-analysis.

Figure 1

Data Search Chart



Results

Physical Symptoms Improvement

Common physical symptoms caused by IBS are abdominal pain, abdominal discomfort, stool urgency, stool frequency, stool consistency, gas, belching, bloating, and lethargy. These symptoms can easily cause disruptions to daily living and have a tendency to come and go at random intervals. The Visual Analogue Scale (VAS) and IBS Symptom Severity Scoring (IBS-SSS) questionnaire were used to determine the type and prevalence of physical symptoms.

Abdominal Pain, Abdominal Discomfort, and Fatigue

All articles reviewed concluded that abdominal pain and abdominal discomfort severity significantly decreased from baseline for those following a LFD, but not for those following a normal diet (Patcharatrakul et al., 2019; Paduano et al., 2019; Seamark et al., 2021; Nawawi et al., 2020; Altobelli et al., 2017; Weynants et al., 2020).

Bloating, Gas, Belching, Heartburn, and Acid Regurgitation

Those who followed the LFD reported significantly less symptoms of bloating and gas compared to when they were on a traditional diet (Patcharatrakul et al., 2019; Paduano et al., 2019; Seamark et al., 2021; Zhang et al., 2021; Nawawi et al., 2020; Altobelli et al., 2017). However, no difference in belching frequency between the LFD group and traditional diet group was seen **(**Patcharatrakul et al., 2019). In one study, physical symptoms were reported less frequently in the long term except for heartburn and acid regurgitation (Seamark et al., 2021).

Stool Urgency, Stool Consistency, and Stool Frequency

Two groups of researchers determined that stool urgency, stool consistency, and stool frequency between those following the LFD and those following a traditional diet did not change significantly (Patcharatrakul et al., 2019; Altobelli et al., 2017). While another group of researchers found that stool urgency was reduced by 49% and symptomatic improvement of stool frequency was achieved after following a LFD (Zhang et al., 2021).

General Physical Symptoms

Based on a systematic review of five pediatric LFD studies, the LFD reduces the severity of one or more GI symptoms in about one quarter to one half of pediatric patients (age 4-19) with IBS (Fisher et al., 2020). After six weeks of participants following a LFD during a clinical trial, it was determined that 22 out of 30 patients (73.3%) with IBS had a significant reduction (30-60%) in their physical symptoms related to IBS (Naseri et al., 2021). Visits to a provider for symptoms also decreased from 96% to 34% (Seamark et al., 2021). Majority of participants (66%) were satisfied with their overall physical symptom control when following an LFD (Nawawi et al., 2020).

Mental Symptoms Improvement

IBS is associated with increased psychological distress inducing anxiety and depression. These non-GI symptoms of IBS have been shown to play a significant role in the morbidity experienced by IBS patients (Kortlever et al., 2019). The prevalence of anxiety and depression in IBS patients is 31.4% and 37.1% respectively (Prospero et al., 2021). The Hospital and Depression Scale (HADS), Pittsburgh Sleep Quality Index (PSQI), State-Trait Personality Inventory (psychological indices concerning depression and anxiety), Karolinska Sleep Questionnaire (sleep quality and quantity), and the Happiness Measures were used to determine the impact that a LFD had on anxiety, depression, and sleep quality/quantity.

Anxiety

Anxiety symptoms significantly improved from baseline at each check mark throughout two LFD studies (Bellini et al., 2020; Kortlever et al., 2019). Stress caused by IBS symptoms also significantly decreased compared to baseline for those following the LFD (Prospero et al., 2021).

Depression

Bellini et al. (2020) found significant improvement in depressive symptoms for those who followed the LFD. In another study, improvements for depression were seen in about half of participants (Kortlever et al., 2019).

Sleep Quality/Quantity

At the beginning of two studies, the majority of participants rated their sleep as having "insufficient quality and quantity". The scores at each checkup after starting the LFD improved slightly, but not significantly. This means that the LFD did not significantly help participants get a better night's sleep (Bellini et al., 2020; Kortlever et al., 2019).

Quality of Life Improvement

IBS is a disorder that has a chronic nature of recurrent and exacerbating symptoms. These symptoms negatively affect QoL, work productivity, and social functioning. QoL for those dealing with IBS is mostly measured by an IBS-QoL questionnaire. This questionnaire consists of 34 IBS specific topics with eight subcategories: dysphoria, interference with daily activities, body image, health worry, food avoidance, social reaction, sexual function, and relationships. The questionnaire is scored on a zero to 100 scale, with increasing scores indicating a better quality of life (Hahn et al., 2021).

The LFD reduced IBS severity to a moderate to large extent and also increased QoL scores when compared with a control diet (Hahn et al., 2021; Orlando et al., 2020). In one study, those who participated in a LFD scored a mean IBS-QoL score of 68 at week one. However, during week 12 the mean IBS-QoL score was 74. A six-point increase was noted after 12 weeks of following an IBS diet, which is considered significant (Laatikainen et al., 2020). A qualitative study involving 36 participants with a mean age of 39 showed that when participants reduced

their consumption of FODMAPs from 22.1 grams to 2 grams ($p < 0.001$) a mean increase of 28.7 points was noted in the IBS-QoL questionnaire, which achieved major significance ($p < 0.001$) (Cardoso et al., 2020).

Table 1

Article Data Extraction Chart

Authors	Date	Location	Type of Study	Key Findings
Bellini, M., Tonarelli, S., Barracca, F., Morganti, R., Pancetti, A., Bertani, L., de Bortoli, N., Costa, F., Mosca, M., Marchi, S., & Rossi, A.	2020	Italy	Qualitative study	A LFD improves the GI symptoms of IBS patients, their quality of life, and their anxiety and depressive symptoms in the short and long term.
Hahn, J., Choi, J., & Chang, M. J.	2021	Korea	Meta analysis	The LFD group showed a moderate reduction in the severity of their symptoms. They also showed an improvement in their quality of life and a significant decrease in stool frequency.
Laatikainen, R., Poussa, T., Koskenpato, J., Hillilä, M., Loponen, J., Hongisto, S.-M., & Korpela, R.	2020	Finland	Non-controlled intervention study	Those on a LFD had reduced symptoms based on a symptom severity scoring system (IBS-SSS) and had an improved quality of life compared to those on a regular diet.

Patcharatrakul, T., Juntrapirat, A., Lakananurak, N., & Gonlachanvit, S.	2019	Thailand	Randomized control trial	Those who followed the LFD saw a significant improvement in IBS symptoms and a lower intestinal H2 production.
Paduano, D., Cingolani, A., Tanda, E., & Usai, P.	2019	Italy	Qualitative study	Using the Bristol Stool Scale, the Visual Analogue Scale, and the SF12 questionnaire related to quality of life, the IBS diet reduced symptom severity, bloating, and abdominal pain significantly.
Fisher, K., Hutcheon, D., & Ziegler, J.	2020	United States of America	Systematic review	The studies showed that the elimination of FODMAPs reduced the severity of one or more GI symptoms in those with IBS.
Orlando, A., Tutino, V., Notarnicola, M., Riezzo, G., Linsalata, M., Clemente, C., Prospero, L., Martulli, M., D'Attoma, B., De Nunzio, V., & Russo, F.	2020	Italy	Controlled intervention study	After 90 days on the LFD, participants scored their abdominal pain, abdominal distension, bowel habits, general interference with life, and stool frequency. Those on the LFD had scores that showed that their symptoms were significantly reduced.
Naseri, K., Dabiri, H., Rostami-Nejad, M., Yadegar, A., Houri, H., Olfatifar, M., Sadeghi, A., Saadati, S., Ciacci, C., Iovino, P., & Zali, M. R.	2021	Iran	Clinical trial study	IBS-SSS was significantly reduced in those following the LFD compared to a generic diet. Normalization of gut microbiota composition also occurred on the LFD.

Dimidi, E., Rossi, M., & Whelan, K.	2017	United Kingdom	Systematic review	It is clear that a LFD has a beneficial effect in the majority of patients with IBS.
Seamark, L., Barclay, Y., Marchant, C., Williams, M., & Hickson, M.	2021	United Kingdom	Service evaluation	For those on a LFD, all symptoms were reported significantly less frequently in the short term, and all symptoms except heartburn and acid regurgitation were reported less frequently in the long term. Symptoms reduced in frequency were abdominal pain (62%), bloating (50%), increased wind (48%) and urgency to open bowels (49%). Visits to a provider for symptoms also decreased by 96% to 34%.
Zhang, Y., Feng, L., Wang, X., Fox, M., Luo, L., Du, L., Chen, B., Chen, X., He, H., Zhu, S., Hu, Z., Chen, S., Long, Y., Zhu, Y., Xu, L., Deng, Y., Misselwitz, B., Lang, B. M., Yilmaz, B., & Kim, J. J.	2021	China	Randomized controlled trial	LFD group achieved earlier symptomatic improvement in stool frequency and flatulence than those following a traditional diet.
Quigley, E. M. M.	2021	United States of America	Meta-analysis	Explains what IBS is, how it affects daily living, and symptoms of the disorder.

Nawawi, K. N. M., Belov, M., & Goulding, C.	2020	Ireland	Qualitative study	Four-point Likert scale used to evaluate for IBS symptoms. 66% of patients were satisfied with their overall symptom control while on the LFD. The best symptom improvement was shown in those who were fully adherent to the LFD.
Cardoso, F., Azevedo, M., Oliveira, B., Poínhos, R., Carvaho, J., Almeida, R., & Correia, F.	2020	Portugal	Qualitative study	IBS-GAI (Irritable Bowel Syndrome – Global Assessment Scale), IBS-QoL, and IBS-SSS scales utilized. On the LFD there was a significant improvement in GI symptoms and quality of life for the majority of the patients in the study.
Altobelli, E., Del Negro, V., Angeletti, P. M., & Latella, G.	2017	Italy	Meta-analysis	Those on the LFD experienced significantly less pain and bloating compared to those on a traditional diet.
Kortlever, T. L., Ten Bokkel Huinink, S., Offereins, M., Hebblethwaite, C., O'Brien, L., Leeper, J., Mulder, C. J. J., Barrett, J. S., & Gearry, R. B.	2019	New Zealand	Prospective observational study	LDF led to significant improvements in QOL, GI symptoms, fatigue, and anxiety and depression related to their condition. FIS (Fatigue Impact Scale), GSRS (Gastrointestinal Symptom Rating Scale), and IBS-QOL scale used.

Prospero, L., Riezzo, G., Linsalata, M., Orlando, A., D'Attoma, B., & Russo, F.	2021	Italy	Qualitative study	IBS-SSS, Symptom Checklist-90-Revised, 36-Item Short-Form Health Survey, IBS-QoL, and the Psychophysiological questionnaire were administered. At the end of the LFD, GI symptoms, psychological state, and QoL significantly improved.
Weynants, A., Goossens, L., Genetello, M., De Looze, D., & Van Winckel, M.	2020	Belgium	Retrospective cross-sectional study	89% of patients were satisfied that they follow the LFD for management of IBS symptoms. Those on a LFD experienced less abdominal pain as well.
Slomski, A.	2020	United States of America	Meta-analysis	77% of gastroenterologists surveyed recommended a LFD to those with IBS.

Discussion

Summary of Findings

Researchers agree that the LFD improves physical symptoms of IBS, such as abdominal pain, abdominal discomfort, stool urgency, stool frequency, stool consistency, gas, belching, bloating, and lethargy. The LFD also decreases IBS related anxiety and depression but does not improve sleep quality and sleep quantity. QoL was significantly improved for those who followed a LFD rather than a traditional diet. Decreased visits to a provider for IBS related symptoms were also reported. Seventy-seven percent of gastroenterologists surveyed recommended the LFD to those with IBS (Slomski, 2020).

Study Limitations

One study limitation is that the articles were selected if they were published between 2017 and 2022. The LFD was created in 2005, meaning that results from the first 12 years of the diet's creation are not included in this review. This makes it difficult to trend data throughout the years and see what improvements or new findings have arisen since the year the diet was created.

Another limitation is that six of the 19 articles chosen are meta-analyses and systematic reviews. The goal was to have all primary sources for this review. However, there were limited primary sources related to the specific research question since the LFD was created only 17 years ago. For this reason, augmentation with meta-analyses and systematic reviews was needed to obtain a fuller view of the LFD in relation to IBS that primary sources alone could not offer.

Gaps and Controversies in the Literature

One issue with the low FODMAP diet is that it can be overly restrictive and cause nutritional deficits. Some people may be sensitive to many of the FODMAP categories and may not be able to add many of them back into their diet permanently during the Personalization Phase. The LFD requires substitution or elimination of foods across many food groups. This causes the potential for inadequate intake of specific nutrients, particularly carbohydrates, fiber, iron, B vitamins, and calcium (Staudacher, 2017). It is important to work with a dietitian while on a LFD to ensure that the body is receiving enough nutrients and that the diet is safe for an individual.

Further studies are needed to establish the long-term effects and safety of the LFD for IBS. Most of the literature reviewed in this paper had participants follow a LFD anywhere from four to 52 weeks. Past 52 weeks, not much is known on the effectiveness and safety of the diet. It is not known if following the LFD long term leads to nutritional deficits since many essential nutrients are eliminated during the diet. The effectiveness of the LFD in the pediatric population

is also insufficiently researched. These are just some of the gaps in the literature that the research community needs to be investigating so that they can start new trials and studies to solve these unknowns.

Implications for Nursing Practice

Based on the results, the LFD should be taught correctly to gastroenterologists, medical professionals, and patients with IBS in order to help those with the disorder cope with symptoms that can be very disruptive to their daily lives. Patients need a more personal control when it comes to symptom management, and the LFD can offer that based on the research. Nurses in all areas of healthcare should be taught to recognize the symptoms of IBS. This way, they can partner with clinic and hospital providers, nutritionists, and gastroenterologists to discuss the effects that the LFD may have on the patient to alleviate some of their IBS symptoms.

References

Altobelli, E., Del Negro, V., Angeletti, P. M., & Latella, G. (2017). Low-FODMAP diet improves irritable bowel syndrome symptoms: A meta-analysis. *Nutrients, 9(9), 940.* https://doi.org/10.3390/nu9090940

Bellini, M., Tonarelli, S., Barracca, F., Morganti, R., Pancetti, A., Bertani, L., de Bortoli, N., Costa, F., Mosca, M., Marchi, S., & Rossi, A. (2020). A low-FODMAP diet for irritable bowel syndrome: Some answers to the doubts from a long-term follow-up. *Nutrients, 12(8), 2360.* https://doi.org/10.3390/nu12082360

Cardoso, F., Azevedo, M., Oliveira, B., Poínhos, R., Carvaho, J., Almeida, R., & Correia, F. (2020). Low-FODMAP diet and its role in irritable bowel syndrome (IBS) management. *Proceedings of the Nutrition Society, 79(OCE2), 1.* https://doi.org/10.1017/S0029665120000956

Dimidi, E., Rossi, M., & Whelan, K. (2017). Irritable bowel syndrome and diet: Where are we in 2018? *Current Opinion in Clinical Nutrition & Metabolic Care, 20(5), N.PAG.* https://doi.org/10.1097/MCO.0000000000000416

Fisher, K., Hutcheon, D., & Ziegler, J. (2020). Elimination of fermentable carbohydrates to reduce gastrointestinal symptoms in pediatric patients with irritable bowel syndrome: A narrative review. *Nutrition in Clinical Practice, 35(2), 231–245.* https://doi.org/10.1002/ncp.10269

Hahn, J., Choi, J., & Chang, M. J. (2021). Effect of low FODMAPs diet on irritable bowel syndromes: A systematic review and meta-analysis of clinical trials. *Nutrients, 13(7), 2460.* https://doi.org/10.3390/nu13072460

Kortlever, T. L., Ten Bokkel Huinink, S., Offereins, M., Hebblethwaite, C., O'Brien, L., Leeper,

J., Mulder, C. J. J., Barrett, J. S., & Gearry, R. B. (2019). Low-FODMAP diet is associated with improved quality of life in IBS patients—A prospective observational study. *Nutrition in Clinical Practice, 34(4), 623–630.* https://doi.org/10.1002/ncp.10233

Laatikainen, R., Poussa, T., Koskenpato, J., Hillilä, M., Loponen, J., Hongisto, S.-M., & Korpela, R. (2020). Effect of low-FODMAP diet in Finnish IBS patients. Results from non-controlled 12-week intervention study. *Proceedings of the Nutrition Society, 79(OCE2), 1.* https://doi.org/10.1017/S0029665120003535

Monash University. (2019). Starting the FODMAP diet. https://www.monashfodmap.com/ibs-central/i-have-ibs/starting-the-low-fodmap-diet/

Naseri, K., Dabiri, H., Rostami-Nejad, M., Yadegar, A., Houri, H., Olfatifar, M., Sadeghi, A., Saadati, S., Ciacci, C., Iovino, P., & Zali, M. R. (2021). Influence of low FODMAP-gluten free diet on gut microbiota alterations and symptom severity in Iranian patients with irritable bowel syndrome. *BMC Gastroenterology, 21(1), 1–14.* https://doi.org/10.1186/s12876-021-01868-5

Nawawi, K. N. M., Belov, M., & Goulding, C. (2020). Low FODMAP diet significantly improves IBS symptoms: an Irish retrospective cohort study. *European Journal of Nutrition, 59(5), 2237–2248.* https://doi.org/10.1007/s00394-019-02074-6

Orlando, A., Tutino, V., Notarnicola, M., Riezzo, G., Linsalata, M., Clemente, C., Prospero, L., Martulli, M., D'Attoma, B., De Nunzio, V., & Russo, F. (2020). Improved symptom profiles and minimal inflammation in IBS-D patients undergoing a long-term low-FODMAP diet: A lipidomic perspective. *Nutrients, 12(6), 1652.* https://doi.org/10.3390/nu12061652

Paduano, D., Cingolani, A., Tanda, E., & Usai, P. (2019). Effect of three diets (low-FODMAP,

gluten-free and balanced) on irritable bowel syndrome symptoms and health-related quality of life. *Nutrients, 11(7), 1566.* https://doi.org/10.3390/nu11071566

Patcharatrakul, T., Juntrapirat, A., Lakananurak, N., & Gonlachanvit, S. (2019). Effect of structural individual low-FODMAP dietary advice vs. brief advice on a commonly recommended diet on IBS symptoms and intestinal gas production. *Nutrients, 11(12), 2856.* https://doi.org/10.3390/nu11122856

Prospero, L., Riezzo, G., Linsalata, M., Orlando, A., D'Attoma, B., & Russo, F. (2021). Psychological and gastrointestinal symptoms of patients with irritable bowel syndrome undergoing a low-FODMAP diet: The role of the intestinal barrier. *Nutrients, 13(7), 2469.* https://doi.org/10.3390/nu13072469

Providence. (2022, April 4). Irritable bowels? You're not alone. https://www.providence.org/news/uf/675315322?streamId=5696608#:%7E:text=Researchers%20estimate%20that%20IBS%20affects,become%20more%20familiar%20with%20IBS.

Quigley, E. M. M. (2021). Low FODMAP (fermentable oligo-, di-, monosaccharides, and polyol) diet goes global. *American Journal of Clinical Nutrition, 113(6), 1394–1395.* https://doi.org/10.1093/ajcn/nqab084

Seamark, L., Barclay, Y., Marchant, C., Williams, M., & Hickson, M. (2021). Long-term symptom severity in people with irritable bowel syndrome following dietetic treatment in primary care: A service evaluation. *Journal of Human Nutrition & Dietetics, 34(5), 890–900.* https://doi.org/10.1111/jhn.12860

Slomski, A. (2020). The low-FODMAP diet helps IBS symptoms, but questions remain. *JAMA: Journal of the American Medical Association, 323(11), 1029–1031.*

https://doi.org/10.1001/jama.2020.0691

Staudacher, H. M. (2017). Nutritional, microbiological and psychosocial implications of the low FODMAP diet. Wiley Online Library. https://onlinelibrary.wiley.com/doi/full/10.1111/jgh.13688#:%7E:text=19%20The%20low%20FODMAP%20diet,%2C%20B%20vitamins%2C%20and%20calcium.

Weynants, A., Goossens, L., Genetello, M., De Looze, D., & Van Winckel, M. (2020). The long-term effect and adherence of a low fermentable oligosaccharides disaccharides monosaccharides and polyols (FODMAP) diet in patients with irritable bowel syndrome. *Journal of Human Nutrition & Dietetics, 33(2), 159–169.* https://doi.org/10.1111/jhn.12706

Zhang, Y., Feng, L., Wang, X., Fox, M., Luo, L., Du, L., Chen, B., Chen, X., He, H., Zhu, S., Hu, Z., Chen, S., Long, Y., Zhu, Y., Xu, L., Deng, Y., Misselwitz, B., Lang, B. M., Yilmaz, B., & Kim, J. J. (2021). Low fermentable oligosaccharides, disaccharides, monosaccharides, and polyols diet compared with traditional dietary advice for diarrhea-predominant irritable bowel syndrome: a parallel-group, randomized controlled trial with analysis of clinical and microbiological factors associated with patient outcomes. *American Journal of Clinical Nutrition, 113(6), 1531–1545.* https://doi.org/10.1093/ajcn/nqab005