Abstract

Small Intestinal Bacterial Overgrowth (SIBO) is a clinical condition that causes gastrointestinal distress and resulting malabsorption due to the presence of an abnormally large amount of microorganisms growing within the small intestine. This paper reviews the case of a client with SIBO following the Fermentable Oligo-, Di- and Mono-saccharides and Polyols (FODMAPs) elimination diet, which has been gaining attention worldwide for its role in potentially reducing SIBO’s gastrointestinal symptoms. Although the diet is still relatively new, evidence does suggest that reducing intake of FODMAPs can help manage symptoms in about 75% of patients, simply because the bacteria will not be given the substrate for their fermentation (Gibson, 2010). In this paper, the FODMAPs diet will be discussed in detail, including a list of foods to avoid, foods that are allowed, FODMAPs approved meals, and how to begin testing food tolerance once already following the FODMAPs diet.

Introduction

Overview and Pathophysiology of SIBO

SIBO is a clinical condition that is characterized by an abnormally large amount of microorganisms growing within the small intestine. Normally, the small intestine has less than 10,000 bacteria per mL of fluid; the majority of these bacteria are Gram-positive and the bacteria housed in the small intestine are different from that in the colon (Dukowicz, 2007). In someone with SIBO, at least 100,000 bacteria per mL of fluid are present in the small intestine, and the bacteria more closely resemble that of the colon versus the small intestine (Basseri,
2011). SIBO is not simply caused by any one bacterial strain; in general, it is an extension of colonic bacteria into the small intestine (Bures, 2010). One study found that contaminating flora in SIBO patients included commonly identified oropharyngeal and colonic flora, just at different levels from those usually found in their original location (Bouhnik, 1999).

The small intestine is approximately 21 feet long and is part of the gastrointestinal tract that connects the stomach and the colon, or the large intestine. Under normal conditions, the small intestine will digest and absorb nutrients into the body with the help of beneficial bacteria that are always present in the small intestine. These normal bacteria confer many healthy benefits, such as vitamin synthesis, enhanced digestion, and improved immune function (Scarleta, 2011). The presence of excess bacteria in the small intestine, however, will impede its ability to properly absorb and digest nutrients; any food that is not absorbed and digested into the body in the small intestine will pass into the colon. The presence of this food in the colon can lead to gastrointestinal symptoms, malabsorption, and malnutrition. Diarrhea, fatty stools, abdominal pain, bloating, and flatulence are all common in people with SIBO due to the malabsorption caused by bacterial overgrowth (Bures, 2010). In addition to simply having an excess of bacteria, the type of bacteria present also plays a role in the symptoms that will manifest. For example, an overgrowth of bacteria that metabolize bile salts to unconjugated or insoluble compounds may lead to fat malabsorption; microorganisms that metabolize carbohydrates to short-chain fatty acids and gas may produce bloating; and Gram-negative coliforms, such as the Klebsiella species, may produce toxins that damage the mucosa, causing secretion and blocked absorption (Dukowicz, 2007).
Etiology, Risk Factors, and Prevalence of SIBO

There are many risk factors for developing SIBO; in some cases, a cycle arises in which the underlying disease is complicated by and worsened by the SIBO. The etiology of SIBO is usually complex and may be multi-faceted, but diminished gastric acid secretion and disordered gastrointestinal motility of the small intestine appear to be among the most common contributors as they promote an environment in which excess bacteria can thrive (Scarlata, 2011). Normally, the small intestine involves complex and coordinated movements to properly digest foods; this process involves the migrating motor complex (MMC), which is a movement or “cleansing wave” of the small intestine that occurs frequently to remove waste (Pimentel, 2006). If the motility of the small intestine is impaired, it will therefore impair its ability to clean itself.

Disordered gastrointestinal motility can be caused by an anatomic obstruction (e.g. a fistula, diverticula, or surgical resection) or autonomic neuropathy. Diminished gastric acid secretion can be caused by the use of medications such as proton pump inhibitors. Compromised immunity may also lead to an environment in which unhealthy bacteria can thrive (Bures, 2010). Underlying causes for these conditions are lactose intolerance, type 1 diabetes, inflammatory bowel disease, scleroderma, Crohn’s disease (scarring), pancreatitis, and bariatric surgery (Bures, 2010). SIBO is also found in many patients with Irritable Bowel Syndrome (IBS). The connection between SIBO and IBS remains to be determined, but SIBO and IBS symptoms mimic each other and the conditions often present together. Individuals with IBS
appear to have less “cleansing waves” in the small intestine, which may explain the connection (Pimentel, 2006).

The prevalence of SIBO in particular disease and disorders differs greatly in literature, in particular when related to IBS, and in the general public the prevalence is unknown. This is partly because SIBO is greatly underdiagnosed as SIBO’s symptoms may be incorrectly ascribed to the underlying disease (Bures, 2010). One study also found that older age and female sex were predictors of SIBO in patients with IBS; no previously published clinical evidence suggests SIBO is more common in women than men, but substantially more females than males are diagnosed with IBS (Reddymasu, 2010). Prior studies have found, however, that SIBO is more common in older adults – this is likely the result of the reduced intestinal motility that occurs naturally with age (Reddymasu, 2010).

**SIBO Diagnostic Tests: Intestinal Aspirates Culture**

The gold standard for diagnosis of SIBO is a culture of intestinal aspirates – in other words, growing the bacteria from a sample of fluid taken from the small intestine. The bacteria in a known quantity of fluid are then counted. This sort of culture is done by passing a long, flexible tube through the nose, down the throat and esophagus, and through the stomach under the guidance of an X-ray so that the fluid can be obtained from the small intestine. Not only is the passing of the tube uncomfortable, but it is also expensive and requires a good amount of skill on the part of the person placing the tube. In addition, the tube has access limitations; it can only sample certain areas of the small intestine, usually the duodenum, which is the uppermost area of the small intestine. If the overgrowth involves just the jejunum (the
name for the middle section of the small intestine) or the ileum (the final section before the colon), then it may be out of reach of the tube used in this procedure. Given these potential problems, quantitative culturing such as this is usually only utilized for research purposes and is not a routine or common procedure for most laboratories (Pimentel, 2006).

**SIBO Diagnostic Tests: Hydrogen Breath Test**

A more common, non-invasive, and inexpensive alternative used to test for SIBO is the hydrogen breath test (Gasbarrini, 2007). As discussed, bacteria in the colon digest sugars and carbohydrates as food, producing carbon dioxide, hydrogen, and methane gases. The types of bacteria found in the esophagus, stomach, and small intestine produce little gas. In a normal small intestine, most of the carbohydrates we eat are digested and absorbed, never reaching the colon. In the case of SIBO, gas will be produced both in the small intestine (because the bacteria there are similar to colonic bacteria in individuals with SIBO) and in the colon, because the carbohydrates will not be fully and properly digested in the small intestine and will therefore pass into the colon, where they are digested by the gas-producing bacteria. A small amount of this gas will be absorbed through the lining of the colon into the blood, where it will circulate to the lungs and be eliminated in breath, where they can be measured (Marks, 2012).

To conduct a hydrogen breath test, an individual will be instructed to fast for 12 hours. At the start of the test, the individual will blow a single breath of air into a small balloon as a baseline measurement. They will then ingest a small amount of sugar (either lactulose or glucose), and their breath samples will be tested again for hydrogen and methane every 15 minutes for the next three or four hours (Marks, 2012).
In the case of a hydrogen breath test using lactulose, the individual ingests lactulose (a sugar that is only digested by colon bacteria), the ingested lactulose travels through the small intestine undigested and reaches the colon, where the bacteria digest it, releasing gas. In a normal individual, there is one single peak of gas in the breath following the ingestion of lactulose, immediately after the lactulose enters the colon (Marks, 2012). In someone with SIBO, there will usually be two peaks of gas in the breath – one as the lactulose passes the gas-producing bacteria in the small intestine (which, in the case of SIBO, resemble that of the colon instead of normal small intestinal flora), and again when the lactulose reaches the colon (Marks, 2012). A lactulose breath test is positive if the patient produces at least 20 ppm of hydrogen and/or methane within the first two hours (Scarlata, 2011).

![Lactulose breath test with a double peak (Dukowicz, 2007).](image)

If glucose is used in the hydrogen breath test instead of lactulose, the results are slightly different. Glucose is normally digested and absorbed fully before it reaches the colon, therefore excreting no gas at all as it never reaches the gas-producing colon bacteria. In someone with
SIBO, gas will be produced, as the bacteria present in the small intestine resemble that of the colon. Lactulose breath tests are preferred over glucose, as the glucose test only measures the overgrowth of the proximal small intestine (Marks, 2012).

There are limitations of hydrogen breath tests, however; a number of other conditions such as pancreatic insufficiency, celiac sprue, Crohn’s disease, a small intestinal stricture, and other anatomical abnormalities may also cause a positive hydrogen breath test (and related GI distress). It has been estimated that hydrogen breath tests only diagnose 60% of patients with SIBO (Marks, 2012).

_Treatment Options_

SIBO, once diagnosed, is typically treated with antibiotics; these antibiotics are often given cyclically or rotated to prevent tolerance. The optimal duration of antibiotic therapy is not known (though a 7 to 10 day course is common), and little supporting evidence exists for which antibiotics to use in the case of SIBO. Ideally, antibiotic therapy should be based on bacterial culture and sensitivity data, but this approach is impractical for clinical use. Instead, treatment is directed at likely organisms on the broad spectrum (Dukowicz, 2007). Tetracycline (and its derivatives), amoxicillin/clavulanate, ciprofloxacin, and doxycycline are often recommended, though no conclusive data is available on their success (Dukowicz, 2007).

The problem, however, is that the while the antibiotics may temporarily treat the SIBO, they do not fix the underlying disease. This means that often when antibiotics are stopped, the symptoms return. In addition, being on antibiotics for too long may cause the emergence of bacteria that are immune to the antibiotics, along with other side effects such as decreased
immunity as the antibiotics may also kill your healthy bacteria. Probiotics are sometimes recommended in those with SIBO, though the benefits have not yet been conclusively researched (Dukowicz, 2007). In addition, supplements are often recommended for those with SIBO, as malabsorption often leads to nutrient deficiencies. In particular, vitamin B12 and fat-soluble vitamins such as A, E, D, and K are usually recommended.

**Diet Therapy**

A relatively new form of managing SIBO symptoms (and IBS) that has been gaining attention worldwide is called the FODMAPS elimination diet. The low FODMAP diet was originally created by Susan Shepherd, a dietitian and celiac disease sufferer, and Peter Gibson, a gastroenterologist. They started with the concept that lactose and sugar alcohols exacerbated diarrhea in individuals that malabsorbed these substrates, then expanded to also include other commonly malabsorbed short chain carbohydrates (Gibson, 2010).

Although the diet is still relatively new, evidence does suggest that reducing intake of FODMAPs can help manage symptoms in about 75% of patients, simply because the bacteria will not be given the substrate for their fermentation (Gibson, 2010). The diet is designed to help manage symptoms of SIBO and/or IBS, not cure the disorders. However, speculation has been made that the diet may help “starve” the bacteria responsible for the overgrowth, thus leading to less bacteria growth and potentially an improvement in the condition (Scarlata, 2011). More research remains to be done on this theory.

**FODMAPs Overview**
FODMAPs is simply an acronym that stands for the group of poorly digested short-chain carbohydrates that bacteria ferment in the colon—Fermentable Oligo-, Di- and Mono-saccharides and Polyols. Examples of these are fructose (a monosaccharide), lactose (a disaccharide), fructans and galactans (oligosaccharides), and sorbitol, mannitol, maltitol, xylitol, and isomalt (polyols). Carbohydrates are the only food group that bacteria ferment, and if malabsorption occurs in the small intestine as a result of the SI-BD, more fermentation (and uncomfortable GI symptoms) will occur. How much of these FODMAPs an individual can tolerate will vary and must be determined through trial and error; what bothers some might not bother others.

Fructose is often found in fruit juices and their concentrates, sodas, sport drinks, some yogurts, and natural sweeteners like honey and agave. Lactose is found in milk and dairy-based foods; as people age, it’s not uncommon for their bodies to decrease production of lactase, the enzyme required to digest lactose. Sugar alcohols like sorbitol (in pears and sugar-free and diet foods/drinks), mannitol (in vegetables like mushrooms and snow peas), xylitol (in sugar-free gym, mints, and candy), and other sweeteners that end in “ol” taste sweet but are poorly absorbed in the body. This is why they are low (or devoid) of calories compared to regular sugar, and is also why they can cause GI distress. Fructans are naturally found in onions, garlic, artichokes, and wheat. Inulin, another fructan, can often be found in packaged foods like granola bars and cereals because it is added to increase the fiber content of the product and add to the texture. Finally, galacto-oligosaccharides (GOS) are usually found in beans and legumes; the fact that they are poorly digested is the reason beans can often cause gas and cramping.
**The FODMAPs Elimination Diet**

On a FODMAPs elimination diet, the person in question will eliminate all foods containing these carbohydrates initially (usually for at least three weeks) and then slowly add them back in, one at a time, to determine if they are tolerated or not. High and low FODMAP foods were determined by analyzing food for FODMAP content—so for example, pistachios were shown to have too many fructans/GOS compared to other nuts, which is why they are excluded in the diet when some other nuts/seeds are not.

Below is a list of foods to avoid on a FODMAPs elimination diet, meaning that all these foods include high levels of FODMAPs.

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Vegetables</th>
<th>Sweeteners</th>
<th>Grains</th>
<th>Nuts</th>
<th>Lactose</th>
</tr>
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<tbody>
<tr>
<td>Apples, apricots,</td>
<td>Artichokes, asparagus, cabbage,</td>
<td>Agave, honey, high fructose corn syrup,</td>
<td>Rye, wheat, barley, probiotic supplements</td>
<td>Pistachios,</td>
<td>Milk, condensed and evaporated</td>
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<td>blackberries, cherries,</td>
<td>cauliflower, chickpeas, garlic,</td>
<td>sorbitol, mannitol, maltitol, isomalt, xylitol</td>
<td>or food additives with inulin or FOS</td>
<td>cashews</td>
<td>milk powder, yogurt, ice cream,</td>
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<tr>
<td>mango, nectarines,</td>
<td>lentils, red kidney beans,</td>
<td>(found in sugar-free gums, mints, cough drops</td>
<td>(chickory root)</td>
<td></td>
<td>custard, ricotta, cottage cheese,</td>
</tr>
<tr>
<td>pears, peaches,</td>
<td>baked beans, leeks, mushrooms,</td>
<td>&amp; some medications)</td>
<td></td>
<td></td>
<td>cream cheese, margarine</td>
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<tr>
<td>persimmon, plums,</td>
<td>green pepper, pumpkin, shallot,</td>
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<tr>
<td>prunes, raspberries,</td>
<td>snow peas/sugar snap peas, soybeans</td>
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<td>watermelon</td>
<td>&amp; soymilk, onions, onion or garlic</td>
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<td></td>
<td>salt/powder</td>
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Foods that are low in FODMAPs and therefore acceptable for someone following the
elimination diet (not including meat) – to be eaten in normal recommended portion size amounts to stay within your personal caloric ranges:

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Vegetables</th>
<th>Sweeteners</th>
<th>Grains</th>
<th>Nuts/Seeds (1-2 Tbsp)</th>
<th>Dairy/Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banana, blueberries, cantaloupe, coconut, grapefruit, grapes, honeydew, kiwi, lemons, limes, oranges, passionfruit, pineapple, rhubarb, star fruit, strawberries, tangelos</td>
<td>Bok choy, bean sprouts, red bell pepper, lettuce, carrots, chives, cucumber, green beans, eggplant, tomatoes, potatoes, spinach, swiss chard, garlic &amp; onion infused in oil, water chestnuts, scallion (green part only)</td>
<td>Maple syrup, table sugar (sucrose), glucose, aspartame</td>
<td>Gluten free bread, corn, rice, quinoa, rice cakes, potato &amp; tortilla chips, oats</td>
<td>Almonds, macadamia, peanuts, pecans, pine nuts, walnuts, pumpkin seeds, sesame seeds, sunflower seeds, chia seeds (3/4 Tbsp.)</td>
<td>Lactose free milk, ice cream, yogurt, cottage cheese, and sorbet. Brie, camembert, cheddar, feta, mozzarella, parmesan, swiss cheeses. Rice, almond, or coconut milk.</td>
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Alcohol (wine, beer, vodka, or gin; rum is questionable) is allowed on a low FODMAPs diet, although recommendations note limiting intake to no more than 1 drink per day as alcohol is also a gastric irritant.

Here is an example of what someone on a FODMAPs diet might actually eat throughout the day:

- **Breakfast:** Scrambled eggs with feta cheese, tomato and red bell peppers, plus a banana
• **Lunch**: Turkey sandwich on gluten free bread with swiss cheese, sprouts, sliced cucumbers, lettuce, and mustard. Carrot sticks and grapes on the side.

• **Snack ideas**:
  - Lactose-free yogurt with blueberries
  - Celery sticks with peanut butter

• **Dinner**: Grilled chicken, baked potato (regular or sweet), and sautéed spinach seasoned with salt, pepper, garlic infused olive oil, and pine nuts.

**FODMAPs Diet Implementation**

According to literature, the following procedure is recommended when working with someone on a FODMAPs diet (Gibson, 2010):

1. Explain the physiological basis of the diet
2. Provide information on low and high FODMAP foods; discuss plan for how to restrict FODMAPs
3. Provide list/advice for suitable alternative foods and meals, while promoting a nutritionally adequate diet
4. Request and review a food and symptom diary from client; continue to request and review food diary on follow up visits.
5. After at least a few weeks (and up to as much as 6 to 8 weeks) of dietary compliance with the low FODMAPs diet, begin to add back foods one at a time to test tolerance.
As of this paper, there is no one common recommendation for suggested amounts of or time spacing of foods on reintroduction; more research should be done to determine a specific protocol for this as well as follow-up procedures.

**Description of the Case**

The client discussed in this case came to see a Registered Dietitian for help managing her SIBO using the FODMAPs elimination diet. She had already found out about FODMAPs on her own and started trying to follow it, but requested assistance in continuing.

**Client Overview**

The client is a 59 year old white female, 167.5 cm tall and with a weight of 83 kg. She is overweight with a BMI of 29.5; her body fat percentage is 29. Her past medical history includes the following:

- SIBO (diagnosed in January 2012 via hydrogen breath test)
- Cancer diagnosis in 1981 (left mastectomy in 1986)
- Food allergies: cantaloupe, honeydew melon
- Lactose intolerance
- Osteoporosis
- High cholesterol
- Kidney disease
- Family history of diabetes and hypertension

The client is employed full time as a nurse; she is single and has no children. She reported taking the following supplements: vitamin B12, B100, biotin, fish oil, licorice root, and L-glutamine powder (doses unknown). She does not smoke or take drugs and rarely drinks alcohol.
First Visit with the RD – August 10, 2012

The client was diagnosed with SIBO in January 2012 via a hydrogen breath test. After research online, she learned about the FODMAPs diet, and decided to try to follow it on her own in an attempt to manage her symptoms. She first came to see the RD in August 2012 for additional help. The client presented with a pleasant demeanor and expressed motivation and willingness to change her eating habits in order to feel better. She reported having been following the FODMAPs diet loosely, but having trouble with meals out and finding processed foods that are FODMAPs approved, such as bread, rolls, crackers, etc.

During the session, the RD assessed the client’s knowledge of which foods contained FODMAPs. She was knowledgeable of which foods to avoid but having trouble reading food labels to determine when processed foods were hidden sources of FODMAPs, such as onion and garlic powder. She also reported having occasional problems with emotional eating, eating when bored, and feeling uncontrolled, especially with sweet foods. The RD used motivational interviewing tactics to discuss these issues with the client, and reminded her that while it might be overwhelming to go without some of her favorite foods, eliminating the FODMAPs might help her feel better.

Here are the goals that were mutually agreed upon with the client after the first visit with the RD:

1) Follow a strict low FODMAPs diet for three weeks; after this initial period foods can start being re-introduced one at a time to test tolerance.
a. Goal: Determine “must avoid” foods, as well as “small amounts are okay” foods and “this doesn’t bother me at all” foods.

2) Limit meals eaten out at restaurants.
   a. Gluten free doesn’t necessary mean FODMAP free.
   b. When eating out, choose simple grilled meats and vegetables with no seasonings or sauces (often a hidden source of onion or garlic powder).

3) Avoid processed foods for now.
   a. Often hidden sources of onion/garlic powder.
   b. Label reading assistance can be provided in the future.

The RD also provided her with examples of what to eat for each meal – this information was emailed to her after the first meeting. The RD performed a “typical day of eating” recall, learned about the client’s food likes and dislikes, and used that information to provide her with the following meal ideas.

- **Breakfast:**
  - Oatmeal made with Lactaid, rice, almond, or coconut milk, served with blueberries and pumpkin seeds
  - Gluten-free cereal (such as Erewhon Corn Flakes or Crispy Brown Rice cereal) with Lactaid, rice, almond, or coconut milk, one sliced banana, and pumpkin seeds
  - One slice of gluten-free bread with peanut or almond butter and grapefruit or a banana
  - A homemade smoothie:
    - Recipe #1: One banana + ½ cup almond milk + 1 Tbsp. peanut butter + 4 ice cubes
    - Recipe #2: ¾ cup blueberries and strawberries + 1/3 cup lactose-free yogurt + 1/3 cup coconut milk + 6 fresh mint leaves

- **Lunch:**
- Tuna salad wraps: Tuna mixed with plain lactose-free yogurt and mustard, lemon juice, and dried dill, served in Bibb lettuce leaves. On the side: celery with peanut butter.
- Rice bowl: ½ to ¾ cup brown rice + chopped lettuce and tomato, topped with grilled chicken or shrimp and grated cheddar. Top with fresh lemon juice and a drizzle of olive oil for dressing.

- PM Snack:
  - Homemade Trail Mix (1 serving is ¼ cup)
    - Mix together any combination of the following raw nuts/seeds and dried fruit: almonds, macadamia nuts, peanuts, pecans, walnuts, pumpkin seeds, sesame seeds, sunflower seeds, raisins
    - Put the trail mix into ziplock bags for easier grabbing on the go – ¼ cup per bag.

- Dinner:
  - Lean grilled steak (London broil or Flank) or chicken, Bibb lettuce salad with carrots, tomatoes, and orange pepper slices, topped with lemon juice and a drizzle of olive oil. Plus roasted potatoes (with salt and olive oil).
  - Quinoa sautéed with red pepper and olive oil topped with grilled chicken or fish.

The client was also referred to websites with FODMAPs friendly recipes and given a FODMAP friendly foods handout and grocery shopping list (see appendix). In addition, the RD recommended she start taking some bone-friendly supplements like calcium, Vitamin D, and magnesium, given her history of osteoporosis and the likelihood that nutrients were not being absorbed properly due to the SIBO.

**Second Visit with the RD – August 24, 2012**

During this visit, the RD reviewed the client’s extensive food logs (in which she noted everything eaten as well as any GI issues that occurred on those days). The client had been mostly sticking to the FODMAPs friendly diet (with a few slip ups), was feeling much better, and ready to start testing specific food tolerances in another week or so. It was explained that she would need to be sure to only add in one new food and not multiple at any given time, because
otherwise she wouldn’t know which foods were causing any GI issues that might arise. After some discussion it was determined that grains would be the first food to reintroduce and test out, starting with pasta on her upcoming 3 week trip to Italy, because she’d want to eat that anyway. After a discussion, it was determined that she would try eating up to ½ cup of cooked pasta once per day, wait to see if there was any reaction, and then increase to a maximum of 1 cup per day if indicated. The RD recommended she try to stick to the eating out guidelines (grilled meats, no sauce, etc.) so that other irritants were less likely to be incorporated into meals. The client also expressed interest in trying gelato while in Italy, so that was determined to be the next food that she would try to see if it caused any symptoms.

Third Visit with the RD – October 10, 2012

The next time the client came to see the RD was after her 3 week trip to Italy. She reported having completely “fallen off the FODMAPs wagon” and said that while the food tasted good, she felt sick the whole trip with numerous GI issues. She hadn’t been able to follow the plan to test the pasta or gelato since she ate a number of FODMAP unapproved foods every day. The experience, she said, and how ill she felt after it all, made her realize that she really does need to stick to FODMAPs – at least for now, until she can start testing foods one-by-one to see which ones are well tolerated. Unfortunately, the client reported a change in job hours and insurance benefits that would mean she would no longer be able to afford to see the RD. She said she would be in touch again in January 2013 to give an update. The RD gave her a book on FODMAPs and some websites to refer to; the client said she was going to work hard to follow the diet and feel better again.
Discussion

This case highlights many of the gaps in research on SIBO and how it is diagnosed and treated, in addition to whether the FODMAPs diet is an appropriate way to reduce gastrointestinal distress in all clients with SIBO. The research done on the FODMAPs diet remains sparse; more research should be done on the large scale to determine the percentage of patients that experience a reduction in symptoms, and why others do not. There is also a need for biomarkers or other clinical predictors that would enable better individualization of the dietary approach to treatment. However, in the client studied, following the diet for a few weeks did lead to a large reduction in the GI distress that normally plagued her.

It is unknown whether elimination of these items from the diet will cause hyperresponsiveness if and when they are later reintroduced. For example, the client reported much GI distress when she went off the diet during her trip in Italy. It is unclear if her symptoms were the same as before or whether she had become hyperresponsive to the FODMAPs since eliminating them from her diet. This hyperactive response has been anecdotally described, but not formally studied (Gibson, 2010). Additionally, it would be useful to study the long term effects of following this diet and whether there were any physiological or nutritional detriment to the client’s health after following the diet for longer periods of time.

Implications for the Practicing RD

Despite the complex and restrictive nature of the FODMAPs elimination diet, it has been found that patient compliance is very good, likely due to the quality of life improvements that are afforded (Gibson, 2010). RDs who wish to work with someone following a FODMAPs diet
may want to take a self-study course offered by Kate Scarlata, an RD who has become an expert in the field.

The practicing RD may also want to evaluate the evidence for implementation of this diet; in particular, continued research is necessary to determine what groups should and should not be advised to follow this time. Research has not been done to determine if the diet is safe for all age ranges and conditions (e.g. pregnancy). The practicing RD may also want to consider the socioeconomic status and education level of the patient who wants to follow or who may benefit from this diet. This is an expensive and rather detailed diet that requires consistent access to fresh fruits and vegetables, nuts, and gluten-free products. Clients must be able to distinguish between foods (e.g. nuts) and read complicated food labels to determine if the ingredients are approved. Research has not yet been done to determine whether this diet would be feasible in patients of low socioeconomic status or minimal education levels.

**Conclusion**

In conclusion, this diet may reduce symptoms in patients who have SIBO but there is still a lot of work that needs to be done. More research is necessary on antibiotic treatment methods, on the causes and relationship with IBS, on the reintroduction of high FODMAPs foods, on the benefits of probiotics (if any) in these patients, and more. If this diet were to become more prevalent, better resources for both RDs and clients will be necessary, including potential food labeling and FODMAPs friendly processed/packaged foods to assist with compliance.
Appendix

Website resources for the low FODMAPs diet:

- **Kate Scarlata, R.D.**
  - FODMAPs information:
  - Printable handouts (shopping list & checklist):
  - FODMAPs recipes:
    - [http://blog.katescarlata.com/fodmaps/](http://blog.katescarlata.com/fodmaps/)
  - Self-study course for RDs:

- **UVA Nutrition Services**
  - Informational FODMAPs handout:
# FODMAPs CHECKLIST

<table>
<thead>
<tr>
<th>FODMAPs</th>
<th>LACTOSE</th>
<th>FRUCTOSE</th>
<th>FRUCTANS /GOS</th>
<th>POLYOLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.5g/serving</td>
<td>&lt;0.2g/serving</td>
<td>&lt;0.2g per serving</td>
<td>&lt;0.3g per serving</td>
<td></td>
</tr>
</tbody>
</table>

- **Milk, evaporated milk, yogurt, ice cream, custard, ricotta, cottage cheese**
- **FRUIT**
  - Apples, boysenberry, cherries, mango, pears, figs, raspberries, watermelon
  - **VEGETABLES**
    - Artichokes, asparagus, sugar snap peas
  - **SWEETENERS**
    - Agave, honey, High Fructose Corn Syrup (HFCS)
  - **ALCOHOL**
    - Rum
- **GRAINS**
  - Rye, Wheat, barley-large quantity, Inulin (may be labeled as chicory root) or FOS
- **NUTS**
  - Pistachios, cashews

**CAUTION!**

**HIGH FODMAPS**

- Lactose free milk, Lactose free ice cream, Lactose free cottage cheese, Lactose free yogurt and sorbet (check ingredients)

- **CHEESE**
  - Brie, camembert, cheddar, feta, mozzarella, Parmesan, Swiss

- **FRUIT**
  - Banana, blueberries, cantaloupe, coconut, dragonfruit, grapefruit, grapes, honeydew, kiwi fruit, lemons, limes, oranges, passionfruit, pineapple, rhubarb, starfruit, strawberry, tangelos

- **VEGETABLES**
  - Arugula, bamboo shoots, bok choi, bean sprouts, red bell pepper, lettuce, carrots, chives, cucumber, green beans, eggplant, endive, tomatoes, potato, radish, rutabaga, spinach, Swiss chard, fennel, oil infused with garlic or onion, water chestnuts, scallions (green part only), zucchini

- **SWEETENERS**
  - Maple syrup, table sugar (sucrose)

- **ALCOHOL**
  - Most wine & beer, vodka & gin (limit to 1 drink in general as gastric irritant)

- **-1 serving fruit per meal max**
- **-1 medium orange or banana**
- **-1 cup berries, cantaloupe, pineapple or rhubarb**

**FODMAP FRIENDLY!**

- **BREADS/GRAINS**
  - Gluten free bread (check ingredients), corn/rice/quinoa pasta, rice cakes, potato & tortilla chips, rice, quinoa, oats

- **NUTS/SEEDS**
  - Almonds, macadamia, peanuts, pecans, pine nuts, walnuts, pumpkin seeds, sesame seeds, sunflower seeds, 3/4 Tbsp chia seeds, 3/4 Tbsp flax

- **FRMd TOFU**

- **MODERATE FRACTANS/GOS**
  - Beef roast < 1/2 slice, broccoli < 1/2 cup, Brussels sprouts < 1/2 cup, butternut squash < 1/2 cup, fennel bulb < 1/2 cup, green peas < 1/3 cup, pumpkin < < 1/2 small, savoy cabbage < 1 cup, snow peas < 10 pods, sweet corn < 1/2 cob

**REFERENCES:** Low FODMAP diet booklet edition 3, Monash U. team, USDA nutrient data bank, personal email and conversations with Monash U. research team.
# LOW FODMAPS GROCERY LIST

Always recheck ingredients. Manufacturers modify on an ongoing basis to ensure ingredients are FODMAPS-friendly.

## GRAINS
- Oats
- Oat bran
- Polenta
- Quinoa
- Rice: Brown and White
- Rice bran
- Gluten free pasta: rice, quinoa, and corn

## BRAND NAME CEREALS
- Ancient Harvest Quinoa Flakes
- Bob's Red Mill Mighty Tasty Hot Cereal
- Cheerios
- Eden Organics Brown Rice Flakes Hot Cereal
- Erewhon Gluten free Corn Flakes
- Erewhon Gluten free Crispy Brown Rice
- EnviroKidz Gorilla Munch
- EnviroKidz Peanut Butter Panda Puffs
- GiGi’s Gluten Sensible Beginnings Cereal

## BREADS
- Liff’s White Sandwich Bread
- Food for Life Brown Rice Tortillas
- Food for Life Multi-Seed English muffins
- Rudi’s Plain Tortillas

## FLOURS AND BAKING MIXES
- King Arthur Multi-Purpose flour
- Namaste Perfect Flour Blend
- Namaste Foods Waffle and Pancake mix
- Bisquick Gluten-free Pancake and Baking Mix
- Namaste Foods Brownie Mix
- Namaste Foods Blonde Mix
- Namaste Foods Muffin Mix

## PROTEIN
- Beef
- Chicken
- Fish
- Egg
- Pork
- Tofu

## NUTS/SEEDS (allow one handful per sitting)
- Almonds
- Chia seeds
- Flax seeds
- Macadamias
- Peanuts
- Pecans
- Pine nuts
- Pumpkin seeds
- Sesame seeds
- Sunflower seeds
- Walnuts

## NUT BUTTER
- Smucker’s Peanut Butter
- Skippy Peanut Butter
- Teddy Peanut Butter
- 365 Smooth Almond Butter (Whole Foods)

## DAIRY

## CHEESE
- Cheddar
- Swiss
- Parmesan
- Brie
- Feta
- Camembert
- Mozzarella

## MILK
- Lactose free
- Almond milk
- Coconut milk
- Rice milk

## YOGURT/KEFIR
- Green Valley yogurt
- Lifeway kefir (strawberry or blueberry)

## PRODUCE

### FRUIT (limit to one serving per meal)
- Avocado (limit to 1/4)
- Banana (small)
- Blueberries
- Cantaloupe
- Coconut
- Dragonfruit
- Grapefruit
- Grapes
- Honeydew melon
- Kiwi fruit
- Lemon
- Lime
- Orange
- Passion fruit
- Pineapple
- Rhubarb
- Starfruit
- Strawberries
- Tangelos
- Orange juice or grapefruit juice (limit to 1/3 cup)

## SNACKS + SWEETS

### Rice Cakes
- Blue Diamond Almond Nut Thins
- Lundberg Rice Chips (sea salt)
- Schar Cheese bits
- Mary’s Gone Crackers (original)
- Real Food corn thins
- Kettle Baked Potato Chips (sea salt)
- Tortilla Chips
- Glutino Pretzels
- Aleia’s almond horn cookies
- Aleia’s peanut butter cookies
- Gilbert’s Super Dooper Snickerdoodles
- Gilbert’s Sensational Sugar cookies
- Sarabeth’s Cranberry Relish
- Sarabeth’s Strawberry Rhubarb Spreadable Fruit

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Works Cited


