

Fermentable carbohydrate intake and food avoidance behaviour in elderly patients with irritable bowel syndrome: A case report

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ABSTRACT

Background: Fermentable carbohydrates or FODMAPs (Fermentable Oligo-, Di-, Monosaccharides, and Polyols) are short-chained, poorly absorbed carbohydrates which trigger gastrointestinal symptoms causing pain, bloating, distension, diarrhea, and constipation in Irritable Bowel Syndrome (IBS) patients. This debilitating condition has an impact on the quality of life of patients. In addition, due to lack of dietary intervention, it can result in food restriction to alleviate symptoms as patients avoid a wide variety of food and beverages. **Objective:** To compare FODMAP and nutrient intake, food avoidance behavior and quality of life in 2 long standing patients with IBS. **Methods:** Patients were selected on the basis of being diagnosed with IBS by a gastroenterologist. A 24-hour dietary recall with multiple pass method was used to assess intake. FODMAP intake was determined using published data. Symptom severity and quality of life was measured using a validated questionnaire. Meanwhile, food avoidance was assessed using a dietary trigger piloted questionnaire. **Results:** Two female Chinese patients with severe gastrointestinal symptoms were selected for this case series. Patient 1 was a 75-year-old female presenting with constipation-predominant IBS and patient 2 was a 61-year-old, presenting with diarrhea-predominant IBS. Patient 1 had a higher energy intake: 2198 kcal, and FODMAP intake 10.6g/d, compared to patient 2 with an energy and FODMAP intake of 1800 kcal and 3.6g/d respectively. Both patients avoided a wide of range of food groups including cereals and grains, animal products, dairy and spicy foods. They also reported reduced scores for quality of life. **Conclusion:** Both patients had low intake of calcium as a result of food avoidance. This highlights the importance of appropriate and timely dietary intervention to this group of patients, to promote improved symptom management without compromising nutrient intake.

Keywords: Fermentable carbohydrates; FODMAPs; food avoidance; irritable bowel syndrome; dietary trigger

INTRODUCTION

FODMAPs

Fermentable Oligo-di-monosaccharide and Polyols (FODMAPs) are a group of undigested, poorly absorbed carbohydrates which induce gastrointestinal symptoms in IBS patients. (Halmos et al., 2014; Ong et al., 2010). As FODMAPs occur naturally in most foods, they are quite common in diets. FODMAPs are often found in the form of fructans or oligosaccharide in wheat or rye flour, wheat or rye-based cereals, pasta and noodles, onion, brussels sprouts, onion, garlic, lentils and legumes. They are present as lactose, a disaccharide in milk and milk-based products, such as cheese, yogurt and ice-cream. Other form of FODMAPs include fruit sugar and sugar alcohols. Fruit sugar or monosaccharide is found in apples, pears, mangoes and watermelon. Meanwhile, sugar alcohol also known as polyol is found in both fruits and vegetables such as mushroom, cauliflower, apples, pears and stone fruits, as well as sugar-free mints or candies (Gibson, 2017; Varney et al., 2017).

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Cut-off value for FODMAPs

The cut-off value to denote a food as low FODMAP, based on clinical evidence, is by grams-per-serve for each individual FODMAP. The values for oligosaccharides in grains, legumes and nuts is <0.30 g; oligosaccharides in vegetables, fruits and other products <0.20 g; total polyols <0.40 g; excess fructose <0.15 g; and lactose <1.00 g (Varney et al., 2017). The intake of FODMAPs is dependent upon the amount and type of FODMAPs present in more than one food. Categorised by the cut-off values above, FODMAPs are present in low, moderate or high amounts in each food. However, the concentration of FODMAPs varies greatly for different foods even if it contains the same type of FODMAP. Fructan levels in garlic are typically 17.4g/100g, as compared to white bread, 0.68g/100 (Muir et al., 2009). Therefore, a medium clove of garlic will be classified as high FODMAPs based on this cut-off, but not a slice of bread. If more than one FODMAP is present in fruits, vegetables or composite dishes, this will also be classified as high FODMAPs based on the cut-off. A good example will be a slice of vegetarian pizza which contains fructans (wheat flour, mushroom, onion), lactose (cheese) and mannitol (mushroom) (Biesiekierski et al., 2011; Muir et al., 2009; Muir et al., 2007). Even if the amount of FODMAP is small in each ingredient, cumulatively a slice of pizza would still be classified as high in FODMAPs. It is important to remember that besides fruits and fruit beverages, most foods are consumed are in the form of composite dishes.

Mechanistic effect of FODMAP

FODMAPs are poorly absorbed, consequently exerting substantial osmotic effects - particularly fructose, lactose and polyols (Shepherd et al., 2013; Barrett and Gibson 2012). Their osmotic effect, as demonstrated in imaging studies, increases small bowel water content in the intestinal lumen (Murray et al., 2014; Placidi et al., 2012). Other FODMAPs, such as oligosaccharides, undergo rapid fermentation in the colon to produce hydrogen, carbon dioxide, and short chain fatty acids (Schaafsma and Slavin, 2015; Gibson and Roberfroid, 1995). It is believed that the osmotic and fermentative effects of FODMAPs induce functional gut symptoms such as diarrhea, bloating and abdominal discomfort (Shepherd et al. 2008), leading to food avoidance behavior among patients (Hayes et al., 2014; Ligaarden et al., 2012; Østgaard et al., 2012).

Irritable Bowel Syndrome

Irritable Bowel Syndrome (IBS) is a chronic functional gastrointestinal disorder often presenting with abdominal pain and distension, which is either relieved or exacerbated by defecation, or a change in bowel habit (Holtmann et al., 2016). It is characterised by symptoms such as abdominal pain and or distension, diarrhea and constipation, which improve with defecation (Chey et al., 2015; Longstreth et al., 2006). The prevalence of IBS in Malaysia is around 11% to 14% (Lee et al. 2012, Rajendra and Alahuddin 2004). IBS is classified as subtypes: either diarrhea predominant (IBS-D), constipation predominant (IBS-C) or mixed with both subtypes (IBS-M). IBS-D is defined as having more than a quarter (25%) of bowel movements with either mushy or liquid stool, and less than a quarter (25%) with hard or lumpy stool. IBS-C is the reverse of IBS-D, further defined as having more than a quarter (25%) of bowel movements with hard or lumpy stool and less than less than a quarter (25%) with mushy or liquid stool. IBS-M is defined to have more than a quarter (25%) of bowel movements similar to IBS-D and IBS-C (Drossman et al., 2010). The pathophysiology of IBS is multifactorial. In current understanding of this disorder, factors that have been explored include: disorders of the gut-brain axis; diet; genetic factors; infections and gut microbiota alterations; low-grade mucosal inflammation and altered intestinal permeability as a result of the inflammation; disordered bile salt metabolism; abnormalities in serotonin metabolism; and alterations in brain function (Holtmann et al., 2016).

Food Avoidance

Avoidant/Restrictive Food Intake Disorder (ARFID) is a feeding disorder characterised by avoidance or restriction of food leading to nutritional deficiency, weight loss, and psychosocial impairment (Thomas et al., 2017). In a recent observational study almost 13% of gastroenterology patients reported food avoidance concerns, and had lower quality of life scores (Harer et al., 2019). In order to manage their symptoms, IBS patients usually avoid a wide range of food and beverages which they perceive as dietary triggers. In one case control study, patients restricted milk products, fruits and vegetables (Hayes et al., 2014). In another study, symptom severity was associated with a high intake of vegetable for IBS-C patients and a higher intake of fruit, berries, carbonated beverages and alcohol for IBS-D patients. (Ligaarden et al., 2012). The most common foods reported as symptom producers were cabbage, onion and peas/beans as well as hot spices, deep-fried food, pizza, coffee, and cream (Simren et al., 2001). When patients are not advised on dietary restriction, they typically restrict a wide variety of foods or even food groups, resulting in a lower intake of essential nutrients (Stevenson et al., 2014; Bohn, et al., 2013).

Quality of life

Despite IBS being a non-life-threatening disorder, it is still associated with a poor quality of life, having a negative impact on both work and social domains. Patients with severe symptoms such as pain and discomfort, have a lower quality of life compared with those with milder symptoms (Monnikes, 2011). In a study involving female IBS patients, in comparison to young adults, for those between 58 to 75 years of age the severity of symptoms was negatively associated with quality of life. However, these patients reported milder symptoms compared to the rest of the group (Tang et al., 2012).

CASE PRESENTATION

Ethics and setting

The study was approved by the UKM Research Ethics Committee (UKM PJP/111/8/JEP-2019-058). Both patients were diagnosed almost a year ago and were referred by a gastroenterologist. Consultations were undertaken at the HUKM gastroenterology clinic.

Materials used in this study

Weight and Height measure

Patient weights (in light clothing) were measured to the nearest 0.1kg using a digital weighing scale: SECA 800 (Germany). Height (barefoot) was measured to the nearest 0.1 cm using a mobile stadiometer: SECA 217 (Germany).

Questionnaires

IBS symptom severity scale (IBSSSS) was measured using a validated questionnaire, employing a visual analogue scale (VAS) (Francis, et al., 1997). There were five items in the questionnaire with a total maximum score of 500. Four of these were VAS assessing abdominal pain, bloating/distension, disturbance of bowel habit and impact on life; the fifth was proportion of days with pain. Patients marked the VAS using a cross, based on their symptoms in the last 10 days. The severity was categorised based on their total scores. Scores of 75 to 175 were categorised as mild cases, 175 to 300 moderate, 300 and above severe; less than 75 in remission.

Quality of life was measured using EQ-5D-5L and EQ-VAS, a validated questionnaire which was divided into five dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression (Herdman et al., 2011). Each dimension has five levels: no problems, slight problems, moderate problems, severe problems, and extreme problems/inability. The scores for each level ranged from zero (no problems) to four (extreme problems) with a maximum score of 20. The questionnaire was combined with a vertical

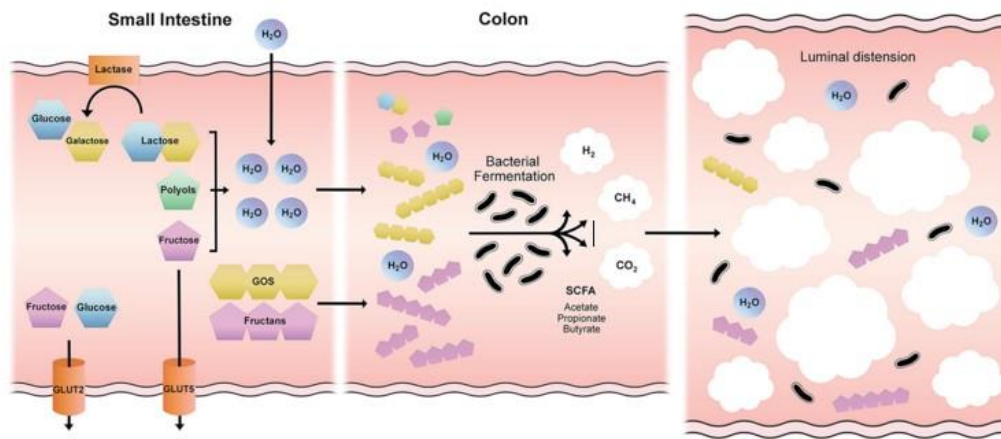


Figure 1: Mechanistic effect of FODMAPs

In the small intestines, unabsorbed FODMAPs increases luminal water predominantly and exerts an osmotic effects. They then pass the colon to be fermented by gut microbiota which produces short chain fatty acids gases such as methane, hydrogen and carbon dioxide. Accumulation of these gases causes luminal distention in patients. Reprinted from "The low FODMAP diet: recent advances in understanding its mechanisms and efficacy in IBS" by H.M. Staudacher and K. Whelan, 2017, *Gut*, 66(8) p.1519. Copyright © 2020 BMJ Publishing Group Ltd & British Society of Gastroenterology. Reprinted with permission.

100mm VAS, to assess global quality of life (EQ-VAS). Patients had to tick a box based on their current level of QoL for all five dimensions, and mark x on the VAS as appropriate.

The dietary trigger questionnaire that had been piloted was used to assess the most common self-reported food triggers in IBS patients. The content of the questionnaire was developed based on recent studies within the UK (Hayes et al., 2014; Williams, et al., 2011), and Europe (Böhn et al., 2013). Patient dietary intake was assessed using a 24-hour dietary recall using the multiple pass method and analysed using Nutritionist ProTM Diet Analysis Software (2007) energy and macronutrients. FODMAP intake was estimated using published data (Prichard et al., 2016; Yao et al., 2014; Muir et al., 2009; Muir et al., 2007).

Anthropometry

Patient 1, a 75-year-old Chinese female, presented with IBS-C. She weighed 54.3 kg and was 1.53 metres in height with a BMI of 23 kg/m². Meanwhile, patient 2 was a 61-year old Chinese female presented with IBS-D. She weighed 48 kg and was 1.57 metres in height with a BMI of 19.5kg/m². Both patients had normal BMI.

Clinical

Both patients had been diagnosed with IBS for more than 2 years and they were not on any antibiotics or gastric motility medications. They both had a colonoscopy and routine blood test done as part of the investigations prior to being diagnosed with IBS. Meanwhile, patient 2 had undergone abdominal surgery. Due to time constraints a thorough medical history was not taken. The IBSSS scores were more than 300mm for both patients, indicating severe IBS with symptoms such as abdominal distension and pain. Patient 1 related her symptom severity to the death of her husband within the last year of the time she was assessed. With regards to quality of life, patient 1 also reported moderate problems with mobility, pain, and anxiety/depression and rated her overall health during assessment to be 60%. Meanwhile patient 2 reported a severe problem in mobility and pain, and moderate problems with self-care, carrying out normal activities, anxiety and depression, and rated her overall health during the assessment to be 50%.

Intake and food avoidance

Patient 1 had a total calorie intake of 2198 kcal with 49% from carbohydrate, followed by 20% from protein and 31% from fat and an estimated FODMAP Intake of 10.6 g/day. Patient 2 had an intake of 1800 kcal with 56% of intake from carbohydrate, followed by 12% of

intake from protein and 35% intake from fat and an estimated FODMAP intake of 3.6g/day. With regards to food avoidance both patients avoided similar food groups including cereal and grains (wheat and rye bread, pasta, cream crackers and corn flakes), milk products (cheese and cream), animal products (meat, sausages, processed meats), alcoholic beverages (beer, wine, spirits) and spicy food. However, patient 2 had more restrictions including vegetables (onion, garlic, tomato, sweet potato, pumpkin, ochra), coffee and pickles.

Socioeconomic status

Both patients were retirees with a monthly income between RM 1,000.00-3,000.00.

DISCUSSION

The objective of this case series was to compare dietary and FODMAP intake, quality of life and food avoidance behavior between two patients with different IBS subtypes. Therefore, two patients with different IBS subtypes were selected as it was believed that their intake and symptoms would differ. This is the first study to assess dietary and FODMAP intake within this group of patients. There is limited data on population FODMAP intake as most randomised controlled trials assess intake as a measure of compliance. In a validation study, it was reported that healthy volunteers (n=72) had a mean intake of 23.5g of FODMAPs (Barrett and Gibson 2010). An Australian randomized controlled trial (RCT) reported baseline intake of 16.3g in patients (n=30), which prior to FODMAP restriction was adequate to trigger symptoms such as pain, bloating and wind among patients. When patients in this study reduced their intake to 3.05g/day, 70% of patients reported symptom improvement (Halmos et al., 2014). However, patients and volunteers in both the studies were young adults. A more recent RCT in the US was the only study to include older patients between the age of 50-75 years (n=14). However, the trial was only able to assess lactose and polyol intake, which was 11g/day (n=50) (Eswaran et al., 2016). It is still unclear what constitutes a high FODMAP or a low FODMAP diet, but based on previous studies we can accept that a low intake would be anywhere between 0.2g to 3.0g of FODMAPs.

Patient 1 had a higher FODMAP intake, around 10.6 g/day compared to patient 2. Her main FODMAP intake consisted of free fructose: 1.37g, mainly from orange and fruit juice; oligosaccharides, 5.2g from wheat products, noodles, onions, garlic and lactose and 4.0g from milk, cheese, and chocolates. Patient 2 had a FODMAP intake of only 3.6 g/day, consisting of oligosaccharide: 3.3g from noodles, beans and pulses; polyol: 0.3g from broccoli. However, both patients were not meeting their calcium requirements, patient 1 with an intake of 955mg

and patient 2 with an intake of 702mg - less than the 1200mg Recommended Nutrient Intake requirement for elderly (NFFN, 2017). The findings are similar to another study which demonstrated that IBS-D patient had lower calcium intake compared to IBS-C patients (Stevenson et al., 2014).

Despite both patients reporting food avoidance behavior, based on their dietary recall they were both consuming high FODMAP-containing foods in their diet. As patients were not advised on the low FODMAPs diet, they were unaware of the high FODMAP containing foods and continued to consume them, leading to experience of severe symptoms. Although patient 2 had a much lower FODMAP intake than patient 1, the level was still high enough to contribute to symptoms; the patient had a high IBSSS score of 330, categorized as severe. One possible reason for this was that this patient may have been more sensitive, particularly to oligosaccharides, despite consuming a low FODMAP diet. Tolerance to the same type of food differs within individuals. This needs to be considered when patients are advised on reintroduction of the diet. However, limitations of this study are acknowledged in that owing to time constraints a detailed medical history was not obtained. As both patients were elderly, there were other factors that may have contributed to their poor quality of life - especially for patient 2 previously having had abdominal surgery. Dietary and FODMAP intake was assessed using a 24-hour dietary recall which may not be 100% accurate. A 24-hour dietary recall has its limitation as it depends on memory and patients may have under reported their intake which could have also underestimated FODMAP intake.

CONCLUSION

FODMAPs trigger gastrointestinal symptoms in IBS patients, and patients who have not received dietary advice to manage their symptoms continue to avoid food and beverages which they perceive to trigger symptoms. This leads to unnecessary restriction of certain low-FODMAP foods, increasing the risk of nutritional deficiency. Patients also continue to suffer from severe gastrointestinal symptoms, as they still consume high-FODMAP foods in their diet, impacting on quality of life. It is appropriate that all IBS patients be referred to dietitians trained in delivering the low FODMAP education, to assist patients in managing symptoms.

DISCLOSURES

The authors declare no conflicts of interest in this work.

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