What are adults with IBD eating? A closer look at the dietary habits of a population-based Canadian IBD cohort

Authors:
Kathy Vagianos, RD, MSc
Departments of Nutrition and Food Services, Health Sciences Centre and the University of Manitoba IBD Clinical and Research Centre

Ian Clara, PhD
Departments of Community Health Sciences, University of Manitoba and the University of Manitoba IBD Clinical and Research Centre

Rachel Carr, MSc
Alberta Health Services and the University of Manitoba IBD Clinical and Research Centre

Leslie A Graff, C.Psych., PhD
Department of Clinical Health Psychology, Faculty of Medicine and the University of Manitoba IBD Clinical and Research Centre

John R Walker, C. Psych., PhD
Departments of Clinical Health Psychology, University of Manitoba and the University of Manitoba IBD Clinical and Research Centre

Dr. Laura E. Targownik, MD
University of Manitoba Department of Internal Medicine, Section of Gastroenterology and the University of Manitoba IBD Clinical and Research Centre

Lisa M Lix, PhD, P.Stat.
Departments of Community Health Sciences and the University of Manitoba IBD Clinical and Research Centre.

Linda Rogala, BN
University of Manitoba IBD Clinical and Research Centre

Norine Miller, RN
University of Manitoba IBD Clinical and Research Centre

Dr. Charles N. Bernstein, MD
University of Manitoba Departments of Medicine and the University of Manitoba IBD and Clinical Research Centre

ABSTRACT. *Background:* A comprehensive study of what subjects with Inflammatory Bowel Disease (IBD) are eating that encompasses food avoidance, dietary sugar consumption and a comparison to the non IBD Canadian population has not been documented. The aim was to analyze these interrelated dietary components. *Methods:* Food avoidance and sugar intake data was collected from 319 IBD subjects enrolled in the University of Manitoba IBD Cohort study. Diets of subjects with IBD (n=256) were compared to a matched, non IBD Canadian cohort using the nutrition questions obtained from the Canadian Health Measures Survey (CHMS). *Results:* Food avoidance among IBD is prevalent for: alcohol, popcorn, legumes, nuts, seeds, deep fried food and processed deli meatwith a higher prevalence among subjects with active IBD. Subjects with active IBD also consumed significantly more portions of sports drinks and sweetened beverages compared to those with inactive disease. When compared to the non IBD Canadian population, subjects with IBD consume significantly less iron rich food but more milk. *Conclusions:* Food avoidance is common among IBD but may be due more to personal preferences while sugar laden beverages may be displacing other foods higher in nutrients. The overall diet of IBD subjects differed to from the non IBD Canadian population however deficiencies were observed in both groups. Considering malnutrition among persons living with IBD, nutrition education by trained dietitians as part of the IBD team is imperative to address food avoidance an overall balance nutrition as part of treating and preventing nutritional deficiencies.

Clinical Relevancy Statement: This study compares the diet of a population based sample with IBD compared to a non IBD Canadian population. We confirm that dietary deficiencies exist in both the IBD and non IBD population. We also report that among all IBD patients, there is a high prevalence of food avoidance, oftentimes food of high nutritional value, while an increased intake of sugar laden beverages exists among patients with active IBD. Deficiencies in the overall diet of patients with IBD, compounded with food avoidance and increased sugar intake, are interrelated dietary concerns that must be determined as these patients are at risk for malnutrition. A comprehensive nutritional assessment and education by trained dietitians as part of an IBD team is imperative.

Introduction:

Inflammatory bowel disease (IBD) is a chronic inflammatory disease that exclusively involves the colon in ulcerative colitis (UC) and may involve any part of the gastrointestinal tract (GI) in Crohn's disease (CD). The disruption of the gastrointestinal tract by inflammation and the associated symptoms of IBD, including anorexia, abdominal pain, nausea, and diarrhea, can result in changes in dietary habits as a means of controlling symptoms. Patients with IBD report that certain foods can induce or exacerbate IBD symptoms.[1] These food types are commonly referred to in the IBD literature as "trigger foods."

It is important to consider the assessment of dietary intake in the clinical care of patients of IBD as malnutrition has been reported in up to 85% of patients with IBD and can affect patients, particularly those with CD, even when their disease is inactive.[2-5] Recent work by our group showed that many persons with IBD have an inadequate intake of vitamins A, C, D, and E, as well as calcium, folate, and iron.[4] Patients' beliefs about food avoidance, and ultimately their dietary restrictions, may further compromise their nutritional status, particularly if foods avoided are of high nutrient density.

While many patients believe their diet directly affects their disease course, the impact of diet on the onset of IBD, or on the exacerbation of IBD symptoms, is less clear. During the 1970's and 1980's there was interest in the role of simple sugars and carbohydrates in IBD following an observation that adolescents with CD had eaten large amounts of sweets prior to their diagnosis,[6,7] with results suggesting that carbohydrate intake may play a role in the onset of IBD or the flare up of symptoms. Subsequent research has investigated the role of various macronutrients in the diets of IBD, but these have been consistently criticized for their recall bias, limiting the extent of the reliability of the results.[8,9]

Interestingly, the dietary intake of patients with IBD compared to non IBD individuals has not been well documented. Nutritional deficiencies cited as specific to IBD may reflect more common eating habits in the general population, and as such need to be better delineated.

Hence, there are distinctive, yet interrelated "gaps" in the understanding of diet for IBD patients. Using a population-based cohort of IBD participants and a matched community comparison group, this study aimed to: 1) determine if patients with IBD avoid particular foods and their reasons for avoidance; 2) determine if sugar intake, specifically, is different between patients with active IBD vs. inactive IBD; and 3) determine other differences in dietary intake among IBD patients compared to Canadians who do not have IBD.

Methods

Participants: The Manitoba IBD Cohort Study was initiated in 2002, with participating individuals 18 years of age or older and diagnosed with IBD within the previous seven years (median of 4.3 years). They were recruited from the population-based University of Manitoba IBD Research Registry.[10,11] We have previously reported that the IBD Cohort Study participants were similar demographically, and thus representative of the general IBD population in Manitoba.[12] Participants completed surveys semi-annually and underwent annual in-person interviews. At study initiation there were 388 IBD Cohort Study participants.[13] Data regarding food avoidance and sugar intake, were collected at 48 months (2006-2007) after entry into the longitudinal study. At this point, there were 319 individuals with complete data for analysis in this study, and they had a median of 8 years disease duration. A second wave of data regarding intake of specific dietary components using the Canadian Health Measures Survey (CHMS) food questionnaire were collected at 72 months (2009-2010) after study entry, at a median of 10 years

disease duration. The final sample included 256 individuals who had complete data across these time points for analysis in this study. The Manitoba IBD Cohort Study was approved by the University of Manitoba Health Research Ethics Board and participants provided written informed consent.

Disease activity: To assess disease status, participants completed the Manitoba IBD Index (MIBDI). The MIBIDI is a single-level 6-level response rating scale validated to characterize symptomatic disease activity, based on symptom frequency over the previous six months, and is particularly applicable for longitudinal studies involving multiple measurement periods.[11] Those who rated their symptoms from levels 1 to 4 (constantly active, often active, sometimes active, or occasionally active one or two days per month) were categorized as having *active* disease. Those reporting their symptoms as occurring rarely to never over the previous six months (levels 5 or 6) were categorized as having *inactive* disease.

Nutritional Intake Measures

Food Avoidance: A food avoidance questionnaire was developed by the research dietitian in collaboration with the research team based on clinical interviews (n=126) in a previous IBD study.[4] At that time, participants were asked to list all foods that are routinely avoided. The most frequently identified foods that were avoided were included in the food avoidance measure used in the current study, with an additional question related to reasons for avoiding these foods. These foods included: nuts and seeds; salad or raw vegetables of any type; legumes; tomato products (sauce, juice or ketchup); raw fruit; deep fried/higher fat foods; milk and milk products; processed/luncheon/deli meat; tea or coffee; alcohol; popcorn; and red meat (unpublished data).

On the food avoidance questionnaire, for each food item, patients were asked to indicate if they normally eat that food (yes or no), if they consumed the food when their IBD was active (yes or no), and if they consumed the food when their IBD was inactive (yes or no). If the respondent avoided the food, they were asked to identify the primary reason why the food item was avoided. Response choices were: 1) "Eating this food causes me to have GI upset with symptoms that last up to 24 hours" 2) "Eating this food causes me to have GI upset with symptoms that last days to weeks" 3) "I have read/heard that people with IBD should avoid this food" 4) "A health professional (doctor, nurse, dietitian, other) has advised me to avoid this food" 5) "I do not like this food (personal preference)" or 6) other. The food avoidance questionnaire was administered by the research nurse at the 48 month point of the IBD cohort study (2006 – 2007) during face-to-face interviews with the participants.

Sugar Consumption: A questionnaire was developed by the research dietitian in collaboration with the research team to assess sugar intake. Foods commonly consumed that are determined to be high in simple sugar were included in the survey. The questionnaire asked about amounts of foods high in simple sugars that were consumed during the prior six months. Food types included: sugar, candy, chocolate, pastries, jams or jelly, regular soft drinks, diet soft drinks, sport drinks, fruit juices, and sweetened drinks. Participants were asked to identify if they normally eat/drink this food (yes or no) and then reported the number of portions consumed per week over the last 6 months. The sugar intake questionnaire was administered by the research nurse at the 48 month point of the IBD cohort study (2006 – 2007) during face-to-face interviews with the participants.

Specific dietary components

The nutrition questions regarding specific dietary components were taken directly from the Canadian Health Measures Survey (CHMS) and administered as part of the 72 month data collection phase for the IBD Cohort Study (2009 – 2010). This time point was chosen to better match the time during which the CHMS was administered to the non IBD Canadian population and the anticipated availability of the CHMS data results for comparison to our IBD data. The primary outcome of interest was to determine how the food intake of IBD cohort participants compared to a matched sample from the Canadian population. The CHMS nutrition questions were administered by a research nurse via face-to-face interviews with the participants.

Comparison of the IBD diet vs. the non IBD Canadian Diet

The CHMS is a nationally representative survey that includes the Canadian population aged 6 to 79 years living in private households at the time of the survey.[14-17] Data were collected at 15 sites across Canada from March 2007 through February 2009. Measures included intake frequency of certain food groups and associated nutrients. To develop the matched comparison group with the IBD cohort, a subsample of the CHMS respondents that were proportionally matched to the IBD sample on gender and age (collapsed into 5-year groupings) distributions was used. This resulted in a sample of 300 individuals from the CHMS.

Data analysis

Descriptive statistics were used to provide means, frequencies, and proportions as appropriate. For the comparisons of the IBD and community samples, the data from the two samples were merged. The CHMS data were weighted using the master weight provided by Statistics Canada,

and a weight was created for each of the IBD participants that were proportional to their probability of being selected from the IBD Research Registry. Mean frequencies of food intake across several types of food were compared between the IBD and CHMS samples using independent-sample t-tests, with a significance level of $p<.05$.

Results

Table 1 illustrates the demographic and disease characteristics of the IBD cohort at month 48 and month 72. Similar demographics were observed at both time points. At month 48, 52% had CD and 48% had UC, and overall 48% had active disease. The mean age was 44.6 years, and 61% were female.

Food Avoidance: Table 2 illustrates the types of foods those with IBD regularly avoid or avoid selectively when their disease is active. A substantial proportion always avoid nuts and seeds (27%), legumes (30%), deep fried higher fat food (25%), processed deli meat (25%), alcohol (31%), and popcorn (30%). However, a larger proportion tends to eat these foods when they are feeling well, but avoid them during active disease (i.e. nuts and seeds 35%). The most commonly avoided foods during active disease were salad and raw vegetables, deep fried foods, and alcohol. A primary reason for avoidance of foods such as legumes, processed deli meat, and tea/coffee was personal preference (i.e. “I do not like this food”; Table 3). A large percentage of IBD participants reported that they avoided food items because they caused gastrointestinal upset that lasted up to 24 hours (e.g., 71% for salad/raw vegetables; 51% for milk and milk products; Table 3). Items most commonly avoided due to GI upset included nuts and seeds, salad and raw vegetables, tomato products, raw fruit, deep fried higher fat foods, milk and milk products, and red meat. Up to 15% of the patients were avoiding foods on the basis of professional advice, with milk and milk products being the item most typically avoided on health professional’s advice.

Sugar Consumption: The mean weekly intake of sugar-laden foods and beverages are reported in Table 4, comparing those with active and inactive disease, and comparing those with CD and UC. Participants with active disease consumed significantly more portions of sports drinks and sweetened beverages compared to those with inactive disease (mean = 2.3 bottles vs. 1 bottle of sports drinks; 5.1 cups vs. 2.6 cups of sweetened drinks per week, $p<0.05$). There were no differences in consumption of or intake of sugar laden food or drink in CD vs. UC. There was a trend towards a higher intake of regular soft drinks among CD vs. UC ($p=0.08$).

Specific dietary components; Comparison of the IBD Diet vs. the non IBD Canadian Diet: The general diet, using food categorized according to the CHMS questionnaire, was compared between the IBD cohort and the non IBD community controls (Table 5). Participants with IBD consumed significantly less red meat, salt water fish, shellfish, eggs, dried beans, nuts, pasta, fruit, tomatoes, lettuce, fried potatoes, regular soft drinks, and fruit juices compared to those without IBD. IBD participants consumed significantly more sausages/bacon, fresh water fish, milk, cottage cheese, spinach, other potatoes, diet soft drinks, and water compared to the non IBD group. Differences in weekly food intake were also observed in the IBD cohort between those with active disease and inactive disease. Participants with active disease reported significantly less frequent intake of nuts, cereal, fruit, lettuce, and spinach compared to those with inactive disease, and more frequent consumption of red meat and regular soft drinks.

Discussion

To our knowledge, this is the first study that compares the dietary intake of a population based sample with IBD to that of controls sampled from the population at large that do not have

IBD. Garriguet (2007) recently analyzed the Canadian diet based on the 2004 Canadian Community Health Survey.[18] Canadians, on average, are within acceptable ranges for the number of servings from the four major food groups. However, these averages mask the substantial proportions of adults who do not have a balanced diet. That is, between 40 and 60% of Canadian adults are not consuming the minimum amount of recommended fruits and vegetables per day and 46 to 84% of adults are not consuming the minimum number of milk products as recommended.[18] Others have reported that despite fortification and supplement use, the calcium intake of Canadians needs to be improved.[19]

Persons with IBD in our study consumed milk 7.8 times per week, which equates to approximately once daily. This was the main source of calcium considered in this survey and would equate to approximately 300 mg of calcium per day (if using a 1 cup serving size). These findings would suggest that adequate calcium is not being consumed to facilitate prevention of osteoporosis, a potential comorbidity in IBD. However, other sources of calcium may have been consumed that were not specifically quantified in the CHMS nutrition questionnaire (i.e. fortified orange juice, almonds, hard cheese). Interestingly, participants with IBD consumed more milk that the community sample, despite the fact that 15% were specifically avoiding milk on the advice of their health professionals.

Persons with IBD were found to consume significantly less iron rich and protein foods, such as red meat, fish, eggs, dried beans, and nuts, compared to the non IBD community sample. This is a concern considering iron deficiency, protein malnutrition, and malabsorption are common nutritional complications in IBD. In our previous work, we reported that 39% of IBD subjects had iron deficiency.[4] Although our current study did not analyze for micronutrient deficiencies, it could be assumed that the decreased intake of iron rich foods among the IBD

cohort is a contributor to the development of iron deficiency anemia. Our data confirm that a significant proportion of persons with IBD avoid various types of foods, and that the avoidance is more widespread when disease is active. The foods avoided were similar to those reported elsewhere.[1] Some food types (nuts and seeds, salad and raw vegetables, tomato products, raw fruit, deep fried foods, milk, and red meat) may not necessarily exacerbate IBD-related symptoms as participants reported symptoms that lasted only 24 hours upon ingesting those food types. Of particular interest is the large number of foods that are avoided simply due to personal preference by many respondents (legumes, processed meat, tea or coffee, alcohol, popcorn). In previous reports these foods have been identified as "trigger foods" for IBD exacerbation by patients.[20] Our study suggests that many of these foods are excluded from the diet due to personal preferences, and may not be related to their IBD. Persons with IBD have strong beliefs about the role diet may play on the exacerbation of symptom. [21] Our data underscores the importance of considering a person's belief system on food and symptoms despite the lack of evidence from prospective controlled trials to support a direct link to dietary belief's and exacerbation of IBD symptoms. A primary approach to providing advice on food avoidance for person with IBD should incorporate food diaries to track symptoms (whereby patients then become empowered to control their own symptoms), while dietitians / health care providers have a tool to identify dietary nutritional deficiencies and make recommendations appropriately. Interestingly, some of the foods that persons with IBD in our present study report as "always avoiding" (legumes, milk, fruit) are considered high FODMAP foods (fermentable, oligo-, di-, mono-saccharides and polyols). High carbohydrate diets and diets high in FODMAPs have been suggested to be associated with abdominal symptoms in functional gastrointestinal disorders

implying that a low FODMAP diet may be warranted in patients with IBD who report functional gut symptoms.[22, 23]

Ballegaard et al., (1997) identified that 65% of persons with IBD report being intolerant to one or more food items compared to only 14% of healthy controls.[24] The foods most often blamed for causing diarrhea and abdominal pain included: onions, cabbage, apples, strawberries, citrus fruit, beef, and smoked meat. Among a Canadian IBD cohort, 34 foods have been cited as *never eaten* by 40% or more of persons with IBD.[25] These foods included: milk (whole and chocolate), artificial sweetener, diet soft drinks, beer, decaffeinated coffee, liquor, wine, Mexican food, fried fish, liver, bran cereal, blackberries, and apricots. More systematic evaluation is needed to determine to what degree food types trigger symptoms in the absence of inflammation in persons with IBD versus triggering definite inflammation, and to what degree food is avoided as a preference or taste preference versus unpleasant effects of the ingestion.

Of interest, 15% of persons with IBD in our study who avoided milk responded that this was secondary to advice received from a health professional. While lactose intolerance may occur as a result of small intestinal inflammation causing loss of brush-border lactase activity, we did not gather information on why lactose avoidance was recommended, or which type of health professional was providing this guidance.

Avoidance of nutrient dense foods is a particular concern for the management of IBD. Although our study did not analyze for micronutrient deficiencies, avoidance of salad and raw vegetables in 10% of all IBD participants and in 46% of those with active disease suggests some risk of dietary deficiency of vitamin C and A, folate, and fibre for many patients, as these foods are key sources of these nutrients. Avoidance of milk products in 12% of all IBD and 29% of active IBD may lead to a potential deficiency in calcium and vitamin D among a group known to

be at risk for osteoporosis.[2] Micronutrient deficiency of vitamin D was not analyzed in our present study; however, in our previous work, 44% of IBD subjects had vitamin D deficiency.[4] Considering that persons with IBD are at risk or may already be malnourished, care providers should ensure these nutrients are provided through other food or supplemental sources.

We report that there is a significantly greater intake of sports drinks and sweetened drinks for those with active IBD compared to those with inactive disease. Whether this was a cause or by-product of the disease activity itself cannot be determined from these data. Studies have postulated that an increased intake of sugar may be caused by the disease itself as a result of a decreased ability to taste sweet substances from zinc deficiency.[26] We were unable to report on zinc deficiency, but in our previous work we report a trend to a higher prevalence of zinc deficiency in active IBD vs. inactive.[4] Alternatively, a diet high in sugar may simply be a marker for another dietary excess or deficiency. Large percentages of participants with active IBD avoid nuts and seeds, fruits, vegetables, and milk products; hence a situation may emerge where many nutrient dense food groups are avoided and sugar is increased. High sugar products may also be a source of easy to ingest calories for individuals who have reduced their intake but need to maintain adequate hydration and calories. The high intake of soft drinks is of interest since carbonated beverages are a modern phenomenon and if these were ingested to excess before the onset of disease it may have implications for disease etiology.

Mayberry et al., (1980) reported that IBD patients added significantly more teaspoons of sugar per day to their diet compared to controls.[26] Silkoff et al., (1980) reported that CD patients consumed significantly more grams of carbohydrate per day compared to controls.[27] In 2004, Sakamoto et al., used a validated semi quantitative food frequency questionnaire (FFQ) to identify that in the pre-illness diet of patients with IBD, there was an increased consumption of

sugars, sweeteners, and sweets, and that these were positively associated with an increased risk of CD and UC.[8] Recall bias limits in the interpretation and validity of the results.[28] Ideally, prospective dietary intervention studies are more reliable. Interestingly there is only one intervention study in which IBD patients and controls were provided either a high fibre/ low sucrose diet or a low fibre/unrestricted sucrose diet.[29] In this study there were no significant differences between the dietary groups in terms of surgery, hospital admissions, or symptom exacerbation. We, too, could not determine as to when persons with IBD increased their sugar intake in relation to their disease becoming active. Further exploration of sugar intake habits (particularly prior to disease onset) is warranted, since the relative balance of nutrients ingested can impact on the gut microbiome and could be considered a trigger of IBD.[30]

Conclusions

This study is one of the few to document what patients with IBD typically eat. Previous work from our group has shown that although the vast majority (80-89%) of persons diagnosed with IBD view nutrition information as being very important, only 8 to 16% of patients report receiving adequate information on nutrition in the early period following diagnosis, despite a strong interesting obtaining this knowledge.[31] Our study shows that persons with IBD will avoid particular foods, oftentimes nutrient rich foods, based on symptoms and personal preference, while sugar laden beverages may be displacing other foods that are higher in nutrients. The overall diet of our IBD sample differed to some extent from a general non IBD community sample. However, deficiencies exist in both groups, flagging the need to assess the diet and address deficiencies, particularly for the chronic disease group given other health risks. Considering the risk of malnutrition among people with IBD, nutrition education by trained

dietitians as part of the IBD team is imperative to address food avoidance and overall balanced nutrition as part of treating and preventing nutritional deficiencies among this group

References

1. Prince A, Whelan K, Moosa A., Lomer MCE, Reidlinger D. Nutritional problems in inflammatory bowel disease: The patient perspective. European Journal of Crohn's and Colitis. 2011;5:443-450
2. Lomer MCE. Symposium 7: Nutrition in inflammatory bowel disease. Dietary and nutritional considerations for inflammatory bowel disease. 2011. Proceedings of the Nutrition Society;70:329-335.
3. Husain A, Korzenik JR. Nutritional issues in inflammatory bowel disease. Semin Gastrointest Dis. 1998;9:21-30.
4. Vagianos K, Bector S, McConnell J, Bernstein CN. Nutrition assessment of patients with inflammatory bowel disease. **JPEN.** 2007;31:311-319.
5. O'Sullivan M, O'Morain C. Nutrition in inflammatory bowel disease. Best practice and research clinical gastroenterology. 2006;20:561-573.
6. Miller B, Fervers F, Rohbeck R, Strohmeyer G. Sugar consumption in patients with crohn's disease (German). Verh. Dtsch. Ges. Inn. Med. 1976;82:922-924.
7. Martini GA, Brandes JW. Increased consumption of refined carbohydrates in patients with crohn's disease. Klin. Wschr. 1976;54:367-371.
8. Sakamoto N, Kono S, Wakai K, et al. Dietary risk factors for inflammatory bowel disease: a multicentre case-control study in Japan. Inflamm Bowel Dis. 2004;11:154-162.
9. Chapman-Kiddell CA, Davies PSW, Gillen L, Radford-Smith GL. Role of diet in the development of inflammatory bowel disease. Inflamm Bowel Dis. 2012;16:137-151

10. Bernstein CN, Blanchard JF, Rawsthorne P et al. The epidemiology of Crohn's disease and ulcerative colitis in a central Canadian province: A population-based study. Am J Epidemiol. 1999;149:916-924.
11. Clara I, Lix LM, Walker JR et al. The Manitoba IBD index: evidence for a new and simple indicator of IBD activity. Am J Gastroenterol. 2009;104:1754-63.
12. Longobardi T, Walker JR, Graff LA, Bernstein CN. Health service utilization in IBD: comparison of self-report and administrative data. BMC Health serv Res. 2011;11:137.
13. Graff LA, Walker JR, Lix L, et al. The relationship of inflammatory bowel disease type and activity to psychological functioning and quality of life. Clinic Gastro Hepatol. 2006;4:1491-1501.
14. Bryan, S. N., St-Denis, M., & Wojitas, D. Canadian Health Measures Survey: Clinic operations and logistics. 2007.
15. Health Reports (Statistics Canada, Catalogue 82-003), 18 Suppl, 53-69; Day, B., Langlois, R., Tremblay, M., & Knoppers, B. M. (2007). Canadian Health Measures Survey: Ethical, legal and social issues. Health Reports (Statistics Canada, Catalogue 82-003), 18 Suppl, 37-52.
16. Giroux, S. Canadian Health Measures Survey: Sampling strategy overview. 2007
17. Tremblay, M. Wolfson, M., & Conner Gorber, S. Canadian Health Measures Survey: Rationale, background and overview. Health Reports (Statistics Canada, Catalogue 82-003). 200718 Suppl, 7-20.
18. Garriguet D. Canadian's eating habits. Health Reports. 2007.18:17-32.

19. Vatanparast H, Dolega-Cieszkowski JH, Whiting SJ. Many adult Canadians are not meeting current calcium recommendations from food and supplement intake. 2009. Appl. Physiol. Nutr Metab;34:191-196.
20. Zallot C, Quilliot D, Chevaux J, et al. Dietary beliefs and behavior among inflammatory bowel disease patients. Inflamm Bowel Dis. 2013;19:66-72.
21. Hou JK, Lee D, Lewis J. Diet and inflammatory bowel disease: Review of patient-targeted recommendations. Clinic Gastro Hepatol. 2014 (article in press).
22. Gibson PR, Shepherd SJ. Evidence-based dietary management of functional gastrointestinal symptoms: the FODMAP approach. Journal of Gastroenterology and Hepatology. 2010;25:252-258.
23. Gearry RB, Irving PM, Barrett JS, Nathan DM, Shepherd SJ, Gibson PR. Reduction of dietary poorly absorbed short-chain carbohydrates (FODMAPs) improves abdominal symptoms in patients with inflammatory bowel disease – a pilot study. 2009. Journal of Crohn's and Colitis;3:8-14.
24. Ballegaard M, Bjerstrom A, Brondum S, Hylander E, Jensen L, Ladefoged K. Self reported food intolerance in chronic inflammatory bowel disease. Scand J Gastroenterol. 1997;32:569-571.
25. Joachim G. Responses of people with inflammatory bowel disease to foods consumed. Gastroenterology Nursing.2000;23:160-167.
26. Mayberry JF, Rhodes J, Newcombe RG. Increased sugar consumption in Crohn's disease. Digestion. 1980;20:323-326.
27. Silkoff K, Hallak A, Yegena L, et al. Consumption of refined carbohydrate by patients with Crohn's disease in Tel-Aviv-Yafo. Postraduate Medical Journal. 1980;56:842-846.

28. Krishnan A, Korzenik JR. Inflammatory bowel disease and environmental influences. Gastroenterology Clinics. 2002;31:21-39.
29. Ritchie JK, Wadsworth J, Lennard-Jones JE, Rogers E. Controlled multicetnre therapeutic trial of an un refined carbohydrate, fibre rich diet in Crohn's disease. BMJ. 1987;295:517-520.
30. Ananthakrishnan, A. Envirnonmental risk factors for inflammatory bowel disease. Gastroenterology and Hepatology. 2013;9:367-374.
31. Wong S, Walker JR, Carr R, et al. The information needs and preferences of persons with longstanding inflammatory bowel disease. Can J Gastroenterol. 2012;26:525-531.