Child and Parent Perceived Food-Induced Gastrointestinal Symptoms and Quality of Life in Children with Functional Gastrointestinal Disorders

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Abstract

It is unknown whether children with functional gastrointestinal disorders (FGIDs) identify specific foods that exacerbate their gastrointestinal (GI) symptoms. The objectives of this study were to determine the perceived role of food on GI symptoms and to determine the impact of food-induced symptoms on quality of life (QOL) in children with FGIDs. Between August and November 2010, 25 children ages 11–17 years old with FGIDs and a parent completed a food symptom association questionnaire and validated questionnaires assessing FGID symptoms and QOL. In addition, children completed a 24-hour food recall, participated in focus groups to identify problematic foods and any coping strategies, and discussed how their QOL was affected. Statistical analyses were conducted using chi-squared, t-testing, Mann-Whitney U, Wilcoxon signed-rank, and Spearman's rho. Children identified a median of 11 (range 2–25) foods as exacerbating a GI symptom, with the most commonly identified foods being spicy foods, cow's milk, and pizza. Several coping strategies were identified including consuming smaller portions, modifying foods, and avoiding a median of 8 (range 1–20) foods. Children reported that food-induced symptoms interfered with school performance, sports, and social activities. Although the parent's assessment

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of their child's QOL negatively correlated with the number of perceived symptom-inducing foods in their child, this relationship was not found in the children. Findings suggest that specific foods are perceived to exacerbate GI symptoms in children with FGIDs. Moreover, despite use of several coping strategies, food-induced symptoms may adversely impact children's QOL in several important areas.

Keywords

pediatrics; irritable bowel syndrome; functional dyspepsia; diet

INTRODUCTION

Functional gastrointestinal disorders (FGIDs), such as irritable bowel syndrome (IBS), functional abdominal pain, and functional dyspepsia are prevalent, affecting approximately 10–25% of school-aged children.[1–3] These disorders often cause significant morbidity and lead to school absences, increased use of health care resources, and decreased quality of life (QOL). Unfortunately, these disorders are often chronic with up to 65% of children with FGIDs becoming adults with FGIDs.[4,5]

The etiology of FGIDs is thought to be multifactorial including altered brain-gut interactions, genetic predispositions, and/or environmental factors such as diet.[3,6] Twenty-five to 75% of adults with IBS report specific food-induced worsening of their gastrointestinal (GI) symptoms such as abdominal pain and diarrhea.[7] Adults with IBS identify diets high in carbohydrates, fatty foods, coffee, alcohol, and hot spices as the primary culprits.[8] Avoidance of certain foods may improve GI symptoms as demonstrated through dietary interventions, promoting avoidance of foods high in fermentable oligosaccharides, disaccharides, monosaccharides, and polyols (FODMAPs) in some adults with FGIDs.[9] However, adults who self-impose dietary restrictions without medical supervision may reduce their intake of important nutrient-containing foods and impair overall nutrition.[7,10]

The perceived role of specific foods on GI symptoms in children with FGIDs is unknown. Furthermore, how perceived food-induced GI symptoms may relate to QOL has not been evaluated. The study hypothesis was that children with FGIDs and their parents would identify specific foods that exacerbated their GI symptoms and negatively affected their QOL. The study also hypothesized congruence between children and parents on which specific foods worsened GI symptoms. Therefore, both qualitative and quantitative methods were employed to investigate these relationships.

METHODS

Subjects

Children, ages 11–17 years, diagnosed with and actively experiencing GI symptoms due to a FGID, were recruited via mail, phone, pediatric gastroenterology clinic visits, newsletters, and advertisements at the Children's Nutrition Research Center (CNRC) and Texas Children's Hospital (TCH). Children were enrolled from August 2010 to November 2010.

Children were determined to have a FGID if they experienced abdominal discomfort for greater than 3 months without an identified metabolic, neoplastic, anatomic, or inflammatory (e.g. inflammatory bowel disease) etiology for their symptoms.[11] Children were included if they had been evaluated by a physician within one year of enrollment without an organic etiology identified (e.g. celiac) for their GI symptoms and if their GI symptoms were reportedly exacerbated by food(s). The majority of children 22/25 (88%) had seen a pediatric gastroenterologist. Children were excluded if they had previously undergone an abdominal surgical procedure (e.g. cholecystectomy) or if they and/or their parents were unable to speak English as the questionnaires used were only validated in English, and the focus groups were conducted solely in English.

The study was cross-sectional in design as this was the first attempt to describe the phenomenon of perceived food intolerance (PFIs) in our population that would be representative of real world findings, typically found in a clinical setting. Informed, written consent was obtained from the parent and assent from the child. The study was approved by the Baylor College of Medicine and the Texas Woman's University Institutional Review Boards.

During the study visit at the CNRC, a 24-hour food recall, in which the children had previously recorded all foods consumed within the past 24 hours, was reviewed with the child by an interviewer. Interviewers included registered dietitians, physicians, and research coordinators who were trained to review dietary recalls and administer the questionnaires (see below). All meals with their individual food components (e.g. type of bread eaten from a sandwich) and snacks were reviewed during the visit and appropriate changes made to the 24-hour food recall record as needed. Children and parents were interviewed individually in private, separate rooms by the assigned interviewer. The questionnaires were administered in the following order:

Rome III Diagnostic Criteria Questionnaire

The Rome III Diagnostic Criteria Questionnaire was utilized to identify the presence and severity of GI symptoms and to determine FGID subtypes.[11] Children completed the questionnaire on their own. Likewise, parents filled out the parent-proxy questionnaire in reference to their child.

Food Symptom Association Questionnaire (Supplemental Appendix)

Given that a validated food symptom association questionnaire is not available in children, a local questionnaire that listed 97 foods or food types (e.g. spicy foods) was developed. The foods listed in the questionnaire were based, in large part, upon foods included in the Harvard Youth/Adolescent Food Frequency Questionnaire.[12] The investigators, as deemed applicable to our population, determined modifications of the foods asked. For example, foods such as beer, wine, and liquor were eliminated from the questionnaire. Additions included gas-producing foods (e.g. watermelons, cherries, cabbage, etc.) and foods with high sugar content which may exacerbate GI symptoms in those with FGIDs.[13]

An assessment of symptoms, severity, avoidance of foods, and frequency of symptoms with food ingestion mirrored that used in an adult questionnaire, as no validated pediatric

questionnaire was available.[8] The interviewer administered the food questionnaire. Participants were instructed to identify any food causing a GI symptom (i.e., abdominal pain, nausea, vomiting, bloating, flatulence, satiety, diarrhea, reflux, and constipation). If a GI symptom was noted, the questionnaire then prompted the interviewer to ask the severity of the symptom(s) (rated on a 0–4 scale; "none, "little", "some", "bad", and "very bad"), the frequency of symptom(s) with ingestion (rated on a 0–4 scale; "none", "rarely", "sometimes", "often", or "always"), and whether the food was regularly avoided (yes/no). At the end of the questionnaire, participants were also asked if they felt "all foods" exacerbated their own or their child's GI symptoms.

Pediatric Quality of Life Inventory (PedsQL™) Generic Core Scale

The PedsQL™ is a standardized, age-appropriate, self-administered measure addressing physical, emotional, social, and school functioning health-related QOL.[14] The questionnaire quantifies QOL on a 0–100 scale, with 100 being the highest QOL score possible. Parents completed the parent-proxy PedsQL™ on their own, which contained the same questions as the child version.

The PedsQL™ Gastrointestinal Symptom Scale

Validated solely as a parent-proxy form, the PedsQL™ Gastrointestinal Symptom Scale was completed only by the parents, who rated their child's frequency of experiencing eight different GI symptoms (e.g., abdominal pain).[15] The Gastrointestinal Symptom Scale follows the same 0–100 scale as the PedsQL™, with 100 reflecting *no* GI symptoms.

Following completion of the questionnaires, children were asked to participate in a focus group. A total of 8 different focus group sessions occurred that were age-specific with children ages 11–14 years and 15–17 years being grouped separately. The focus groups were led by an experienced, qualitative moderator and audiotaped for later review. The moderator presented pictures of 82 different foods on flash cards to guide children in identifying foods that affected symptoms, to determine what coping strategies, if any, were used when dealing with symptom-inducing foods, and to discuss if and how their QOL may be affected. Probing questions were used to expand and clarify responses. Flash cards for all the foods from the food questionnaire were not included when a food type was felt to be too broad to represent in one picture (e.g. fast foods, fried foods). However, these types of foods were identified during discussion of specific foods (e.g. chicken and its preparation). Notes during the focus groups were also taken by one of the authors for further review and analysis.

Data Analysis

SPSS (version 19.0; August 2010; The Predictive Analytics Company, SPSS Inc, Chicago, IL) software was used to analyze the data. Continuous data were compared between groups using parametric (e.g. paired samples t-test, independent samples t-test) or non-parametric (Mann-Whitney U test) tests depending upon the type of distribution of the variables tested. The severity and frequency of GI symptoms associated with PFIs were compared with a Wilcoxon signed rank test. Correlations of PFIs and QOL scores were measured using Spearman's rho test. Values of $P<0.05$ were considered statistically significant. Unless otherwise specified, data are presented as the mean ± SD. Focus group session recordings

and notes were reviewed. Results with respect to PFIs were tabulated, and the top ten identified PFIs were compared between the focus group and questionnaire results. Themes for areas of impact on QOL and coping mechanisms were identified, reviewed, and categorized based on agreement by all the authors.[16] Individual quotations which represented these themes were selected and included in the manuscript.

RESULTS

Baseline Characteristics

Twenty-five child/parent dyads were enrolled. Demographics and Rome III FGID classification are summarized in Table 1.

Perceived Food Intolerances

The median number of foods identified by individual children as inducing GI symptoms was 11 (Range: 2–25). The median number of avoided foods reported by individual children was 8 (range: 1–20). Based on review of the 24-hour diet recall, 16 of 25 (64%) children had eaten an identified, perceived, symptom-inducing food within 24 hours of the study visit. The most commonly identified spicy foods were salsa, chili, Cajun food, green spicy peppers, and pico de gallo. The most frequently identified GI symptoms in response to foods on the questionnaire in descending order were abdominal pain, nausea, vomiting, gas, bloating, and eructation. These same GI symptoms were reported during the focus groups.

Strong consensus was found among methods in identifying foods associated with GI symptoms although the order varied (Table 2). For the top three foods, spicy food was the most commonly identified of the PFIs for all three methods (Table 2). Fried foods, spicy foods, and deep-fried foods did not overlap, as these were not specifically assessed in the focus groups.

There were no differences in report of the severity or frequency of symptoms with ingestion of the food/food type between children and parents with respect to the ten most frequent foods/food types exacerbating GI symptoms (data not shown). The specific foods associated with the highest frequency of GI symptoms and most severe GI symptoms when ingested varied widely among children and parents (data not shown). A majority of children did not endorse one specific food or food type as causing the most severe or most frequent GI symptoms. Likewise, parents reported a similar relationship.

The number of PFIs identified between male and female children from the entire cohort did not differ (median 8.5, range: 3–16 vs. 11, range: 2–25, respectively; P=0.25). In addition, male and female children did not differ in the number of avoided foods (median 6.5, range: 1–11 vs. 8, range: 1–20, respectively; P=0.36). Older children (>14 years of age) had more PFIs than their younger counterparts (median 15, range: 2–25 vs. 7.5, range: 3–14, respectively; P =0.02). In addition, older children avoided more foods than younger children did (median 10, range: 1–20 vs. 5, range: 1–14; P =0.04). The median total number of PFIs identified by children did not differ significantly from that of the parents (median 7, range: 0–27; P=0.55). Similarly, the median number of PFIs identified by younger children or older children in comparison to their parents did not differ significantly (data not shown). The

median number of avoided foods identified by children did not differ significantly from that of the parents (median 5, range: 0–26; P=0.38).

Coping Strategies / Improvement of Symptoms with Food

During the focus groups, children identified multiple coping strategies for food-induced symptoms. These included complete avoidance or decreased consumption of the food. Two out of seven (28.5%) participants believed that avoidance of all foods that induced symptoms would lead to cessation of all experienced GI symptoms. Children also modified (e.g., attempting to wipe away excess pasta sauce from pizza) or sought out foods in different states (e.g., ripened vs. unripened bananas), given the perception that foods of one state may influence GI symptom onset. One 16-year-old female stated regarding eating pizza: "*I will literally peel the cheese and pepperoni up and scoop up all the tomato and put it back, and it helps [the pain].*"

Food states identified during the focus groups as causing less pain included: unripened bananas, high fat content milk (e.g. 2% or whole milk), white meat chicken, clear sodas, dark chocolate, and goat or American cheese. Food states that were identified during the focus groups as causing more pain included ripened bananas, low fat milk (1%/skim), dark meat chicken, dark sodas, milk chocolate, and other cheeses.

Children also identified that consumption of some foods/beverages could ameliorate their GI symptoms (e.g. chewing gum, consuming mints, drinking water). Additional, beneficial foods identified by participants included popsicles, bread, yogurt, saltine crackers, and various fruits (e.g., bananas, apples, pears, and papayas).

Impact on Quality of Life

During the focus group sessions, children identified numerous food-related symptoms as affecting aspects of their lives. Numerous participants identified food intake as negatively affecting their performance in school and sports activities. Children reported missing activities outside of school due to food-induced pain. For some, this led to seeing less of their peers, as a 16-year-old female described: "*I can't have fun as much. The minute you sit down and hang out with friends, then you relax, it's [the pain] back again.*" Furthermore, concern for food-induced symptoms led to changes in behavior related to food in social situations. A 13-year-old girl described avoidance of eating outside of the home: "*I don't eat at friends' houses; I don't trust her food. I bring my own.*"

Participants were concerned about the perception others had of them due to the food-induced symptoms. A 16-year-old girl stated: "*You kind of feel left out because you want to be able to eat the same things they do, but you don't want to be that person at the party throwing up because of that.*"

The PedsQL Core Scale reported by the child did not correlate with the total number of PFIs ($r^2 = 0.01$, P=0.64) or avoided foods ($r^2 = 0.08$, P= 0.18) identified in the child food questionnaire. The overall QOL score as assessed by the parent was significantly worse than that reported by the child (63.3 ± 14.4 vs. 72.2 ± 11.4, respectively; $P < 0.01$). In contrast to the children, parents' perception of their child's overall QOL correlated inversely with the

parental perception of the child's total number of PFIs ($r^2 = 0.31$, $P < 0.01$) and avoided foods ($r^2 = 0.29$, $P<0.01$). In addition, the PedsQL Gastrointestinal Symptom Scale correlated inversely with the parent-identified number of PFIs ($r^2 = 0.38$, $P<0.01$) and number of avoided foods ($r^2 = 0.38$, $P<0.01$).

DISCUSSION

To our knowledge, this is the first study to investigate the role of PFIs in the lives of children with FGIDs. Both qualitative and quantitative methods demonstrated that children identify specific, symptom-inducing foods/food types and employ multiple coping strategies to ameliorate these food-induced symptoms, including food avoidance and choosing different forms of foods. Numerous areas of QOL appeared to be affected by perceived food-induced symptoms. Somewhat surprisingly, children with FGIDs also consumed specific foods to alleviate their GI symptoms in addition to avoiding or modifying their consumption of foods.

Proposed mechanisms for food-induced symptoms in FGIDs have included malabsorption, abnormal colonic fermentation, stimulation of motor responses within the GI tract, stimulation of mechanoreceptors or chemoreceptors, altered secretion, psychological factors, food allergy, visceral hypersensitivity, and abnormal gas handling.[8,13] Mechanoreceptor and chemoreceptor stimulation by spicy foods has been described, and this may have played a role in symptom generation in our study population.[17] Lipids have been shown to increase small intestinal motility, yet decrease ileocolonic transit.[18] Alterations in motility may play a role in our population given the prominence of fatty foods such as pizza and ice cream in inducing symptoms (Table 2). Mechanistic studies further evaluating the roles these foods may play in childhood FGIDs are needed to help develop better dietary management strategies.

There was good concordance between child (questionnaire and focus group) and parent (questionnaire) report for both the types of foods that caused symptoms (Table 2) as well as the frequency and severity of food-induced symptoms (data not shown). This concordance was also found when analyzing different age groups. This agreement using both qualitative and quantitative data supports the overall validity of the study. These associations are in contrast to divergent child and parent reporting of defecation frequency and stool characteristics in children with IBS.[19] The concordance of the questionnaire results with those from the focus group and parent questionnaire suggests that the food questionnaire used may be useful for future studies. However, its use will require formal confirmation of its validity.

One of the many notable findings included that the most frequently identified foods causing symptoms were not often the same ones that resulted in the most severe or most frequent symptoms when ingested. This observation may provide insight as to why a large percentage of children were found to have eaten a food perceived to induce symptoms on their 24-hour recall diaries. Children's coping skills such as decreasing portion sizes of foods perceived to induce symptoms may also play a role. Further investigation into why children may eat

foods, which they themselves know potentially causes symptoms, is warranted, as this dynamic may influence dietary interventions within this population.

Older children perceived more foods as inducing symptoms than younger participants. This observation may be due to the ability of older children to have more control over their food choices, be more accurate reporters, and/or have increased exposure to a greater number of foods. In addition, adolescents tend to consume more foods that are higher in fat and sugar content compared to younger children, in part due to taste preferences.[20,21]

To our knowledge, improvement in symptoms of children with FGIDs when eating specific foods rather than avoiding or modifying food consumption has not been previously reported. The majority of the work with respect to food and GI symptoms in FGIDs is related to exacerbation of symptoms and not their amelioration.[22] To date, there is a paucity of placebo-controlled data evaluating the efficacy of dietary interventions in childhood FGIDs.[23] However, data from studies in adults with IBS underline the importance of diet in exacerbating or ameliorating symptoms in some patients.[7,8] Hopefully the results of this study will be helpful in designing prospective studies regarding the role of foods in GI symptom generation in childhood FGIDs.

QOL depends upon the patient's attitude, psychosocial state, support systems, and coexistent conditions.[24] Overall, it has been found that children with FGIDs demonstrate significantly lower physical, emotional, social, and school functioning when compared to control children.[15] Moreover, increased GI symptoms have been found to negatively affect health-related QOL in children with FGIDs.[15] The focus groups identified several areas in which perceived food-induced symptoms negatively affected the QOL of the children including the following: school activities, friendships, and social situations. Overall QOL and the PedsQL Gastrointestinal Symptom Scale were inversely correlated with the number of PFIs and avoided foods reported by the parent but not the child. The reason for the discrepancy is not immediately clear. However, two observations may help explain these findings. First, we have reported previously that parents tend to view their child's psychological distress as greater than what is perceived by the children with FGIDs themselves.[25] Second, consistent with this study, a previous study identified that the majority of parents perceive their children with FGIDs to have food-related symptoms.[26]

Another explanation may relate to the proportion of children with active vs. passive coping strategies. Most children believed they would no longer have GI symptoms by completely avoiding symptom-inducing foods. Children using active coping mechanisms would avoid such foods and thus, break the link between PFIs and QOL.

There are a few limitations to this study. First, the sample size was modest which allowed for several rich discussion focus groups, but limited quantitative data collection. Second, the study questionnaires have not been validated in languages other than English, and the focus groups were conducted solely in English. Therefore, the generalizability to non-English speakers needs to be established. Third, selection bias may have occurred with parents particularly interested in the role of diet in their child's FGID symptoms enrolling in the study. Fourth, the design of our study did not include a control group although that did not

affect our hypotheses. Fifth, recall bias (e.g., 24-hour recall food record) may have played a role given the manner in which the data were collected. Prospective studies comparing a control group of healthy children vs. children with FGIDs validating a dietary approach would be beneficial. Finally, although the Pediatric Rome III Diagnostic Questionnaire has been used to categorize children into specific FGIDs categories, children were grouped together for this initial evaluation. However, classification can be incongruent or overlap with multiple categories of FGIDs even if one uses objective measures such as a questionnaire for classification.[27]

A major strength of the study was the mixed methods approach in which both questionnaires and focus groups were used to gain insight into the role of foods in the lives of children with FGIDs. Mixing of quantitative and qualitative methods can be complementary and allow for determination of patterns and more in-depth insights into participant attitude, thoughts, and actions.[28,29] Several recommended strategies were followed with the mixed methods approach.[30] First, the items discussed in the focus groups and in the food questionnaire were very similar. Second, only a short time period separated data collection between quantitative and qualitative methods. Third, objects of interest were presented in a concrete manner, namely through images. Fourth, participant response was anchored to the common context of food-induced GI symptoms and QOL. Finally, agreement between methods was estimated by identifying that the quantitative and qualitative methods had significant overlap in the most commonly identified PFIs.[30]

The study findings may assist practitioners in better identifying and understanding the perception of food with respect to GI symptoms and QOL in children with FGIDs. These results draw attention to the importance of foods, both as a potential inducer and ameliorator of symptoms, in these children. For future investigation in the role of foods and QOL in this group of children, obtaining information from both children and their parents is recommended to provide further insight.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Demographics and Functional Gastrointestinal Disorder Classification in the Enrolled Subjects

Characteristics	n (%)
Gender	
Females	19 (76%)
Males	6 (24%)
Ethnicity	
Caucasian	10 (40%)
Hispanic	5 (20%)
African American	8 (32%)
Miscellaneous/Other	2 (8%)
Age	
11–13 y	12 (48%)
14–17 y	13 (52%)
Pediatric Rome III Diagnosis	
Irritable Bowel Syndrome	10 (40%)
Abdominal Migraine	9 (36%)
Functional Dyspepsia	1 (4%)
Cyclic Vomiting Syndrome	2 (8%)
Unclassifiable	3 (12%)

Table 2

Comparison of Results from Three Methods to Determine the Most Frequently Identified Foods and/or Food Types that Induce Symptoms in Children with Functional Gastrointestinal Disorders

Children Food Questionnaire		Children Focus Group		Parent Food Questionnaire	
Spicy Foods	17 (68%)[1]	Spicy Foods	22 (88%)	Spicy Foods	15 (60%)
Pizza	13 (52%)	Pizza	13 (52%)	Cow's Milk	14 (56%)
Cow's Milk	14 (56%)	Cow's Milk	13 (52%)	Pizza	12 (48%)
Fried Foods	12 (48%)	Sodas	11 (44%)	Ice Cream	11 (44%)
Deep-Fried Foods	11 (44%)	Cheese	8 (32%)	Deep-Fried Foods	11 (44%)
Fast Foods	10 (40%)	Pasta Sauce	8 (32%)	Pasta Sauce	10 (40%)
Sodas	10 (40%)	Chicken	6 (24%)	Fast Foods	10 (40%)
Cheese	10 (40%)	Salsa	6 (24%)	Sodas	9 (36%)
Ice Cream	9 (36%)	Oranges	6 (24%)	Fried Foods	9 (36%)
Salsa	9 (35%)	Ice Cream	5 (20%)	Cheese	9 (36%)

[1]
n (%) of children or parents

The three methods used were: 1) a food symptom association questionnaire completed by the child with FGID; 2) focus groups of children with a FGID; and 3) a food symptom association questionnaire completed by a parent on their child with a FGID

FGID = functional gastrointestinal disorder