

REGULAR ARTICLE

# The prevalence of functional gastrointestinal disorders in children in Panama: a school-based study

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## ABSTRACT

**Aim:** Functional gastrointestinal disorders (FGIDs) are common in children, but the epidemiology of FGIDs is incompletely understood. Our aim was to perform a population-based study using Rome III criteria to describe the prevalence of FGIDs in children in Panama.

**Methods:** We performed a cross-sectional study of children attending three schools in Panama City, Panama. Children with organic medical diseases were excluded. Subjects provided demographic information and completed the Questionnaire on Pediatric Gastrointestinal Symptoms – Rome III Spanish version.

**Results:** A total of 321 subjects (61.1% female, median age 10 years, range 8–14 years) completed our study. A total of 92 subjects (28.7%) met criteria for an FGID. Gender, age and school type did not differ significantly between subjects with and without FGIDs. The most common FGIDs included functional constipation (15.9%), irritable bowel syndrome (5.6%), and functional abdominal pain or functional abdominal pain syndrome (4.0%). Abdominal pain-related FGIDs were present in 12.1%.

**Conclusion:** FGIDs are common in school-aged children in Panama. The prevalence of abdominal pain-related FGIDs in children in Panama is similar to that described in other parts of the world. Further population-based studies utilising Rome III criteria to measure FGID prevalence in children are needed to advance our understanding of the pathogenesis of FGIDs.

## BACKGROUND

Functional gastrointestinal disorders (FGIDs) are a heterogeneous group of disorders involving recurrent or chronic gastrointestinal symptoms not attributable to structural or biochemical abnormalities. Diagnosis of these disorders is based on clinical presentation as defined by the Rome III criteria (1). FGIDs are commonly encountered in clinical practice and are responsible for 41% of all visits to adult gastroenterologists and more than 50% of visits to paediatric gastroenterologists in the United States (2,3). This is particularly striking when we consider that as few as 2% of children with chronic abdominal pain seek medical attention (4).

Evidence is growing that FGIDs have a significant negative impact on quality of life and daily functioning in both children and adults. Chronic abdominal pain in children is associated with worse quality of life, psychological

comorbidities and school absenteeism (4). Children with FGIDs report lower health-related quality of life than children with organic gastrointestinal diseases, including Crohn's disease and ulcerative colitis (5). Adults with FGIDs have also been shown to have lower health-related quality of life than both the general population and patients with chronic nongastrointestinal disorders (6). The financial burden associated with care for FGIDs is significant and appears to be increasing with time. A review of the Kids' Inpatient Sample Database showed increases in both the

## Abbreviations

FGID, Functional gastrointestinal disorder; IBS, Irritable bowel syndrome; QPGS-RIII, Questionnaire on Pediatric Gastrointestinal Symptoms – Rome III version.

## Key notes

- Functional gastrointestinal disorders (FGIDs), particularly functional constipation and irritable bowel syndrome, are common in children in Panama.
- Studies describing the prevalence of abdominal pain-related FGIDs in children around the world show a surprisingly consistent prevalence.
- A better understanding of the prevalence of FGIDs in different populations may reveal risk factors that contribute to FGID development.

number of hospitalisations for children with FGIDs and the associated cost of these hospitalisations (7). The impact of FGIDs as an international public health problem is becoming increasingly recognised and the importance of a better understanding of this group of disorders is clear (8).

Although information on the prevalence of FGIDs in children is growing, the presence and extent of variation between different populations around the world is not well understood. As the pathogenesis of FGIDs remains unclear, a better understanding of the prevalence of FGIDs in different populations may reveal risk factors that contribute to FGID development. Previous studies have reported estimates of FGID prevalence in regions of North America, South America, Europe and Asia, but few of these studies have been population-based studies using the Rome III criteria for diagnosis (9–19). The Functional International Digestive Epidemiological Research Survey (FINDERS) group was created to perform population-based research on the epidemiology of gastrointestinal disorders. This study is a continuation of this mission and aims to describe the prevalence of FGIDs in school-aged children in Panama using the Rome III criteria.

## METHODS

We performed a cross-sectional study of school-aged children in Panama. Panama is a Central American country with nearly four million residents and is bordered by Costa Rica to the north and Colombia to the south. Twenty-seven per cent of the population is 14 years of age or younger. Spanish is the primary language of Panama. Panama City is the nation's capital and its largest city, with 1.6 million inhabitants (20).

Our study protocol was approved by the principal of each participating school and by the Institutional Review Board and Ethics Committee of Hospital del Niño of Panama City, Panama. Over two consecutive school years in 2013 and 2014, we mailed packages with study materials to families of all children enrolled in grades three through nine in three primary schools in Panama City, Panama. We included one public school and two private schools, and all schools were in session year-round. These packages included an invitation to participate in our study, a consent form to be completed by a parent, and an assent form to be completed by the subject. We also collected demographic information (gender and age) and information on the subject's medical history. We excluded subjects who had a history of organic medical disease based on reported medical history. Subjects were not allowed to participate more than once.

Subjects were asked to complete the Spanish version of the Questionnaire on Pediatric Gastrointestinal Symptoms – Rome III version (QPGS-RIII) Self-Report Form during a school session in April of either 2013 or 2014. The Spanish version of the QPGS-RIII has been previously validated in Spanish-speaking children (21–23). Prior to completing the QPGS-RIII, an audiovisual presentation explaining the questionnaire was given. Members of the research team were present during completion of the QPGS-RIII to

answer any questions. After QPGS-RIII results were entered into a digital format, 10% of questionnaires were reviewed to ensure accurate transcription. Results from all participating schools were aggregated, and this sample was used to calculate FGID prevalence. We evaluated group comparisons using *t*-test and chi-squared test as appropriate. We calculated odds ratios to evaluate the effect of potential risk factors, including gender, age and school type, on FGID development. *p*-values <0.05 were considered statistically significant (Stata 13; StataCorp, College Station, TX, USA).

## RESULTS

We invited 436 students to participate in our study and 361 students (82.8%) agreed to participate. Forty subjects were excluded because of organic medical disease. These diseases included gastroesophageal reflux disease, gastritis, hiatal hernia, oesophageal atresia, Hirschsprung disease, short bowel syndrome, hypothyroidism and ureteral reflux. A total of 321 subjects (73.6% of invited students, 61.1% female, median age 10 years, IQR 9–12, range 8–14) completed our study. Subject characteristics are shown in Table 1. Female gender, age younger than 12 years and public school were not associated with increased odds of FGID diagnosis.

The prevalence of each FGID is shown in Table 2. Fifty-one subjects (15.9%) met criteria for functional constipation, which was the most common FGID in our sample. Subjects with functional constipation most commonly reported pain with stools (70.6%), hard stools (39.2%), <2 stools per week (37.3%), passage of a stool that clogged the toilet (37.3%) and stool retention (37.3%). Thirty-nine subjects (12.1%) met criteria for an abdominal pain-related FGID, and among these irritable bowel syndrome (IBS) was the most common with 18 subjects (5.6%) followed by functional abdominal pain with 12 subjects (3.7%). Vomiting and aerophagia FGIDs were uncommon, with only two subjects (0.6%) meeting criteria. There were no significant differences in diagnoses when comparing subjects who participated in 2013 versus 2014.

The percentage of subjects who were female did not differ significantly between those who met criteria for FGIDs and those who did not (61/92, 66.3% versus 135/229, 59.0%, *p* = 0.12). FGID prevalence did not differ significantly between subjects younger than 12 years and older than 12 years (71/228, 31.1% versus 21/93, 22.6%, *p* = 0.22). FGID prevalence also did not differ significantly between subjects in public school compared to private school (29/111, 26.1% versus 63/210, 30.0%, *p* = 0.46).

The QPGS-RIII includes questions on nongastrointestinal symptoms associated with abdominal pain. Of the subjects who met criteria for an abdominal pain-related FGID, 34 (87.2%) reported associated dizziness, 31 (79.5%) reported headache, 26 (66.7%) reported difficulty sleeping, 25 (64.1%) reported missing school and 23 (59.0%) reported arm, leg or back pain at least 'once in a while' or 25% of the time. Although only a fraction met criteria

**Table 1** Subject characteristics

	All subjects (N = 321)	FGID (N = 92)	No FGID (N = 229)	OR (95% CI)	p-Value
Gender					
Female	196 (61.1%)	61 (31.1%)	135 (68.9%)	1.37 (0.80–2.36)	0.22
Male	125 (38.9%)	31 (24.8%)	94 (75.2%)		
Age					
8–11 years	228 (71.0%)	71 (31.1%)	157 (68.9%)	1.55 (0.86–1.87)	0.12
12–14 years	93 (29.0%)	21 (22.6%)	72 (77.4%)		
School type					
Public	111 (34.6%)	29 (26.1%)	82 (73.9%)	0.83 (0.47–1.42)	0.47
Private	210 (65.4%)	63 (30.0%)	147 (70.0%)		

**Table 2** Prevalence of functional gastrointestinal disorders based on Rome III criteria

All subjects	N = 321 (%)	95% CI, %
FGID	92 (28.7)	23.7–33.6
Vomiting and aerophagia	2 (0.6)	0.0–1.5
Adolescent rumination syndrome	0 (0.0)	0.0–0.0
Cyclic vomiting syndrome	1 (0.3)	0.0–0.9
Aerophagia	1 (0.3)	0.0–0.9
Abdominal pain-related FGIDs	39 (12.1)	8.6–15.7
Functional dyspepsia	3 (0.9)	0.0–2.0
Irritable bowel syndrome	18 (5.6)	3.1–8.1
Abdominal migraine	5 (1.7)	0.2–2.9
Childhood functional abdominal pain	12 (3.7)	1.7–5.8
Childhood functional abdominal pain syndrome	1 (0.3)	0.0–0.9
Constipation and incontinence	51 (15.9)	11.9–19.9
Functional constipation	51 (15.9)	11.9–19.9
Nonretentive faecal incontinence	0 (0.0)	0.0–0.0

for an abdominal pain-related FGID, 159 subjects (49.5%) reported abdominal pain occurring at least once a month. Of the subjects who reported abdominal pain, 96 (60.4%) reported dizziness, 103 (64.8%) reported headache, 81 (50.9%) reported difficulty sleeping, 78 (49.1%) reported missing school and 85 (53.5%) reported arm, leg or back pain at least 'once in a while' or 25% of the time.

## DISCUSSION

In this first description of the prevalence of FGIDs among school-aged children in Panama, we found that FGIDs are common in the population we studied, with nearly a third of subjects meeting Rome III criteria for a FGID. The two most common FGIDs were functional constipation and IBS. Although adult studies show that FGIDs are 2–3 times more common in females than males, we did not find a significant female predominance in subjects who met criteria for an FGID (2). Paediatric studies have not consistently shown a female predominance among children with FGIDs (12,14,15).

The prevalence of FGIDs in Panama is nearly identical to the findings described by Saps and colleagues when

applying the same study methods to a sample of school-aged children in Colombia. Of the 373 children in their study, 29.0% met criteria for an FGID. Fourteen per cent of their subjects met criteria for functional constipation and 5.4% met criteria for IBS (10). The prevalence of FGIDs in Panama is also similar to the findings described by Zablach and colleagues in El Salvador. Of the 395 children in their study, 20.3% met criteria for an FGID, 10.3% met criteria for functional constipation, and 3.8% met criteria for IBS (19).

When we consider the current understanding of the pathogenesis of FGIDs in children, these similarities are perhaps less surprising. The pathogenesis of FGIDs is multifactorial, and there is evidence that genetic, environmental, dietary, social and psychological factors can all play a role in the development of FGIDs. Some of these factors may be similar among these study populations, particularly between school-aged children in Panama and Colombia, two neighbouring countries that share relative environmental, dietary and cultural similarities.

Based on this premise, we would therefore expect the prevalence of FGIDs to vary among differing populations, particularly those with marked genetic, environmental, dietary and social differences. However, our findings were strikingly similar to studies of children in Sri Lanka. Devanarayana and colleagues described the prevalence of FGIDs in a study of 427 Sri Lankan adolescents. Using Rome III criteria, they found that 28.8% of their subjects met criteria for an FGID. Nearly, 14% met criteria for an abdominal pain-related disorder, with 7% meeting criteria for IBS. The prevalence of functional constipation of 4.2% in Sri Lankan adolescents was lower than the prevalence we found in Panama (15). However, a subsequent larger study that included 2694 Sri Lankan children closer in age to our population found a 15.4% prevalence of constipation. They also demonstrated a gradual decrease in prevalence with increasing age, which may explain the differences between our study and the study by Devanarayana and colleagues (14). Another study of 2163 Sri Lankan children focusing specifically on abdominal pain-related FGIDs also found a similar prevalence of abdominal pain-related FGIDs (12.5%) and IBS (4.9%) (16).

There were notable differences between our findings in Panama and studies of East Asian countries. Zhou and colleagues used adult Rome III criteria to describe the prevalence of IBS and functional constipation in 3671 adolescents from Shanghai, China. They found a higher prevalence of IBS (19.9%) and functional constipation (24.9%) than we found in Panama and what was described in Sri Lanka. Although the use of slightly different diagnostic criteria may explain some degree of this difference, the authors did propose a number of potential contributing factors, including an intense cultural pressure to succeed academically among their sample (12).

Sagawa and colleagues used a Japanese version of the QPGS-RIII to study the prevalence of FGIDs among 3976 adolescents in the Gunma prefecture of Japan. Fourteen per cent of subjects met criteria for a FGID. Although the prevalence of abdominal pain-related FGIDs (12.8%, IBS 5.9%) was similar to what we describe in Panama, only 0.3% of subjects met criteria for functional constipation. The authors did not speculate on why the prevalence of functional constipation was lower in their subjects than in studies of other countries (13). Perhaps this suggests that genetic, environmental, dietary and social influences play a greater role in the development of functional constipation than abdominal pain-related FGIDs, for which prevalence remains relatively stable among different populations.

Studies in the United States have shown differing results. Phatak and colleagues recently described FGID prevalence among healthy children presenting to primary care clinics in Connecticut and reported similar FGID (27%), IBS (6.9%) and functional constipation prevalence (13.9%) among normal weight children compared to our group of children in Panama. Functional abdominal pain and functional abdominal pain syndrome were more common in their sample (5.8% and 9.7%, respectively). Obese or overweight children had significantly more FGIDs than normal weight children (17). Saps and colleagues compiled the QPGS-RIII results of healthy controls from five studies performed in Illinois and found that although 8.1% reported abdominal pain, only 2.4% met Rome III criteria for an abdominal pain-related FGID (9). The reason for the difference in prevalence of abdominal pain-related FGIDs between Connecticut and Illinois is unclear, but recruitment of participants in primary care clinic versus via telephone may have had some effect.

We found that subjects with abdominal pain-related FGIDs often experience associated nongastrointestinal symptoms, including dizziness, headache, difficulty sleeping, and arm, leg, or back pain. Over half of these subjects reported missing school because of their abdominal pain. Perhaps more striking was that these associated symptoms and school absence were also fairly common among subjects with abdominal pain who did not meet criteria for an abdominal pain-related FGID, highlighting the impact of abdominal pain on children even without an FGID diagnosis.

A limitation of our study is that our data collection did not include more demographic characteristics or potential

risk factors of FGID development, such as socioeconomic status, ethnic or cultural background, recent gastrointestinal infection, parenting techniques and psychological comorbidity. This would have allowed us to better understand the applicability of our results to children throughout Panama. This would have also not only enabled a better understanding of the differences between Panamanian children with and without FGIDs, but could explain differences between FGID prevalence in children from Panama and children from other countries around the world. Although our sample size is comparable to a number of other population-based studies of paediatric FGID prevalence, a larger sample size would increase confidence that our sample accurately represents children throughout Panama. Finally, our study relies on questionnaire data collected from children in the school setting. The self-reported nature of our data and the setting in which it was administered could have potentially introduced some level of bias into our study.

Our study shows that FGIDs, particularly functional constipation and IBS, are common in school-aged children in Panama. Our study is one of the few population-based studies using the Rome III criteria to measure FGID prevalence in children. Further studies of FGID prevalence in children are needed to promote a better understanding of the pathogenesis of FGIDs, which in turn has the potential to improve our ability to diagnose, treat and perhaps even prevent FGIDs in children.

#### CONFLICT OF INTEREST

None of the authors have any conflict of interest to declare.

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