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Abdominal Pain and Disturbed Bowel Movements are Frequent among Young People. A Population Based Study in Young Participants of the Woodstock Rock Festival in Poland

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ABSTRACT

Background & Aims: Functional gastrointestinal disorders are prevalent worldwide and alterations of gut-brain axis and intestinal barrier integrity may play a pivotal role in both the pathophysiology and clinical course of these bowel malfunctions. We aimed to assess the prevalence of abdominal pain in a selected adult population of Poland to determine potential environmental factors associated with gastrointestinal complaints.
Methods: There were 1479 individuals - 657 women (44.42%) and 822 men (55.58%), aged 24.20±6.08 years. The responders fulfilled an authors' questionnaire based on Rome II and III criteria focused on the abdominal pain prevalence and environmental factors involved in its occurrence.
Results: The frequency of abdominal pain was found to be as high as 19.2%. Male gender (n=822) and basic education level (n=151) lowered the risk of abdominal pain occurrence (OR=0.7, p<0.012 and OR=0.5, p<0.021, respectively). Psychological distress, proton pump inhibitors (PPIs) and antibiotics usage were found as risk factors of abdominal pain (OR=2.503, p<0.01; OR=3.308, p<0.01; OR=3.105, p<0.01, respectively).
Conclusions: Abdominal pain is prevalent in young adult inhabitants of Poland, especially in women. Intense psychological stress, as well as PPIs and antibiotics usage elevate the risk.

Key words: abdominal pain – defecation – stress – Rome criteria – Functional gastrointestinal disorders – FGIDs – irritable bowel syndrome – functional dyspepsia.

Abbreviations: FD: functional dyspepsia; FGID: functional gastrointestinal disorders IBS: irritable bowel syndrome; NSAIDs: nonsteroidal anti-inflammatory drugs; PPI: proton pump inhibitors.

INTRODUCTION

Gastrointestinal complaints occur commonly in the general population with a growing number diagnosed with functional gastrointestinal disorders (FGIDs), which include irritable bowel syndrome (IBS), functional dyspepsia (FD), functional constipation, functional fecal incontinence, and functional anorectal pain [1]. The frequency, intensity, and type of these symptoms vary among individuals. The most frequent are bloating, indigestion, belching, flatulence and borborygmic [2]. Previous Rome II and III criteria included abdominal pain and discomfort in association with a change in the frequency or form of the stool. Abdominal discomfort was abandoned in the Rome IV revision. Functional anorectal pain syndromes are less frequent, inadequately studied and not necessarily associated with alteration in bowel habits. All these clinical entities have a high negative impact on the health related quality of life [3].

The number of adults affected by abdominal pain associated with altered bowel habits is substantial [4]. While it appears to be more prevalent among children and young adults, the effect of variables such as age remains uncertain. The prevalence of FGIDs varies between 10% to 20% in Western populations; most of the available studies are probably biased due to a heterogeneous patient selection methodology [5]. Currently, the Rome Foundation is performing a global epidemiological study surveying more than 70,000 individuals in more than 30 countries using the Rome IV diagnostic criteria, but the results and outcomes are still pending [6].

It is undeniable that FGIDs affect not only the patients, but also their families and employment, with significant detriment to their quality of life [7]. The severity of FGIDs is a main predictor of work and daily activity impairment as

well as absenteeism from work and other activities, which result in substantial socioeconomic costs. It has been reported that yearly costs related to IBS care are at least comparable to costs devoted to all-cause health care, even after controlling for demographics and comorbidities [8]. Of relevance, it was shown that in FGID patients the incidence of depression and other neuropsychiatric disorders are elevated, implicating an increased economic burden [9]. It is therefore of the highest priority to improve diagnostic and treatment protocols for this large patient population.

To the best of our knowledge, no large-scale investigations on environmental factors related to FGIDs in healthy young people in Poland have been conducted. Therefore, this study assessed the presence of symptoms, and use of over the counter medication for suspected FGIDs in a population of young adults participating in a popular music festival in Poland.

METHODS

Study population

A cross-sectional survey in Kostrzyn, Poland, during the Woodstock Music Festival was carried out in 2016 [10]. Data was collected using electronic devices (tablets and smartphones) in which the questionnaire was installed as an application. Study subjects were randomly selected at main communication routes of the festival camp. Inclusion criteria was age between 18-35 years and no history of medically confirmed organic gastrointestinal disease. The surveyed group consisted of 1,484 persons, among them 822 men (55.58%), aged 24.20 ± 6.08 years. There were 5 respondents who did not fit this age range; thus in total 1,479 questionnaires were analyzed.

The Medical Ethical Committee of the Pomeranian Medical University declared this a minimal risk protocol so as questionnaires were returned, they were stored anonymously with no patient identifiers. Written informed consent was not necessary, but oral consent was obtained at the time of patient recruitment to complete the survey.

Questionnaire

The questionnaire was specifically designed by the researchers to assess bowel habit, medication, and over the counter (OTC) supplementation use. The primary goal was to assess the presence of pain associated with suspected FGIDs which was assessed using the following questions: 1. Have you been experiencing pain or unpleasant sensations in the abdomen for 12 months? 2. Have you experienced pain or unpleasant sensations in the abdomen during the last 6 months that disappeared after a bowel movement? 3. Have you experienced pain or unpleasant sensations in the abdomen which appeared with the change in the frequency of stool defecation? and 4. Have you experienced pain or unpleasant sensations in the abdomen which appeared with the change of the consistency and appearance of stool?

The questions had to be answered with either "yes" or "no". The frequency of gastrointestinal symptoms was assessed on a three-point scale: 1 = never, almost never, or once a month or less; 2 = several times a month or several times a week; 3 = every day or several times a day.

The respondents were asked about the frequency of experiencing stress, usage of medications (nonsteroidal anti-inflammatory drugs - NSAIDs, antibiotics, proton pump inhibitors - PPIs), consumption of selected food products (probiotics, alcohol), and having less than 7 hours of sleep. In this case we used a similar scale, ranging from 1 to 3. These factors were further referred to as environmental factors. Self-reported factors such as degree of education and BMI were also recorded. We assumed that basic level of education was after primary school, secondary education was after high school, and high education during/after university studies.

Statistics

Statistical analyses were performed using R statistical software. Main variables were presented as either mean and standard deviations or number and percentage. The analysis was performed in relation to patients that reported one or more of the following symptoms:

- symptom pattern 1: pain or unpleasant sensations in the abdomen for 12 months ;
- symptom pattern 2: pain or unpleasant sensations in the abdomen during the last 6 months that disappeared after bowel movement;
- symptom pattern 3: pain or unpleasant sensations in the abdomen which appeared with the change in the frequency of stool defecation;
- symptom pattern 4: pain or unpleasant sensations in the abdomen which appeared with the change of the consistency and appearance of stool.

Having one or more of these symptoms was defined as having a problem with defecation. Logistic regression analysis was used to assess adjusted odds ratios in order to identify risk factors between the symptoms and environmental factors. Two-sided p value <0.01 was considered as statistically significant.

RESULTS

The study included 1,479 individuals - 657 women (44.42%) and 822 men (55.58%), aged 24.20±6.08 years. There were 151 people who declared basic education (10.21%), 853 people with secondary education (57.67%) and 475 people with higher education (32.12%). The average BMI declared by the participants was 23.07±3.84 kg/m^2. Table I provides data on the number of participants reporting painful defecation.

The factors that reduced the risk of abdominal pain related to bowel habits were male sex (n=822) and basic education level (n=151) (OR=0.7, p <0.012 and OR=0.5, p< 0.021, respectively).

The data also showed that stress was the main factor that increased the risk of abdominal pain and altered bowel habits. A direct relationship between level of stress and gastrointestinal complaints was noted. For example, patients who reported a stress frequency of 2 which equals stress several times a month or several times a week had a 1.5 times higher risk of gastrointestinal problems (OR=1.5 p<0.01). When the declared frequency was 3, meaning stress occurring every day or several times a day, the risk increased 2.5 times (OR=2.5, p <0.01) (see Table II). However, we did not obtain data on what type of stress the participants were experiencing. We presume that in most of them was of mild, psychological origin.

Table I. The number of subjects experiencing abdominal pain and disturbed defecation

Symptom patterns of pain	People declaring pain n (%)	People declaring no pain n (%)
Pattern 1	284 (19.20)	1195 (80.80)
Pattern 2	185 (12.51)	1294 (87.49)
Pattern 3	129 (8.72)	1350 (91.28)
Pattern 4	135 (9.13)	1344 (90.87)

n-number of subjects. For symptom pattern, please see the Methods chapter.

Results also showed that problems with defecation were significantly more common in women, and interestingly also in PPIs users. Depending on the frequency of medication administration, the risk increased 3.4 times (frequency=2; $p<0.01$). In the third category, the risk of abdominal pain and altered bowel habits increased 2.5 times ($p<0.01$). Similarly, the use of antibiotics increased the risk of pain occurrence 3 times (frequency=2; $p<0.01$) and 1.4 times (frequency=3; $p<0.05$). There was no relationship between the frequency of intake of NSAIDs and the occurrence of pain during bowel movement. However, we did not collect information on when the medication was taken. We assumed that the study participants considered the recent months, prior to the survey. Details are presented in Table II.

Table II. Multivariate Linear Regression of the factors affecting the abdominal pain related to bowel habits.

Coefficient (95% CI)	OR	Response n (% of population)	p-value
Male sex	0.717	822 (55.58)	0.011
Education (basic level)	0.592	151 (10.21)	0.021
Education (high level)	0.919	475 (55.58)	0.527
Stress frequency (2)	1.521	705 (47.67)	<0.01
Stress frequency (3)	2.503	220 (14.87)	<0.01
PPIs frequency (2)	3.308	66 (4.46)	<0.01
PPIs frequency (3)	2.577	16 (1.08)	0.081
NSAIDs frequency (2)	1.085	129 (8.72)	0.693
NSAIDs frequency (3)	0.695	23 (1.56)	0.469
Antibiotic frequency (2)	3.105	26 (5.42)	<0.01
Antibiotic frequency (3)	1.472	15 (1.01)	0.0501

CI: confidence interval; 2 = several times a month or several times a week; 3 = every day or several times a day.

DISCUSSION

The aim of the present study was to expand the knowledge regarding the prevalence of abdominal pain and suspected FGIDs in a captive population of younger patients participating in a music festival and to look for environmental factors that could help identify risk factors implicated in the pathophysiology of suspected functional bowel disorders. In this population the incidence of abdominal pain varied between 8.72% to as much as 19.2%. In contrast, Niemyjska et al. [11] evaluated IBS-related symptoms in students of Warsaw University and found that about 50% of study participants declared to suffer from abdominal pain at least once every week, depending on their residence and physical activity, thus related to the experience of psychological and physical stress. These results are however higher than those observed by Aziz et al. [4], who reported that the prevalence of symptom-based Rome IV FGIDs in adults from the United States, Canada and United Kingdom was approximately 10%. Another survey of bowel habits in 2,273 children (mean age 13.2 years) established that abdominal pain related to defecation was present in 10.6% of them [12]. In a systematic review published later, it was shown that painful defecation among children was associated with stressful life events [13]. A single country study from Italy [14] indicated that severe IBS affected 23.5% of adults. Ziółkowski et al. [15] analyzed a population in a middle-size Polish city and found that 23% of participants suffered from dyspepsia and 36% had gastroesophageal reflux disease (GERD). Constipation was found to be present in 13% of participants, and bloating in 31%. A minority of cases (n=7) suffered from diarrhea. This indicates a wide variability of the prevalence of gastrointestinal symptoms indicative of FGIDs, some of which likely indicate methodological and patient population differences, so the results of this study also need to be considered cautiously.

The etiology of FGIDs is complex and not entirely elucidated. Rome Foundation listed several factors which contribute to FGIDs: i) motility disturbance, ii) visceral hypersensitivity, iii) altered mucosal and immune function; iv) altered gut microbiota, and v) altered central nervous system processing [16]. Identification of initial triggers of these abnormalities is an essential part of the initial patient assessment [17]. A few studies confirmed that intestinal barrier disruptions might be responsible for FGIDs onset and clinical prognosis. Experiments proved that both IBS and FD may be related to the imbalance within gut microbiota, tight junction dysregulation and gut associated lymphoid tissue (GALT) activation. Also, the evidence that multiple environmental factors might alter gut microbiota and thus gut-brain axis function is mounting [18–23]. In fact, a comprehensive psycho-neuro-immunological approach to abdominal pain management has been discussed [24]. However, the role of environmental factors in defecation-related abdominal pain in young people requires further research [25].

Our study points to the important role of stress in the occurrence of defecation-related abdominal pain. Stress plays an important role, and is a recognized risk factor for FGIDs [13]. This highlights the fact that despite numerous studies describing the potential negative effect of medication such as PPIs, antibiotics, and NSAIDs [26], the role of stress, its frequency and character are still being undervalued in everyday clinical practice also for FGIDs. The mechanisms linking psychological stress with intestinal inflammation are not fully understood, but studies indicate that stress increases the risk of intestinal inflammation in people and animals [27]. It can induce alterations of gastrointestinal microbiota, can lead to mucosal mast cell hyperplasia, and bacterial translocation across gut barrier, and hence gut inflammation [28]. In two recent cohort studies psychological distress significantly increased the risk of developing both IBS and FD emphasizing that bidirectional gut-brain axis neural and

biochemical pathways may be disrupted by stress hormone release [29, 30]. As in this study and other studies, females are at a greater risk of pain, and have a higher frequency of intestinal problems [31]. It is possible that there is a hormonal cause as sex hormone concentration during the menstrual cycle significantly affects sensitive-motor nerves within the digestive tract, and also modulates sensitivity to stress via gut barrier disruptions, thus altering the gut brain axis function [32].

Interestingly, in the present study, a reduction of the risk of defecation-related abdominal pain among people with a lower level of education was found. It is possible that this is in part due to a lesser exposure of this group to work-related stress. However, we collected no data on profession, which might introduce a potential bias into these results. Similar results were observed in individuals diagnosed with inflammatory bowel disease (IBD), where work-related stress was measured with the aid of a special questionnaire and scores. As shown in the study, overcommitment scores were higher in relation to full-time employees with a high level of education [33]. These data also add to the evidence of the importance of gut-brain communication and its role in the development of gastrointestinal symptoms [34].

Beside stress, other environmental factors, such as PPIs and antibiotics were found to be significant triggers, capable of generating FGIDs symptoms. PPIs but not NSAIDs may decrease α diversity in the gut microbiome. It was found that PPIs lower the abundance of Clotridiales and increase the copy numbers of Actinomycetales, Micrococcaceae and Streptococcaceae, all increasing susceptibility to *Clostridium difficile* infection, risk of visceral hypersensitivity and occurrence of FGIDs related symptoms [35].

Our study has both strengths and limitations. A heterogeneous patient population from different parts of Poland was included, thus the sample may be considered as representative especially for this age group. The questionnaire was author-developed and, while based on the Rome III criteria, would require validation. It would be interesting to apply the same methodology using the Rome IV criteria [36]. While this study did not capture the frequency of symptom recurrence, it did capture the presence of symptoms in the last 12 months. Currently there is a trend to simplify the diagnostic criteria [6], as many physicians do not recognize them in their professional practice [37].

CONCLUSION

The results of this app-based electronic poll indicate that gastrointestinal symptoms are common in young adults in Poland. The data justify undertaking large-scale epidemiological studies among young people in Poland with the aim to investigate the problem of stress-related chronic abdominal symptoms. Further attention should be focused on the stress as one of the main factors negatively influencing public health, as it has potentially significant long-term economical and social impacts.

Conflicts of interest: None to declare.

Authors' contributions: E.S: first draft of the manuscript;, E.S., K.S.Z. and W.M.: manuscript writing; P.B.: statistical analysis. All the authors collected data and approved the final manuscript.

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