

Assessment of the prevalence and somatisation of stress in the form of abdominal pain in school-aged children and adolescents

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Abstract

Introduction: Somatisation is described as the physical manifestation of emotional distress. Pain is one of the most common forms of stress somatisation among the paediatric population. Stress somatisation in the form of abdominal pain results in chronic and/or recurrent gastrointestinal complaints encouraging to seek medical consultations, during which many diagnostic tests are performed, often intensifying the stress.

Aim of the research: This study aims to characterise the paediatric population most likely to experience somatisation of stress in the form of abdominal pain, including gender, in the age range of 10–18 years.

Material and methods: A total of 698 preadolescents were recruited from schools across Poland (mean age = 14.8 ± 2.05 years, age range: 10–18 years; 66.8% female). Children completed the authors' survey questionnaire on stress, lifestyle, abdominal pain and gastrointestinal complaints.

Results: The majority of respondents, 75.4% ($n = 416$), experienced abdominal pain in stressful situations. Abdominal pain associated with stress somatisation was significantly more frequent in girls (86.4%, $n = 324$) compared to the boy group (52.0%, $n = 92$). Belonging to an age group of 16–18 years was associated with the abdominal pain of the highest intensity ($p < 0.05$).

Conclusions: The results suggest that stress somatisation in the form of abdominal pain is a common phenomenon, occurring more frequently and with greater intensity in girls. Identifying high-risk groups has been discussed as essentially helpful for an early response and effective prevention of its consequences.

Introduction

Many definitions of somatisation have been formulated over the years. The most commonly cited definition of somatisation is the physical manifestation of emotional distress [1]. Pain is one of the most common forms of stress somatisation among the paediatric population [2]. Somatisation can manifest as pain, most commonly as abdominal pain, headache, chest pain and pain of a generalised nature, with abdominal pain being the most common location in children [3]. Stress somatisation in the form of abdominal pain results in chronic and/or recurrent gastrointestinal complaints of multifactorial aetiology. This often prompts the patient and family to seek medical consultations, during which many unnecessary diagnostic tests are performed, often intensifying the stress [4]. Abdominal pain is a non-specific symptom, often requiring a multispecialist and complex diagnosis. It may have an organic ori-

gin, as in Crohn's disease or ulcerative colitis (UC), or it may result from functional disorders. However, in nearly 90% of the reported cases, an organic cause of abdominal pain cannot be established [5]. The school years are characterised by an increased susceptibility to stressors such as difficulties in establishing interpersonal relationships, lack of acceptance from peers and caregivers, or inability to cope with school responsibilities. In children who experienced stressors, recurrent abdominal pain was the most commonly reported complaint [6, 7]. Functional gastrointestinal disorders are a group of chronic disorders involving gastrointestinal symptoms in which there are no abnormalities on laboratory or physical examination. The aetiology of functional abdominal pain (FAP) is not fully understood, a large role is given to the influence of stress, but the pathogenesis also includes dysregulation of the gut-brain axis, disturbances of the gut microbiota, abnormal gastrointestinal motility,

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disorders of visceral stimulus conduction, epigenetic factors and psychosocial disorders [7, 8].

Aim of the research

The aim of this study was to characterise the population of children and adolescents most likely to experience stress somatisation in the form of abdominal pain. The results of the study may be helpful in developing appropriate diagnostic recommendations, including questionnaires for functional abdominal pain among children, in whose aetiology stress plays an important role [9]. The specific aims were to answer the following research questions: What proportion of the population of Polish children experiences abdominal pain in stressful situations? Did gender influence the occurrence of abdominal pain, both with and without stressful situations? Did gender influence the severity of abdominal pain in stressful situations? Did the child's age affect the occurrence and intensity of abdominal pain in stressful situations?

Material and methods

Procedure

The survey was conducted from December 2024 to January 2025 and was designed to collect information on stressful situations and stress somatisation manifested by abdominal pain in children and adolescents. Inclusion criteria included age 10–18 years and giving informed and voluntary consent to participate in the study. Schoolchildren and adolescents from 14 different primary and secondary schools of mixed socio-economic status were invited to participate in the study. Participants were informed of the aim of the study. Participation was voluntary and anonymous and did not require written consent from the participant or legal guardian.

Participants

The study group consisted of 698 children ($n = 698$) aged 10–18 years, of whom 232 were boys ($n = 232$). The mean age was 14.8 ± 2.05 years. Three age groups were identified: 10–12 years ($n = 95$), 13–15 years ($n = 321$) and 16–18 years ($n = 282$). Residents of rural areas made up the majority of the study participants, 49.43% ($n = 345$), while residents of small towns (less than 20,000 inhabitants) made up 11.17% ($n = 78$), residents of medium-sized towns (20,000–100,000 inhabitants) made up 29.66% ($n = 207$) and residents of large cities (more than 100,000 inhabitants) made up 9.74% ($n = 68$) of the study group. The majority of respondents were secondary school students with 72.78% of the study group ($n = 508$), of which 77.56% ($n = 394$) were high school students, while 21.85% ($n = 111$) were technical high school students and only 3 respondents (0.59%, $n = 3$) declared that they had attended a vocational school. Due to the nature of the symptom, that is pain, respondents who answered 'I don't know' to the

question 'Have you noticed that your abdomen hurts when you are stressed?' were excluded from further statistical analyses regarding abdominal pain in stressful situations ($n = 146$).

Material

The research method was the author's survey questionnaire, which consisted of 38 questions and was divided into two parts. The first part was completed by the child independently and the second part was completed with the help of the parent/caregiver. The first part, filled in by the child, contained 7 questions on metric data and 22 questions related to stress, lifestyle, abdominal pain and other gastrointestinal complaints. The part completed with the help of the caregivers consisted of 4 questions on the caregivers' educational and occupational background and 5 questions on the child's history of hospitalisation for gastrointestinal disorders and exact disease diagnoses. The main aim was to assess the prevalence and somatisation of stress manifested by abdominal pain in school-aged children and adolescents, and was explored using the following questions: 1. Have you noticed that your abdomen hurts when you are stressed? 2. On a scale of 0 to 10, how would you rate the intensity of abdominal pain in relation to stressful situations? (0 – no pain at all; 10 – most severe pain imaginable) 3. In which of the following situations do you experience abdominal pain? 4. What reactions accompany you during stressful situations? 5. Is the abdominal pain accompanied by additional symptoms? Question 1 had to be answered with 'yes', 'no' or 'I don't know'. The answer 'I don't know' was intended to isolate a group of individuals who were undecided and were consequently excluded from further analyses regarding the occurrence of abdominal pain in stressful situations. In question 2, a visual analogue scale (VAS) was used to assess pain. In the remaining questions, the respondent had the option to provide more than one answer. Questionnaires created in Microsoft Forms were sent via virtual/online gradebook and student mail to primary and secondary school students, mainly in southern Poland.

Statistical analysis

Statistical analysis was carried out using Statistica 13.3 PL and MS Excel. A p -value < 0.05 was considered statistically significant. The χ^2 independence test, the Mann-Whitney test and the Kruskal-Wallis test were used to assess the statistical significance of the hypotheses. The results were presented in the form of tables, box plots and pie charts.

Results

More than 1/2 of the girl group had a negative attitude towards wanting to continue attending school

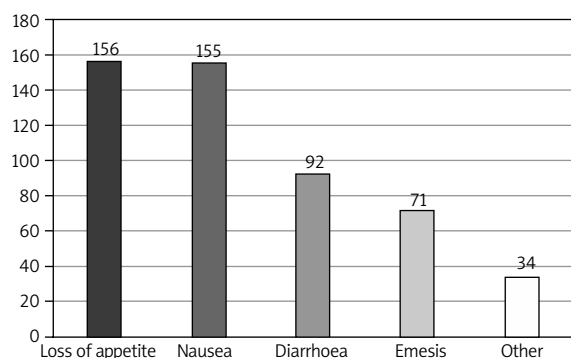


Figure 1. Gastrointestinal symptoms co-occurring with abdominal pain in the study group

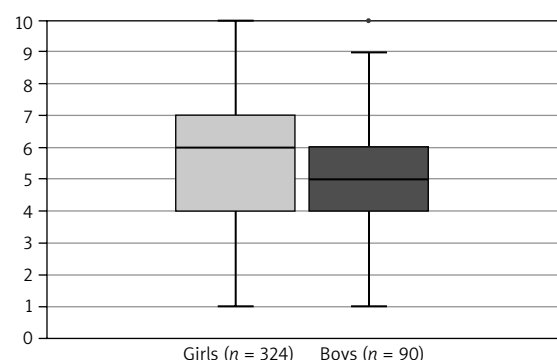


Figure 2. Severity of abdominal pain on the VAS scale depending on gender

Table 1. Comparison between girls and boys in terms of frequency of abdominal pain per month, regardless of aetiology – Mann-Whitney test

Dependent variable	Girls (n = 466)		Boys (n = 232)		Z	P-value	χ^2
	Mdn	IQR	Mdn	IQR			
Frequency of abdominal pain	2	2	1.5	1	6.92	< 0.001	0.07

n – number of observations, *Mdn* – median, *IQR* – interquartile range, *Z* – value of test statistics, *p* – *p*-value for Mann-Whitney test, η^2 – effect size index. To allow for statistical analysis, responses were coded as follows: ‘1 time or less’ – 1 (*n* = 214); ‘2–4 times’ – 2 (*n* = 227); ‘5–8 times’ – 3 (*n* = 103); ‘9–12 times’ – 4 (*n* = 61); ‘More than 12 times’ – 5 (*n* = 68); ‘Pain does not go away at all’ – 6 (*n* = 25).

Table 2. Correlation between gender and occurrence of abdominal pain in stressful situations – χ^2 test of independence

Abdominal pain in stressful situations	Girls		Boys		Total		χ^2	df	P-value	ϕ
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%				
Yes	324	86.4	92	52	416	75.4	76.73		< 0.001	0.37
No	51	13.6	85	48	136	24.6				

n – number of observations, χ^2 – value of test statistics, *df* – degrees of freedom, *p* – *p*-value for χ^2 test, ϕ – effect size index.

– 66.31% (*n* = 309), and for boys the result was similar at 64.22% (*n* = 149). Attending school was a cause of stress for 58.80% of girls (*n* = 274) and 44.83% of boys (*n* = 104). Tests and low grades were a cause of stress for 51.00% of the respondents (*n* = 356). The majority of respondents attended extra-curricular activities, about 1/2 of the sample group of girls, or 51.93% (*n* = 242), and slightly more boys, or 64.44% (*n* = 150). Abdominal pain co-occurred with stress in 75.40% of the children surveyed (*n* = 416). Abdominal pain was the reason for hospitalisation in 12.46% (*n* = 87), and the most common gastrointestinal symptoms co-occurring with pain were loss of appetite (*n* = 156), nausea (*n* = 155), diarrhoea (*n* = 92) and vomiting (*n* = 71) (Figure 1). The severity of abdominal pain in stressful situations averaged 5.37 ± 1.93 points on the Visual Analogue Scale (VAS – minimum value – 1, maximum value 10).

The analysis showed that there was a statistically significant difference between the incidence of abdominal pain per month according to gender, re-

gardless of its aetiology (Table 1). Within 1 month, abdominal pain was more common in girls (*p* < 0.001). The most common frequency of abdominal pain in girls was 2–4 times per month (*n* = 162). Half of the group declared abdominal pain 2–4 times per month or less frequently, and half of the group 2–4 times per month or more frequently. In contrast, the most typical frequency of abdominal pain in boys was once per month or less frequently (*n* = 116); half of the group declared abdominal pain once per month or less frequently, and half of the group declared a frequency of 2–4 times per month or more frequently.

There was also a statistically significant correlation between gender and the occurrence of abdominal pain in stressful situations (Table 2). Girls were more likely than boys to experience abdominal pain in stressful situations.

The severity of abdominal pain in stressful situations was also found to be statistically significantly correlated with gender (Table 3). The severity of stress-related abdominal pain was higher in girls than in boys. The median pain in girls on the VAS scale

Table 3. Comparison of girls and boys in terms of severity of abdominal pain in stressful situations – Mann-Whitney test

Dependent variable	Girls (n = 324)		Boys (n = 90)		Z	P-value	η^2
	Mdn	IQR	Mdn	IQR			
Abdominal pain on the VAS scale	6	3	5	2	2.53	0.012	0.02

n – number of observations, *Mdn* – median, *IQR* – interquartile range, *Z* – value of test statistics, *p* – *p*-value for Mann-Whitney test, η^2 – effect size index, VAS – Visual Analogue Scale.

Table 4. Comparison of age groups in terms of severity of abdominal pain in stressful situations – Kruskal-Wallis test

Dependent variable	10–12 years (n = 52)		13–15 years (n = 202)		16–18 years (n = 160)		<i>H</i> (2)	<i>P</i> -value	η^2
	Mdn	IQR	Mdn	IQR	Mdn	IQR			
Abdominal pain on the VAS scale	5	1	5	3	6	3	10.46	0.005	0.02

n – number of observations, *Mdn* – median, *IQR* – interquartile range, *H* – value of test statistics, *p* – *p*-value for Kruskal-Wallis test, η^2 – effect size index, VAS – Visual Analogue Scale.

was 6 and the quartile range was 3, while in boys the median was 5 and the quartile range was 2 (Figure 2).

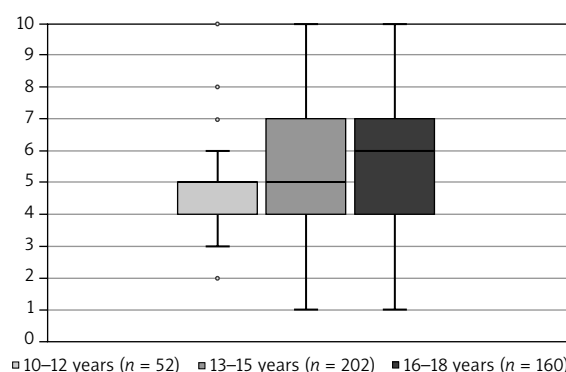
A comparison of the severity of abdominal pain assessed by the VAS scale in each age group (10–12 years, 13–15 years, 16–18 years) showed a statistically significant difference between the medians of abdominal pain severity in stressful situations ($p < 0.05$) (Table 4). Among the 3 age groups mentioned, abdominal pain severity on the VAS scale is highest in the 16–18 years group and lowest in the 10–12 years group (Figure 3).

There was no statistically significant correlation ($p > 0.05$) between age and the occurrence of abdominal pain in stressful situations. In all age groups studied, abdominal pain accompanied stressful situations in 70–80% of the subjects.

Discussion

The results of the app-based questionnaire indicate that somatisation of stress manifesting as abdominal pain is a common phenomenon among paediatric patients in Poland, declared by 75.40% of the respondents ($n = 416$), where stress is one of the main factors modulating the patient's long-term health [10]. The values in our study were similar to the results of a 2011 study where it was demonstrated in 62.80% of the study group [11]. Local abdominal pain may be part of a general negative reaction to stress, manifesting as pain of varying severity [12]. Moreover, it appears that the relationship between chronic pain and mental health, including the perception of stress, is reciprocal, as mental difficulties in managing severe pain translate into more frequent somatic symptoms [13].

The study's statistical analysis confirmed the conclusions of other researchers that the female gender, regardless of age, is affected by the highest risk of abdominal pain. Similarly, a 2022 Cochrane review confirmed

**Figure 3.** Severity of abdominal pain on the VAS scale depending on age group

that female gender in correlation with stress is a major risk factor for functional abdominal pain, alongside gastroenteritis, abuse, poor sleep, obesity, psychiatric disorders and somatic symptoms [14]. However much more research on this issue has been conducted in the adult population [15]. In 2016 and 2017, a similar study was conducted in the United States, which aimed to assess the correlation between students' goal orientation on academic performance and the occurrence of somatic symptoms in relation to stress. A significantly higher incidence of somatic symptoms was found in the group of girls who motivated themselves to learn by comparing their abilities to those of others, whereas no such correlation was found in the group of boys [16].

In the present study, we identified the group at highest risk of experiencing the most severe abdominal pain assessed on the basis of the VAS scale, which turned out to be the girls in the age range 16–18 years. Furthermore, girls experience abdominal pain significantly more often than boys, regardless of its aetiology, with a frequency of 2–4 times per month. The results

of our study were compared with the findings of other studies [17, 18]. Similarly, they showed that girls were the ones who reported abdominal pain more frequently. The two-way relationship between abdominal pain and depression or anxiety with the possibility of one transforming into the other is an important issue [17]. Another possible explanation seems to be the different interaction of sex hormones in the modulation of visceral and somatic pain perception in the brain areas responsible for pain processing, as well as the different effect of gender on gastrointestinal motility [19].

The aetiology of FAP is complex, with a range of contributing factors [20], then, there is no standard approach to the treatment [21], which makes it difficult to manage appropriately. The majority of reports on FAP treatment relate to the adult population, whereas children often respond differently [22]. The most commonly used treatment techniques include cognitive behavioural therapy, hypnotherapy, nutritional counselling, pharmacological treatment of pain and comorbid symptoms [23]. In a 2023 meta-analysis, cognitive-behavioural therapy was shown to be effective in children and adolescents with chronic functional abdominal pain by reducing the severity of abdominal pain, gastrointestinal complaints and depression [24]. Considering that the quality of life of patients with FAP continues to be assessed similarly low to diseases such as inflammatory bowel disease [22], it would be beneficial to harmonise standards or update current practice patterns in relation to functional abdominal pain in children.

Conclusions

Stress somatisation in the form of abdominal pain is an important cause of impaired ability to perform daily activities among paediatric patients. The study identified groups of children and adolescents at risk of more frequent and intense pain episodes, namely girls in the 16–18 age group, in whom both the frequency of stress-related abdominal pain and the intensity of pain measured on the VAS scale are higher. The diagnostics of gastrointestinal disorders in these patient groups (female gender, 16–18 years old) should consider the possibility of stress somatisation, and the interview should focus on past stressful situations in order to correctly diagnose the disease, improve quality of life, and minimise pain-related disability.

Early recognition of the possibility of FAP in children, especially when the patient does not present alarming symptoms, will not only shorten the diagnostic process itself, but will also make it possible to refrain from invasive diagnostic procedures and properly educate parents and patients on the correct response to symptoms. It is important to communicate preventive recommendations to the patient.

Stress affects the human body in a multifactorial way, and therefore treating its consequences requires

a holistic, multidirectional approach to the patient. Optimising the diagnostic process and treatment of at-risk patients will prevent a number of wide-ranging consequences, such as missing school, feeling inferior in the peer group, giving up hobbies or even the onset of depression or anxiety disorders in the patient.

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Ethical approval

The study was approved by the Bioethics Committee of the Medical University of Silesia (Decision No. BNW/NWN/0052/KB/5/24) and the school authorities.

Conflict of interest

The authors declare no conflict of interest.

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