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Assessment of Small Intestinal Bacterial Overgrowth in Functional Disorders of the Alimentary Canal in Children

Ocena przerostu bakteryjnego jelita cienkiego w zaburzeniach czynnościowych przewodu pokarmowego u dzieci

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Abstract

Background. Small intestinal bacterial overgrowth (SIBO) is the excessive growth of nonpathogenic bacterial flora in the upper part of the small intestine. Its diagnosis is based on direct and indirect methods, such as the hydrogen breath test, which is widely used in children. Functional diseases of the gastrointestinal (GI) tract are among the most frequently diagnosed in children and they limit their daily activities. The symptoms of SIBO and lactose intolerance may be overlooked in patients with some functional diseases of the GI tract due to similar clinical symptoms. In contrast to functional diseases of the GI tract, SIBO may significantly disturb the digestion and absorption of food ingredients, leading to disturbances in physical development.

Objectives. Assessment of the prevalence of SIBO in selected functional disorders of the GI system in children, i.e. functional dyspepsia and irritable bowel syndrome (IBS). Disturbance of lactose absorption and lactose intolerance were also assessed.

Material and Methods. The study was conducted on 136 children (86 girls and 50 boys, 5.5–17 years of age) treated during 2007–2008 for chronic abdominalgia, suspicion of functional dyspepsia, and IBS with diarrhea and constipation. The hydrogen breath test was performed in all patients.

Results. The hydrogen breath test revealed SIBO in more than half of the patients with constipation-predominant IBS (54.55%) and rarely in patients with diarrhea-predominant IBS (2.86%). Lactose malabsorption was observed in 37.14% of diarrhea-predominant IBS, 27.85% of functional dyspepsia, and only 4.55% of constipation-predominant IBS patients. Lactose intolerance was observed more frequently in diarrhea-predominant IBS (37.14%) and functional dyspepsia (31.65%) patients and in only 4.55% of constipation-dominant IBS patients.

Conclusions. SIBO was significantly greater in constipation-predominant IBS than in diarrhea-predominant IBS and functional dyspepsia patients and in controls without GI symptoms. Symptoms of lactose intolerance were more frequent in diarrhea-predominant IBS and functional dyspepsia patients (*Adv Clin Exp Med* 2009, 18, 5, 493–500).

Key words: small bowel bacterial overgrowth, irritable bowel syndrome, functional dyspepsia, children.

Streszczenie

Wprowadzenie. Przerost flory jelitowej jest to nadmierne namnażanie niepatogennych drobnoustrojów w początkowym odcinku jelita cienkiego. Rozpoznanie przerostu flory jelitowej opiera się na metodzie bezpośredniej i metodach pośrednich, do których należy wodorowy test oddechowy wykorzystywany powszechnie w diagnostyce chorób przewodu pokarmowego u dzieci. Choroby czynnościowe przewodu pokarmowego należą do schorzeń rozpoznawanych u dzieci najczęściej, a dolegliwości znacznie ograniczają codzienne funkcjonowanie pacjentów. Objawy zespołu przerostu bakteryjnego flory jelita cienkiego, ale także nietolerancji laktozy, mogą pozostać niezauważone u pacjentów z chorobami czynnościowymi ze względu na zbieżność objawów klinicznych tych chorób. W przeciwieństwie do chorób czynnościowych przewodu pokarmowego, zespół jelitowego przerostu bakteryjnego może w istotny sposób zaburzać trawienie i wchłanianie składników pokarmowych, prowadząc do zaburzeń rozwoju fizycznego.

Cel pracy. Określenie częstości występowania przerostu bakteryjnej flory jelita cienkiego w niektórych zaburzeniach czynnościowych przewodu pokarmowego u dzieci: niestrawności czynnościowej oraz zespołu jelita nadwrażliwego. Oceniano także częstość występowania zaburzeń wchłaniania laktozy i objawów nietolerancji laktozy u badanych dzieci.

Material i metody. Badania przeprowadzono wśród dzieci hospitalizowanych w latach 2007–2008 z powodu przewlekłych bólów brzucha z podejrzeniem niestrawności czynnościowej oraz zespołu jelita nadwrażliwego objawiającego się biegunką lub zaparciami. Badaniami objęto 136 dzieci, w tym 86 dziewczynek i 50 chłopców, w wieku 5,5–17 lat. U wszystkich pacjentów wykonano wodorowy test oddechowy.

Wyniki. Wodorowy test oddechowy wykazał przerost bakteryjnej flory jelita cienkiego u ponad połowy badanych pacjentów z zespołem jelita nadwrażliwego z dominującymi zaparciami (54,55%), rzadko natomiast stwierdzano dysbakteriozę u pacjentów z zespołem jelita nadwrażliwego z biegunkami (2,86%). Zaburzenia wchłaniania laktozy występowały u 37,14% dzieci z rozpoznanym zespołem jelita nadwrażliwego z biegunkami oraz 27,85% dzieci z niestrawnością czynnościową, a w zespole jelita nadwrażliwego z zaparciami jedynie u 4,55% dzieci. Objawy nietolerancji laktozy po wykonanym wodorowym teście oddechowym obserwowano częściej również w grupie pacjentów z zespołem jelita nadwrażliwego z biegunkami (37,14%) i niestrawnością czynnościową (31,65%), a zaledwie u 4,55% badanych z grupy pacjentów z rozpoznanym zespołem jelita nadwrażliwego z zaparciami.

Wnioski. Przerost bakteryjny flory jelita cienkiego stwierdzono u 54,55% badanych pacjentów z zespołem jelita nadwrażliwego z dominującymi zaparciami i był on u tych dzieci istotnie statystycznie częstszy niż w postaci biegunkowej, u pacjentów z niestrawnością czynnościową oraz pacjentów bez dolegliwości związanych z przewodem pokarmowym. Objawy nietolerancji laktozy były częstsze u pacjentów z zespołem jelita nadwrażliwego z dominującymi biegunkami i niestrawnością czynnościową (*Adv Clin Exp Med* 2009, 18, 5, 493–500).

Słowa kluczowe: jelitowy przerost bakteryjny, zespół jelita nadwrażliwego, niestrawność czynnościowa, dzieci.

Small intestinal bacterial overgrowth (SIBO, or syndrome of small intestine bacterial overgrowth, dysbacteriosis of the upper alimentary canal, bacterial overgrowth syndrome) is regarded as an increase in the number of nonpathogenic bacteria in the upper part of the small intestine above 10^5 organisms/ml of intestinal content [1–3]. The clinical picture of SIBO varies due to the high variability in proliferating bacterial flora. Among the clinical symptoms of SIBO are chronic steatorrhea, watery diarrhea (secretory or osmotic), abdominalgia, abdominal bloating, symptoms of vitamin B₁₂ deficiency (megaloblastic anemia, ataxia), symptoms of fat-soluble vitamin A and D deficiency (rickets, disturbances of epidermis, night blindness), hypoalbuminemia, body mass decrease, and short stature and, outside the gastrointestinal (GI) system, are arthritis, tendinitis, papulo-macular rash, tuberous erythema, and nephritis [1, 4, 5]. Among the disorders predisposing to bacterial overgrowth are hypochlorhydria (most frequently due to the use of drugs, proton pump inhibitors); anatomical malformation of the intestinal tract, both primary (congenital disorders) and secondary (surgery, tumors); motor function disorders of the intestine due to diabetic neuropathy, pseudo-obstruction, scleroderma, and disturbances in the communication between various segments of the alimentary tract (lack of a Bauhin valve, fistulas, stomias); primary and secondary immunodeficiency; loss of intestinal microflora equilibrium due to antibiotic use; and advanced age (progressive deficiency of hydrochloric acid and intestine congestion) [1, 2, 4, 5].

There is currently no single standardized diagnostic procedure permitting the unequivocal diagnosis of small intestine bacterial overgrowth [6]. Its diagnosis is based on direct and indirect meth-

ods. The direct method, regarded by some investigators as the gold standard, is microbiologic examination of the intestinal content. Among the indirect methods of diagnosing SIBO are breath tests with substances labeled with C¹³ and C¹⁴ isotopes (glycocholic acid test, D-xylose test) and hydrogen breath tests with lactulose or lactose and para-aminobenzoic acid using the ability of bacteria to deconjugate bile acids. The hydrogen breath test, which is simple to perform and, above all, noninvasive, is widely used in the diagnostics of gastrointestinal (GI) disorders in children. This test is used in disorders of digestion and the absorption of disaccharides, mainly lactose intolerance (diagnostics of clinical symptoms after the consumption of the sugar). The syndrome of bacterial overgrowth may also be diagnosed using the hydrogen-methane respiratory test with the use of glucose, saccharose, and lactulose by measuring methane and hydrogen in expiratory air [4, 7–12].

The treatment of bacterial overgrowth consist of the application of antibiotics active against Gram-negative bacteria, usually metronidazole. Alternatively, the most frequently are used tetracycline, amoxicillin with clavulanic acid, trimethoprim with sulfamethoxazole, ciprofloxacin, norfloxacin, and vancomycin. Adjuvant therapy consists of cholestyramine, prokinetic drugs (small doses of octreotide), and probiotics [13–16].

Functional diseases of the GI tract are among the most frequently diagnosed in children. Moreover, in recent years the number of such diseases in the developed countries has been increasing. Although functional diseases of the GI tract are characterized by a mild course, they limit the daily activities and quality of life of patients. The symptoms of SIBO and lactose intolerance may be overlooked in patients with some functional dis-

eases of the GI tract, especially with irritable intestine, due to the similarity of clinical symptoms. In contrast to functional diseases of the GI tract, SIBO may significantly disturb the digestion and absorption of food ingredients, leading to deficiencies and disturbances of physical development.

The aim of this study was to assess the prevalence of small intestine bacterial overgrowth in selected functional disorders of the gastrointestinal system in children, i.e. functional dyspepsia and irritable bowel syndrome (IBS). Disturbance of lactose absorption and lactose intolerance were also assessed.

Material and methods

The study was conducted on children and youngsters treated in the Second Department of Pediatrics, Gastroenterology, and Nutrition, Wrocław Medical University, during 2007–2008 for chronic abdominalgia, suspicion of functional dyspepsia, and irritable bowel syndrome with diarrhea and constipation. The study comprised 136 children, 86 girls (63.24%) and 50 boys (36.76%) aged 5.5–17 years (mean: 11.7 years). Cooperation in the hydrogen breath test was a criterion for inclusion. Intake of drugs diminishing the secretion of hydrochloric acid or antibiotics during the six weeks prior to the beginning of the study was a criterion for exclusion. The control group consisted of 28 children, 13 girls (46.43%) and 15 boys (53.57%) aged 4–17 years (average: 8.7 years), treated at the clinic for reasons other than disorders of the alimentary canal.

In all patients, the hydrogen breath test was performed using a Gastrolyzer 2 apparatus (Bedfont Scientific Ltd.). This method relies on the measurement of the hydrogen concentration in expired air passing over the electrochemical electrode of the device. The measurements were performed on the fasting patient who received a water solution of lactose (2 g/kg body-mass, maximal dose: 50 g) for one and a half hours every 15 minutes. An early increase in hydrogen concentration in expiratory air greater than 20 ppm (parts per million) at fasting or between the fasting level and the highest level within one hour was regarded as an improper result and suggested dysbacteriosis. The difference between fasting level and the highest level within the second hour of the test greater than 20 ppm was also regarded as improper; however, it suggested disturbances of lactose digestion and absorption. On the following day the data of the patient's wellbeing and possible symptoms of intolerance were obtained in an interview with the parents.

Functional dyspepsia was diagnosed in children older than 4 years using the 2006 Rome III criteria, which describe the diagnostic fundamentals of functional disorders of the GI tract [17]. Therefore, functional dyspepsia was diagnosed by the observation of constant or recurrent abdominalgia or discomfort in the upper medial part of the abdomen above the umbilicus not linked with defecation and structure and the frequency of stool. These symptoms were observed at least once a week for at least two months before diagnosis.

Irritable bowel syndrome was also diagnosed in children older than four years of age using the Rome III criteria [17] when abdominal pain or discomfort was observed and at least two of the following conditions for at least of 25% of its duration were fulfilled: relief after defecation and onset connected with a change in defecation frequency or stool consistency. In all patients, inflammatory and anatomical changes as well as metabolic disorders were excluded. These symptoms were observed at least once a week for at least two months.

All results were statistically analyzed using the chi-squared Pearson's test for frequency analysis. In comparing the frequency of two groups, the Yates correction was applied. In the case of small groups (when at least one expected value was smaller than 5), the exact Fisher test was used. A $p < 0.05$ was adopted as the significance level.

Results

Based on history, physical examination, and laboratory studies, the following disorders were diagnosed: IBS with diarrhea in 35 patients, i.e. 19 girls (54.29%) and 16 boys (45.71%), average age 11.4 years; IBS with constipation in 22 children, i.e. 15 girls (68.18%) and 7 boys (31.82%), average age 12.5 years; and functional dyspepsia in the remaining 79 children, i.e. 52 girls (65.82%) and 27 boys (34.18%), average age 11.6 years.

The clinical symptoms reported by the patients depending on the diagnosis are presented in Table 1. In Table 2 the frequencies of the reported symptoms are statistically compared in the particular groups of children with a given diagnosis (statistically significant differences are in bold). Abdominal pains were reported by all patients. Loose stools were observed in all patients with the diarrhea-predominant form of IBS and constipation in all with the constipation-predominant form. Nausea was frequent in the constipation-predominant IBS (59.09%) and functional dyspepsia (51.9%) patients and rare in the diarrhea-predomi-

Table 1. Clinical symptoms in children with diarrhea-predominant IBS, constipation-predominant IBS, and functional dyspepsia

Tabela 1. Objawy kliniczne w grupach badanych dzieci z rozpoznaniem zespołem jelita nadwrażliwego z przewagą biegunek, zespołem jelita nadwrażliwego z przewagą zaparc i niestrawnością czynnościową

Group (Grupa)	Diagnosis (Rozpoznanie)	Symptoms (Objawy)							
		Nausea (Nudności) n %	Vomiting (Wymioty) n %	Abdominal distension (Wzdęcia) n %	Flatulence (Przelewania) n %	Flatus (Nadmierne oddawanie gazów) n %	Diarrhea (Luźne stolce) n %	Constipation (Zaparte stolce) n %	Abdominal pain (Bóle brzucha) n %
1.	Diarrhea-predominant IBS (Zespół jelita nadwrażliwego z biegunkami)	6 (17.14)	2 (5.71)	13 (37.14)	11 (31.43)	9 (25.71)	35 (100)	0 (0)	35 (100)
2.	Constipation-predominant IBS (Zespół jelita nadwrażliwego z zaparciami)	13 (59.09)	3 (13.64)	15 (68.18)	1 (4.55)	7 (31.82)	0 (0)	22 (100)	22 (100)
3.	Functional dyspepsia (Niestrawność czynnościowa)	41 (51.9)	17 (21.52)	7 (8.86)	3 (3.8)	1 (1.27)	0 (0)	0 (0)	79 (100)
4.	Control group (Grupa porównawcza)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

IBS – irritable bowel syndrome.

Table 2. Comparison of clinical symptom prevalence depending on diagnosis

Tabela 2. Porównanie częstości występowania objawów klinicznych w grupach badanych dzieci w zależności od rozpoznanej choroby

Lp.	Clinical symptoms (Objawy kliniczne)	Comparison of clinical symptom prevalence depending on the diagnosis in the subgroup (Porównanie częstości występowania objawów klinicznych w zależności od rozpoznania w podgrupie)					
		1/4	2/4	3/4	1/2	1/3	2/3
1.	Nausea (Nudności)	p = 0.06	p < 0.001	p < 0.001	p = 0.001	p = 0.001	p = 0.72
2.	Vomiting (Wymioty)	p = 0.5	p = 0.08	p = 0.018	p = 0.36	p = 0.07	p = 0.6
3.	Abdominal distension (Wzdęcia brzucha)	p = 0.001	p < 0.001	p = 0.18	p = 0.04	p = 0.001	p < 0.001
4.	Flatulence (Przelewania)	p = 0.001	p = 0.9	p = 0.56	p = 0.036	p = 0.001	p = 1
5.	Flatus (Nadmierne oddawanie gazów)	p = 0.011	p = 0.02	p = 1	p = 0.84	p < 0.001	p < 0.001
6.	Diarrhea (Luźne stolce)	p < 0.001	p = 1	p = 1	p < 0.001	p < 0.001	p = 1
7.	Constipation (Zaparte stolce)	p = 1	p < 0.001	p = 1	p < 0.001	p = 1	p < 0.001
8.	Abdominal pain (Bóle brzucha)	p < 0.001	p < 0.001	p < 0.001	p = 1	p = 1	p = 1

1 – diarrhea-predominant irritable bowel syndrome.
 2 – constipation-predominant irritable bowel syndrome.
 3 – functional dyspepsia.
 4 – control group.

1 – dzieci z zespołem jelita nadwrażliwego z biegunkami.
 2 – dzieci z zespołem jelita nadwrażliwego z zaparciami.
 3 – dzieci z niestrawnością czynnościową.
 4 – dzieci z grupy porównawczej.

nant IBS patients (17.4%). Statistically significant differences in nausea frequency were observed in the children with constipation-predominant IBS and those with functional dyspepsia compared with the control group and the diarrhea-predominant IBS group. Vomiting was most frequently observed in functional dyspepsia (21.52%) and least frequently in diarrhea-predominant IBS (5.71%). This symptom was significantly more frequent in the functional dyspepsia than in the control group. Abdominal flatulence was reported by 68.18% of the children with constipation-predominant IBS and in only 8.86% of those with functional dyspepsia. A significant difference in the frequency of abdominal flatulence was observed in all children with IBS compared with the control and functional dyspepsia groups. Abdominal distension occurred significantly more often in the constipation-predominant IBS than in diarrhea-predominant IBS patients. Flatulence in the stomach dominated in patients with diarrhea-predominant IBS (31.34%) and sporadically in patients with functional dyspepsia (3.8%). This symptom was observed significantly more frequently in patients with diarrhea-predominant IBS than in the remaining patient groups and the control group. Excessive gas production was reported by the patients with diarrhea- and constipation-predominant IBS (25.71% and 31.82%, respectively), but in only 1.27% of cases of functional dyspepsia. Statistically significant

differences in gas production were observed between all children with IBS and the control group functional dyspepsia groups.

In Table 3 the results of the hydrogen breath test depending on diagnosis are presented. The test revealed intestinal bacterial overgrowth in more than half of the patients with constipation-predominant IBS (54.55%) and rarely in patients with diarrhea-predominant IBS (2.86%). Lactose malabsorption was observed in 37.14% of the diarrhea-predominant IBS, 27.85% of the functional dyspepsia, and in only 4.55% of the constipation-predominant IBS patients. Symptoms of lactose intolerance after applying the hydrogen breath test were also observed more frequently in the patients with IBS with diarrhea (37.14%) and functional dyspepsia (31.65%) and in only 4.55% of those with constipation-predominant IBS.

In Table 4, a statistical comparison of the results of the hydrogen breath test depending on diagnosis is presented. A statistically significant difference in intestinal bacterial overgrowth was observed in the constipation-predominant IBS compared with the control, diarrhea-predominant IBS, and functional dyspepsia groups. Lactose malabsorption and lactose intolerance were observed statistically more frequently in the diarrhea-predominant IBS and functional dyspepsia groups than in children with constipation-predominant IBS and those with functional dyspepsia.

Table 3. Results of hydrogen breath test in children with diarrhea-predominant IBS, constipation-predominant IBS, and functional dyspepsia

Tabela 3. Wyniki wodorowego testu oddechowego (WTO) w grupach badanych dzieci z rozpoznaniem zespołem jelita nadwrażliwego z przewagą biegunek, zespołem jelita nadwrażliwego z przewagą zaparcí i niestrawnością czynnościową

Group (Grupa)	Diagnosis (Rozpoznanie)	Positive hydrogen breath test (Dodatni wodorowy test oddechowy)		Positive biological trial in the hydrogen breath test (Dodatnia próba biologiczna w WTO)
		dysbacteriosis (dysbakterioza) n %	lactose malabsorption (upośledzone wchłanianie laktozy) n %	
1.	Diarrhea-predominant IBS (Zespół jelita nadwrażliwego z biegunkami)	1 (2.86%)	13 (37.14%)	13 (37.14%)
2.	Constipation-predominant IBS (Zespół jelita nadwrażliwego z zaparciami)	12 (54.55%)	1 (4.55%)	1 (4.55%)
3.	Functional dyspepsia (Niestrawność czynnościowa)	11 (13.92%)	22 (27.85%)	25 (31.65%)
4.	Control group (Grupa porównawcza)	1 (3.57%)	1 (3.57%)	1 (3.57%)

IBS – irritable bowel syndrome.

Table 4. Comparison of hydrogen breath test results depending on diagnosis

Tabela 4. Porównanie częstości występowania uzyskanych wyników wodorowego testu oddechowego (WTO) w grupach badanych dzieci w zależności od rozpoznanej choroby

Lp.	Hydrogen breath test result (Wynik wodorowego testu oddechowego)	Comparison of positive hydrogen breath test results depending on the diagnosis in the subgroup (Porównanie częstości występowania dodatnich wyników WTO w zależności od rozpoznania w podgrupie)					
		1/4	2/4	3/4	1/2	1/3	2/3
1.	Dysbacteriosis (Dysbakterioza)	p = 0.57	p < 0.001	p = 0.25	p < 0.001	p = 0.15	p < 0.001
2.	Lactose malabsorption (Upośledzone wchłanianie laktozy)	p = 0.004	p = 1	p = 0.016	p = 0.014	p = 0.44	p = 0.044
3.	Positive biological trial in the hydrogen breath test (Dodatnia próba biologiczna w WTO)	p = 0.004	p = 1	p = 0.007	p = 0.013	p = 0.72	p = 0.022

1 – diarrhea-predominant irritable bowel syndrome.
2 – constipation-predominant irritable bowel syndrome.
3 – functional dyspepsia.
4 – control group.

1 – dzieci z zespołem jelita nadwrażliwego z biegunkami.
2 – dzieci z zespołem jelita nadwrażliwego z zaparciami.
3 – dzieci z niestrawnością czynnościową.
4 – dzieci z grupy porównawczej.

Discussion

The symptoms reported by patients with functional disorders of the alimentary canal are similar to those reported in intestinal bacterial overgrowth and lactose intolerance and may be overlooked. All patients complained of abdominal pains. Loose stools were reported by children with the diarrhea form of IBS and constipation with the constipation form. Nausea was reported by more than half of patients with constipation-predominant IBS and those with functional dyspepsia. Vomiting was observed more frequently in functional dyspepsia. Abdominal distension was reported by more than half of the children with constipation-predominant IBS, while flatulence dominated in patients with diarrhea-predominant IBS. Excessive gas production was reported mostly by the IBS patients.

The hydrogen breath test allows the differentiation of the clinical symptoms and diagnosis of dysbacteriosis and intestinal bacterial overgrowth in patients with functional disorders of the alimentary canal. This test is relatively cheap and, above all, noninvasive and uncomplicated [6]. In the analyzed group of patients, the hydrogen breath test demonstrated intestinal bacterial overgrowth in more than half of the patients with constipation-predominant IBS. Intestinal bacterial overgrowth in this group of patients was significantly more frequent than in the other groups of this study. Bacterial overgrowth in children with IBS may be promoted by motor disorders of the GI tract which

predispose to the movement of bacteria from the large to the small intestine and to intestinal content congestion, which enables an excessive proliferation of small intestinal flora. Pimetel et al. [18] performed a hydrogen breath test with lactulose in 65 patients with IBS and in 12 patients with the constipation-predominant form and observed methane in the expiratory air. These authors did not observe this gas in any patient with the diarrhea form of IBS. The hypothesis suggesting a dependence of constipation-predominant IBS on methane-producing bacteria was confirmed by subsiding of this ailment after antibiotic therapy. The studies of many authors suggest that intestinal bacterial overgrowth is observed more frequently in IBS than in the general population. In studies with labeled lactulose, Pimentel et al. [19] noted pathological levels of expired hydrogen in 84% of patients with IBS and in only 20% of healthy subjects. Lupascu et al. [12] obtained similar results using labeled glucose in 32% of patients with IBS compared with 4% in healthy people. Madrid et al. [20], who studied 367 adult patients with functional disorders of the alimentary canal, showed more frequent dysbacteriosis in ill patients. Nucera et al. [21] observed withdrawal of symptoms of IBS in patients with intestinal bacterial overgrowth after antibiotic therapy. The studies cited above pertain to adult patients, and the authors of the present study have not found similar studies conducted on children with functional disorders of the GI tract in the literature. Lisowska et al. [22] analyzed the frequency of intestinal bacte-

rial overgrowth in children with cystic fibrosis and observed improper results of hydrogen breath test in 38.5% of the patients, suggesting intestinal bacterial overgrowth.

Lactose malabsorption was observed in 37.14% of the children with diagnosed diarrhea-predominant IBS and in 27.85% of children with functional dyspepsia. Lactose malabsorption was observed statistically more frequently in children with IBS with diarrhea and those with functional dyspepsia than in the control groups and the children with IBS with constipation. A significant part of the children with functional dyspepsia in whom lactose malabsorption was observed may result from primary hypolactasia of the adult type. Toporowska-Kowalska et al. [23] performed the hydrogen breath test in children hospitalized due to abdominal pains and observed primary hypolactasia in 31.5% of the diagnosed children. In the present studies, lactose malabsorption were observed in children with diarrhea-predominant IBS. However, it seems that the malabsorption and lactose intolerance in patients with IBS do not occur more frequently than in the whole population, but that the patients report their ailments more frequently. Lactose intolerance evokes symptoms similar to those in the diarrhea-predominant form of IBS. It poses, as mentioned earlier, diagnostic difficulties leading to the erroneous diagnosis of IBS in patients with lactose intolerance [24]. Moreover, lactose intolerance intensifies the ailments of patients with IBS since it promotes the production of greater amounts of gas from the same amount of disaccharide [25]. Ill persons may react more sensitively to the same amount of gas than healthy subjects.

In the present study the frequency of clinical symptoms of lactose intolerance after receiving lactose during the breath test was analyzed in

selected functional disorders of the gastrointestinal tract. Symptoms of lactose intolerance after lactose load were observed statistically significantly more frequently in the group of patients with diarrhea-predominant IBS (37.14%) and those with functional dyspepsia (31.65%). Symptoms of lactose intolerance were also observed in children with diarrhea-predominant IBS and with those with functional dyspepsia more frequently than in the control and constipation-predominant IBS groups. In a study by Szostak-Węgierek [26], symptoms of lactose intolerance during the breath test were diagnosed in 3.8% of children, in 14.5% of children aged 7–15 age with lactose malabsorption (2.81% of all the studied patients), and in only 1.2% of those with proper lactose absorption (0.99% of all the studied patients). Kwiecień et al. [27] studied 1639 children in Zabrze aged 8–11 years and diagnosed lactose intolerance in 3.23%, which means 18.25% of patients with an improper result of the hydrogen breath test (3.17% of the whole studied group) and in only 0.07% with a proper result of the hydrogen breath test (0.06% of the whole group). Additionally, it has been confirmed that the frequency of this ailment increases with age. Landowski [28] demonstrated the presence of unpleasant symptoms after the digestion of lactose in 8.1% of preschool, 17.2% of elementary school, and 19.3% of secondary school pupils.

In summary, intestinal bacterial overgrowth was observed in 54.55% of the studied patients with irritable bowel syndrome with predominating constipation and it was significantly greater than in the diarrhea form, in patients with functional dyspepsia, and in patients without GI symptoms. Symptoms of lactose intolerance were more frequent in patients with diarrhea-predominating irritable bowel syndrome (37.14%) and those with functional dyspepsia (31.65%).

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