Оригінальні дослідження

DOI: 10.31793/1680-1466.2024.29-4.324

Gut microbiome composition and frequency of small intestinal bacterial overgrowth in patients with irritable bowel syndrome with constipation and hypothyroid hashimoto's thyroiditis: a pilot single-center, cross-sectional study

J.A. Onofrijchuk, I.A. Svintsitskyi, G.A. Solovyova

Bogomolets National Medical University

Abstract. Irritable bowel syndrome (IBS) is common gastrointestinal disorder. Gut microbiome composition changes play a significant role in its pathogenesis. Hashimoto's thyroiditis (HT) often coexists with IBS and may worsen its clinical course. Small intestinal bacterial overgrowth (SIBO) is highly prevalent in both diseases. **The aim** of study was to determine the gut microbiome composition and SIBO frequency in patients with IBS with constipation (IBS-C) and hypothyroid HT. **Material and methods.** This pilot single-center, cross-sectional study included 25 patients with IBS-C. Based on hypothyroid HT status they were divided into 2 groups: 18 patients with IBS-C and HT with hypothyroidism (study group) and 7 patients with IBS-C (control group). Determination of microbiota composition (*Lactobacillus spp., Bifidobacterium spp., Escherichia coli, Bacteroides fragilis group, Bacteroides tetaitaomicron, Fecalibactrerium prausnitzii, Enterococcus spp., Roseburia inulinivorans*) was performed with quantitative real-time polymerase chain reaction. Glucose hydrogen breath test was used to diagnose SIBO. Statistical analyses were performed using R version 4.4.1 and EZR version 1.68. **Results.** A trend for higher total bacterial count was observed in IBS-C patients with hypothyroid HT. *Firmicutes/Bacteroidetes* ratio was significantly lower (p=0.031) and *Bacteroides fragilis* group / *Faecalibacterium prausnitzii* ratio was significantly higher (p=0.001) in patients of study group compared to control group. In study group patients amounts of *Lactobacillus spp., Bifidobacterium spp.* and *Escherichia coli* were significantly

lower, while levels of *Bacteroides fragilis* group and *Roseburia inulinivorans* were higher (p<0,05). SIBO frequency in hypothyroid HT patients with IBS-C was high (61.1%). Study group also was characterized by significantly higher absolute rise in breath hydrogen above baseline levels compared to control group. **Conclusions.** IBS-C patients with coexisting hypothyroid HT demonstrated significant gut microbiota alterations, such as lower *Firmicutes/Bacteroidetes* ratio and higher *Bacteroides fragilis* group / *Faecalibacterium prausnitzii* ratio, the high rate of SIBO-positive cases and higher frequency of SIBO and a more intense increase in the hydrogen content in the air during a breath test.

Keywords: irritable bowel syndrome, constipation, Hashimoto's thyroiditis, hypothyroidism, gut microbiome, small intestinal bacterial overgrowth.

Introduction

IBS is common gastrointestinal disorder that predominantly affects young people, and its average prevalence is up to 35% of world population [1, 2]. IBS pathogenesis is multifactorial and gut microbiome composition changes play a significant role in its development [3].

Gut microbiome is composed of trillions of different microorganisms, which are similarly distributed in small and large intestines [4]. *Bacteroidetes, Firmicutes, Actinobacteria*, and *Proteobacteria* were described as the most prevalent phylum [5, 6]. Recent studies have shown the relationship between presence of gut dysbiosis and development of autoimmune process [7, 8].

HT often coexists with IBS and may worsen its clinical course. SIBO is highly prevalent both in IBS and HT, and number of SIBO-positive cases in above mentioned conditions has significantly increased in recent years [9].

The aim of present study was to determine the gut microbiome composition and SIBO frequency in patients with IBS with constipation (IBS-C) and hypothyroid HT.

Materials and methods

Patients

This pilot single-center, cross-sectional study was carried out from June 2022 to June 2024 in Kyiv City Clinical Hospital № 4. It included randomly selected patients over 18 years old who met Rome IV criteria for IBS-C. Exclusion criteria were history of inflammatory bowel disease and recent antibacterial therapy (3 months before enrollment), history of cancer, pregnant women, active use of probiotics, presence of any other comorbid autoimmune disorder.

A total of 25 patients were recruited for this study. Based on hypothyroid HT status they were divided into 2 groups: 18 patients with IBS-C and HT with hypothyroidism (study group) and 7 patients with IBS-C (control group).

Thyroid-stimulating hormone, thyroid peroxidase and thyroglobulin antibodies blood tests and thyroid ultrasound were used to confirm the diagnosis of HT. Thyroid-stimulating hormone level from 1.0 to 2.5 was considered a compensation criterion for hypothyroidism due to L-thyroxine replacement therapy. There were no statistically significant differences in comorbid conditions. Baseline characteristics of enrolled participants are presented in **Table 1**.

Table 1. Baseline characteristics of enrolled participants

Characteristics	Study group	Control group	p-value
Age, years, Me (IQR)	35 (29, 46)	40.00 (35.25, 45.50)	0.363
Sex: male/ female, n (%)	6 (33.3) / 12 (66.7)	3 (42.9) / 4 (57.1)	0.673
Body mass index, kg/m^2, Me (IQR)	26.85 (23.82, 31.90)	25.50 (22.85, 32.25)	0.739
Obesity, n (%)	7 (38.9)	2 (28.6)	1.000
Smoking, n (%)	12 (66.7)	4 (57.1)	0.673

Real-time quantitative polymerase chain reaction

Determination of microbiota composition was performed with quantitative real-time polymerase chain reaction. It was conducted in the Diagen Molecular Genetic Laboratory (Kyiv, Ukraine) with the use of Bio Rad CFX 96 fluorescent detector. Before the material collection patients didn't eat products with the complicated digestion such as steamed meat, sausage, and mutton fat. The patients also didn't required to use drugs which affect peristalsis or change the stool color. The stool samples were collected into sterile containers.

VERTE

The material transportation was provided at the temperature of lower than +22 °C for less than 6 hours. Deoxyribonucleic acid (DNA) extraction was provided with the help of QIAGEN QIAamp PowerFecal DNA Kit for getting the maximum DNA clarity. After DNA separation its special fragments (primers) were directly amplified with the help of polymerase enzyme – it helped to receive more copies of the specific DNA zones. The reaction was conducted by DT prime thermal cycler for better control of temperature cycles. PCR included 3 stages: denaturation, annealing, extension, which were repeated providing DNA amplification. The DT prime amplifier has multiplex detection with the use of up to 5 florescence channels. Multiple exposition method provides a wide range of dynamic detection. Manufacturer software was used for data analysis. The method was considered valid and highly specific for determination of microbiome composition in Ukraine.

Reference values for different microbial species are presented in **Table 2**. For further statistical analysis, the data are presented as a decimal logarithm – lg (copies/mL).

Table 2. Reference values for different microbial species

Type of microbiota	Reference range (copies/mL)
Total bacterial count	10^{11}-10^{13}
Firmicutes/Bacteroidetes ratio	1-5
Bacteroides fragilis group / Faecalibacterium prausnitzii	0,01–100
Lactobacillus spp.	10^{7}-10^{8}
Bifidobacterium spp.	10^{9}-10^{10}
Escherichia coli	10^{6}-10^{8}
Bacteroides fragilis group	10^{9}-10^{12}
Bacteroides tetaitaomicron	$<10^{12}$
Fecalibactrerium prausnitzii	10^{8}-10^{11}
Enterococcus spp.	$<10^{8}$
Roseburia inulinivorans	$<10^{10}$

Glucose hydrogen breath test

Glucose hydrogen breath test was used to diagnose SIBO. Gastro+Gastrolyzer SN GP 020893 (Bedfont Scientific Ltd, Great Britain) were used to measure H_2 concentration in the exhaled air. All patients were recommended to avoid milk and dairy products, cabbage, beans, fresh and canned fruit and vegetables. The participants fasted for 14 hours before the test, and were allowed to drink water only. Smoking and chewing gum were restricted as well. After taking the deep breath, the patient was exhaling into the tube connected to the device during 15 seconds. After baseline measurement the patient ingested 50 mg of glucose diluted in 250 mL of water. Measurements were taken every 15 minutes. A rise of H_2 level ⩾20 ppm (parts per million) over baseline was considered as a positive test result for SIBO [10, 11]. The test duration was 120 minutes. Considering that measuring quantitative culture of upper gut aspirate has a lot of limitations (invasiveness, necessity of high-level microbiology labs, high cost, inability of culturing big microbial phyla) [12], glucose hydrogen breath test was chosen as the test for SIBO diagnosis.

Statistical analysis

Statistical analyses were performed using open-source software: R version 4.4.1 (The R Foundation for Statistical Computing, Vienna, Austria) and EZR version 1.68 (Jichi Medical University, Saitama, Japan). The normality of the continuous variables distribution was assessed by Shapiro-Wilk test. The data were not normally distributed and hence non-parametric tools were used for the analysis. The Mann-Whitney U-test was used to compare differences between two groups (study and control) with a continuous scale. The Fisher's exact test was used to evaluate the relationship between two qualitative variables.

Quantitative data are described by median (interquartile range: 25^{th}-75^{th} percentile) – Me (IQR), and qualitative data by numbers (percentages) – n (%). P-values <0.05 were considered statistically significant.

Ethical approval

The study was approved by the Bioethical Expertise and Scientific Research Ethics Committee of Bogomolets National Medical University (approval number: 152; date of approval: November 15, 2021) and was conducted in accordance with the Declaration of Helsinki of the World Medical Association (2013). A written informed consent was obtained from all patients enrolled in the study.

Results

Studying the gut microbiota health markers **(Table 3)**, a trend for higher total bacterial count was observed in IBS-C patients with hypothyroid HT. *Firmicutes/Bacteroidetes* ratio was significantly lower (p=0.031) and *Bacteroides fragilis* group /

Faecalibacterium prausnitzii ratio was significantly higher (p=0.001) in patients of study group compared to control group.

Table 3. Gut microbiota health markers in patients of study and control groups

Markers	Study group	Control group	p-value
Total bacterial count, lg (copies/mL)	11.95 (11.08, 12.87)	10.84 (10.35, 12.00)	0.074
Firmicutes/ Bacteroidetes ratio	0.72 (0.22, 1.20)	1.50 (0.95, 2.75)	0.031
Bacteroides fragilis group / *Faecalibacterium prausnitzii* ratio	500.0 (205.5, 725.0)	55.6 (47.8, 92.2)	0.001

Table 4 shows data on the gut microbiome composition in IBS-C patients regarding the presence of hypothyroid HT. In study group amounts of *Lactobacillus spp., Bifidobacterium spp*. and *Escherichia coli* were significantly lower, while levels of *Bacteroides fragilis* group and *Roseburia inulinivorans* were higher (p<0.05).

Table 5. SIBO characteristics in patients of study and control groups

SIBO characteristics	Study group	Control group	p-value
SIBO frequency, n (%)	11 (61.1)	2 (28.6)	0.202
H_2 level rise, ppm, Me (IQR)	25.5 (18, 35.75)	17 (16, 19)	0.034

Discussion

Gut microbiota alterations in both patients with IBS and HT usually demonstrate controversial results. K. Ponussamy et al. have shown higher diversity of total bacteria as well as *Bacteroidetes* and *Lactobacillus* and lower diversity of *Bifidobacterium* in patients with IBS (regardless of subtypes) [13]. Meta-analysis of 24 studies also reported higher levels of *Lactobacillus* and *Bacteroides* and lower levels of *Faecalibacterium* and *Bifidobacterium* in patients with IBS [14]. In another study that compared 15 IBS-C patients with healthy controls increased levels of *Bacteroides* and *Bifidobacterium* were present in patients with IBS-C [15]. However, the amount of *Bifidobacterium* and *Lactobacillus*, which showed high effect in probiotic purposes, was lower in HT group [16, 17], similarly to our study

Table 4. Gut microbiome composition in patients of study and control groups

Type of microbiota	Study group	Control group	p-value
Lactobacillus spp., lg (copies/mL)	5.24 (5.00, 6.96)	8.78 (7.00, 11.75)	0.004
Bifidobacterium spp., lg (copies/mL)	7.80 (6.97, 8.43)	8.70 (8.45, 9.65)	0.02
Escherichia coli, lg (copies/mL)	6.60 (5.65, 6.89)	7.70 (6.89, 8.87)	0.049
Bacteroides fragilis group, lg (copies/mL)	10.98 (10.38, 11.30)	9.70 (9.13, 10.50)	0.042
Bacteroides tetaitaomicron, lg (copies/mL)	7.95 (6.08, 9.87)	9.85 (8.63, 12.37)	0.23
Fecalibactrerium prausnitzii, lg (copies/mL)	8.48 (8.00, 8.87)	8.60 (7.70, 9.22)	0.928
Enterococcus spp., lg (copies/mL)	5.00 (0.00, 7.71)	6.00 (4.74, 6.63)	0.502
Roseburia inulinivorans, lg (copies/mL)	8.30 (6.60, 9.48)	5.90 (5.15, 6.30)	0.008

The SIBO frequency in hypothyroid HT patients with IBS-C was high (61.1%). The percentage of SIBO-positive cases observed in this group was two times greater than in isolated IBS-C patients, but the difference was not statistically significant (p=0.202) due to the small sample size. Study group also was characterized by significantly higher absolute rise in breath hydrogen above baseline levels compared to control group **(Table 5)**.

results. Several studies identified reduced microbial diversity in patients with HT [18-20]. F. Zhao et al. who studied 28 HT patients and 16 healthy controls have found the increase in abundance level of *Roseburia*, and decrease in *Fecalibacterium*, *Bacteroides* [20]. However, the difference in gut microbiome composition wasn't detected between hypothyroid patients and healthy controls either in crude or adjusted models [21]. Meta-analysis of

VERTE

4 studies demonstrated increased *Bacteroides fragilis* levels in HT group compared to healthy patients [16]. High *Bacteroides fragilis/Faecalibacterium prausnitzii* ratio is considered a sign of gut dysbiosis [22]. Also, this ratio can be associated with the low anti-inflammatory response during the autoimmune thyroiditis. *Firmicutes/Bacteroides* ratio was significantly lower in study group of our study, and meta-analysis showed the same results [16]. Existing literature doesn't provide enough data considering abundance level of *Escherichia coli* in patients with HT, which was significantly lower in study group of our study. X. Zhuang et al. as well as H.N. Liu et al. found no difference in *Escherichia coli* levels depending on presence of IBS [23, 24].

SIBO is present in many IBS patients (from 38 % to 78%) and can be associated with the symptoms of bloating, constipation, and abdominal pain [25-27]. In patients with SIBO a higher level of *Clostridium*, *Escherichia*, and *Enterobacteriae* is associated with bloating [28]. Studies aimed to identify changes in gut microbiome of patients with HT, demonstrated the high correlation between gut dysbiosis, bacterial overgrowth with the development of autoimmune inflammation in the thyroid gland [29]. Our study also showed high SIBO prevalence and higher H_2 level rise if available presence of HT.

The limitations of our study were the single-center, cross-sectional design, small sample size, no data regarding some factors that influence gut microbiome (dietary habits, level of stress etc.).

Conclusions

IBS-C patients with coexisting hypothyroid HT demonstrated significant gut microbiota alterations, such as lower *Firmicutes/Bacteroidetes* ratio and higher *Bacteroides fragilis* group / *Faecalibacterium prausnitzii* ratio. Gut microbiome composition of these patients was characterized by lower amounts of *Lactobacillus* spp., *Bifidobacterium* spp. and *Escherichia coli,* and higher levels of *Bacteroides fragilis* group and *Roseburia inulinivorans*. It was shown the high rate of SIBO-positive cases and higher H_2 level rise in presence of HT. Further larger sample size researches are needed to confirm these findings.

References

1. Black CJ, Ford AC. Global burden of irritable bowel syndrome: trends, predictions and risk factors. Nat Rev Gastroenterol Hepatol. 2020 Aug;17(8):473-86. doi: 10.1038/s41575-020-0286-8.
2. Huang KY, Wang FY, Lv M, Ma XX, Tang XD, Lv L. Irritable bowel syndrome: Epidemiology, overlap disorders, pathophysiology and treatment. World J Gastroenterol. 2023 Jul 14;29(26):4120-35. doi: 10.3748/wjg.v29.i26.4120.
3. Chong PP, Chin VK, Looi CY, Wong WF, Madhavan P, Yong VC. The Microbiome and irritable bowel syndrome – a review on the pathophysiology, current research and future therapy. Front Microbiol. 2019 Jun 10;10:1136. doi: 10.3389/fmicb.2019.01136.
4. Krautkramer KA, Fan J, Bäckhed F. Gut microbial metabolites as multi-kingdom intermediates. Nat Rev Microbiol. 2021 Feb;19(2):77-94. doi: 10.1038/s41579-020-0438-4.
5. Lagier JC, Hugon P, Khelaifia S, Fournier PE, La Scola B, Raoult D. The rebirth of culture in microbiology through the example of culturomics to study human gut microbiota. Clin Microbiol Rev. 2015 Jan;28(1):237-64. doi: 10.1128/CMR.00014-14.
6. Adak A, Khan MR. An insight into gut microbiota and its functionalities. Cell Mol Life Sci. 2019 Feb;76(3):473-93. doi: 10.1007/s00018-018-2943-4.
7. De Luca F, Shoenfeld Y. The microbiome in autoimmune diseases. Clin Exp Immunol. 2019 Jan;195(1):74-85. doi: 10.1111/cei.13158.
8. Gianchecchi E, Fierabracci A. Recent advances on microbiota involvement in the pathogenesis of autoimmunity. Int J Mol Sci. 2019 Jan 11;20(2):283. doi: 10.3390/ijms20020283.
9. Roszkowska P, Klimczak E, Ostrycharz E, Rączka A, Wojciechowska-Koszko I, Dybus A, et al. Small intestinal bacterial overgrowth (SIBO) and twelve groups of related diseases-current state of knowledge. Biomedicines. 2024 May 7;12(5):1030. doi: 10.3390/biomedicines12051030.
10. Tansel A, Levinthal DJ. Understanding our tests: hydrogen-methane breath testing to diagnose small intestinal bacterial overgrowth. Clin Transl Gastroenterol. 2023 Apr 1;14(4):e00567. doi: 10.14309/ctg.0000000000000567.
11. Hammer HF, Fox MR, Keller J, Salvatore S, Basilisco G, Hammer J, et al. European guideline on indications, performance, and clinical impact of hydrogen and methane breath tests in adult and pediatric patients: European Association for Gastroenterology, Endoscopy and Nutrition, European Society of Neurogastroenterology and Motility, and European Society for Paediatric Gastroenterology Hepatology and Nutrition consensus. United European Gastroenterol J. 2022 Feb;10(1):15-40. doi: 10.1002/ueg2.12133.
12. Ghoshal UC, Ghoshal U, Shah A, Holtmann G. Evaluation of small intestinal bacterial overgrowth. Expert Rev Gastroenterol Hepatol. 2023 May;17(5):461-7. doi: 10.1080/17474124.2023.2207008.
13. Ponnusamy K, Choi JN, Kim J, Lee SY, Lee CH. Microbial community and metabolomic comparison of irritable bowel syndrome faeces. J Med Microbiol. 2011 Jun;60(Pt 6):817-27. doi: 10.1099/jmm.0.028126-0.
14. Pittayanon R, Lau JT, Yuan Y, Leontiadis GI, Tse F, Surette M, et al. Gut microbiota in patients with irritable bowel syndrome – a systematic review. Gastroenterology. 2019 Jul;157(1):97-108. doi: 10.1053/j.gastro.2019.03.049.
15. Dior M, Delagrèverie H, Duboc H, Jouet P, Coffin B, Brot L, et al. Interplay between bile acid metabolism and microbiota in irritable bowel syndrome. Neurogastroenterol Motil. 2016 Sep;28(9):1330-40. doi: 10.1111/nmo.12829.
16. Gong B, Wang C, Meng F, Wang H, Song B, Yang Y, et al. Association between gut microbiota and autoimmune thyroid disease: a systematic review and meta-analysis. Front Endocrinol (Lausanne). 2021 Nov 17;12:774362. doi: 10.3389/fendo.2021.774362.
17. Liu J, Qin X, Lin B, Cui J, Liao J, Zhang F, et al. Analysis of gut microbiota diversity in Hashimoto's thyroiditis patients. BMC Microbiol. 2022 Dec 24;22(1):318. doi: 10.1186/s12866-022-02739-z.
18. Zhu X, Zhang C, Feng S, He R, Zhang S. Intestinal microbiota regulates the gut-thyroid axis: the new dawn of improving

Hashimoto thyroiditis. Clin Exp Med. 2024 Feb 22;24(1):39. doi: 10.1007/s10238-024-01304-4.
19. Liu S, An Y, Cao B, Sun R, Ke J, Zhao D. The composition of gut microbiota in patients bearing Hashimoto's thyroiditis with euthyroidism and hypothyroidism. Int J Endocrinol. 2020 Nov 10;2020:5036959. doi: 10.1155/2020/5036959.
20. Zhao F, Feng J, Li J, Zhao L, Liu Y, Chen H, et al. Alterations of the gut microbiota in Hashimoto's thyroiditis patients. Thyroid. 2018 Feb;28(2):175-86. doi: 10.1089/thy.2017.0395.
21. Tabasi M, Eybpoosh S, Sadeghpour Heravi F, Siadat SD, Mousavian G, Elyasinia F, et al. Gut microbiota and serum biomarker analyses in obese patients diagnosed with diabetes and hypothyroid disorder. Metab Syndr Relat Disord. 2021 Apr;19(3):144-51. doi: 10.1089/met.2020.0119.
22. Koval SM, Snihurska IO, Yushko KO, Mysnychenko OV, Halchynska VY. The features of the composition of the gut microbiota in patients with hypertension and abdominal obesity. Pathologia. 2021;18(3):303-10.
23. Zhuang X, Xiong L, Li L, Li M, Chen M. Alterations of gut microbiota in patients with irritable bowel syndrome: A systematic review and meta-analysis. J Gastroenterol Hepatol. 2017 Jan;32(1):28-38. doi: 10.1111/jgh.13471.
24. Liu HN, Wu H, Chen YZ, Chen YJ, Shen XZ, Liu TT. Altered molecular signature of intestinal microbiota in irritable bowel syndrome patients compared with healthy controls: A systematic review and meta-analysis. Dig Liver Dis. 2017 Apr;49(4):331-7. doi: 10.1016/j.dld.2017.01.142.
25. Ghoshal UC, Shukla R, Ghoshal U. Small intestinal bacterial overgrowth and irritable bowel syndrome: a bridge between functional organic dichotomy. Gut Liver. 2017 Mar 15;11(2):196-208. doi: 10.5009/gnl16126.
26. Shah A, Talley NJ, Jones M, Kendall BJ, Koloski N, Walker MM, et al. Small intestinal bacterial overgrowth in irritable bowel syndrome: a systematic review and meta-analysis of case-control studies. Am J Gastroenterol. 2020 Feb;115(2):190-201. doi: 10.14309/ajg.0000000000000504.
27. Takakura W, Pimentel M. Small intestinal bacterial overgrowth and irritable bowel syndrome – an update. Front Psychiatry. 2020 Jul 10;11:664. doi: 10.3389/fpsyt.2020.00664.
28. Barlow JT, Leite G, Romano AE, Sedighi R, Chang C, Celly S, et al. Quantitative sequencing clarifies the role of disruptor taxa, oral microbiota, and strict anaerobes in the human small-intestine microbiome. Microbiome. 2021 Nov 2;9(1):214. doi: 10.1186/s40168-021-01162-2.
29. Cayres LCF, de Salis LVV, Rodrigues GSP, Lengert AVH, Biondi APC, Sargentini LDB, et al. Detection of alterations in the gut microbiota and intestinal permeability in patients with Hashimoto thyroiditis. Front Immunol. 2021 Mar 5;12:579140. doi: 10.3389/fimmu.2021.579140.

Abbreviations

DNA – deoxyribonucleic acid
HT – Hashimoto's thyroiditis
IBS – irritable bowel syndrome
IBS-C – irritable bowel syndrome with constipation
SIBO – small intestinal bacterial overgrowth

Склад кишкового мікробіому й частота синдрому надмірного бактеріального росту в пацієнтів із синдромом подразненої кишки із закрепами та тиреоїдитом Хашимото з гіпотиреозом: пілотне одноцентрове крос-секційне дослідження

Ю.А. Онофрійчук, І.А. Свінціцький, Г.А. Соловйова
Національний медичний університет ім. О.О. Богомольця

Резюме. Синдром подразненої кишки (СПК) є поширеним розладом органів травлення. Значну роль у його патогенезі відіграють зміни складу кишкової мікробіоти. Тиреоїдит Хашимото (ТХ) є частим коморбідним станом при СПК і може погіршити його перебіг. Синдром надмірного бактеріального росту (СНБР) є вкрай поширеним при обох захворюваннях. **Метою дослідження** було визначити склад кишкового мікробіому та частоту СНБР у пацієнтів із синдромом подразненої кишки із закрепами (СПК-З) та ТХ з гіпотиреозом. **Матеріал і методи.** Це пілотне одноцентрове крос-секційне дослідження залучило 25 пацієнтів із СПК-З. Залежно від наявності ТХ з гіпотиреозом їх було розподілено на 2 групи: 18 осіб з СПК-З та ТХ з гіпотиреозом (дослідна група) та 7 пацієнтів із СПК-З (контрольна група). Визначення складу мікробіому (***Lactobacillus*** spp., ***Bifidobacterium*** spp., ***Escherichia coli***, група ***Bacteroides fragilis***, ***Bacteroides tetaitaomicron***, ***Fecalibactrerium prausnitzii***, ***Enterococcus*** spp., ***Roseburia inulinivorans***) проводили за допомогою полімеразної ланцюгової реакції в реальному часі. Для діагностики СНБР використовували водневий дихальний тест з навантаженням глюкозою. Статистичний аналіз проводили з використанням програмного забезпечення R версії 4.4.1 та EZR версії 1.68. **Результати.** Тенденція до більшої загальної бактеріальної маси спостерігалася в пацієнтів із СПК-З та ТХ з гіпотиреозом. Нижче співвідношення ***Firmicutes/Bacteroidetes*** (p=0,031) і вище співвідношення ***Bacteroides fragilis*** / ***Faecalibacterium prausnitzii*** (p=0,001) виявлено в пацієнтів дослідної групи порівняно з контрольною групою. У пацієнтів дослідної групи кількість ***Lactobacillus*** spp., ***Bifidobacterium*** spp. та ***Escherichia coli*** були статистично вагомо нижчими, тоді як показники групи ***Bacteroides fragilis*** та ***Roseburia inulinivorans*** були вищими (p<0,05). Встановлено високу частоту СНБР у пацієнтів із ТХ з гіпотиреозом і СПК-З (61,1%). Дослідна група також характеризувалася вищим абсолютним показником зростання вмісту водню в повітрі при проведенні дихального тесту з навантаженням глюкозою порівняно з контрольною групою. **Висновки.** У пацієнтів із СПК-З і супутнім ТХ з гіпотиреозом виявлено значущі зміни складу кишкової мікробіоти, такі як нижче співвідношення ***Firmicutes/Bacteroidetes*** і вище співвідношення групи ***Bacteroides fragilis/Faecalibacterium prausnitzii***, високу частоту СНБР і інтенсивніше зростання вмісту водню в повітрі при проведенні дихального тесту.

Ключові слова: синдром подразненої кишки, закреп, тиреоїдит Хашимото, гіпотиреоз, кишковий мікробіом, синдром надмірного бактеріального росту.

Для цитування: Онофрійчук ЮА, Свінціцький ІА, Соловйова ГА. Склад кишкового мікробіому й частота синдрому надмірного бактеріального росту в пацієнтів із синдромом подразненої кишки із закрепами та тиреоїдитом Хашимото з гіпотиреозом: пілотне одноцентрове крос-секційне дослідження. Ендокринологія. 2024;29(4):324-330. DOI: 10.31793/1680-1466.2024.29-4.324.

Адреса для листування: Онофрійчук Юлія Анатоліївна, juliya.onofrijchuk@gmail.com, Національний медичний університет ім. О.О. Богомольця, бул. Тараса Шевченка, 13, Київ 01601, Україна.
Відомості про авторів: Онофрійчук Юлія Анатоліївна, аспірантка кафедри внутрішніх хвороб стоматологічного факультету, ORCID: 0000-0002-7762-6218; Свінціцький Ігор Анатолійович, канд. мед.

VERTE

наук, доцент кафедри внутрішніх хвороб стоматологічного факультету, ORCID: 0000-0002-9303-4132; Соловйова Галина Анатоліївна, д-рка мед. наук, професорка, в.о. завідувачки кафедри внутрішніх хвороб стоматологічного факультету, ORCID: 0000-0001-8245-3051.

Особистий внесок: Онофрійчук Ю.А. – збирання даних, аналіз результатів, написання статті; Свінціцький І.А. – аналіз результатів, написання та редагування статті; Соловйова Г.А. – концепція та дизайн дослідження, редагування статті.

Фінансування: стаття підготовлена за власні кошти авторів.

Декларація з етики: автори задекларували відсутність конфлікту інтересів і фінансових зобов'язань.

Стаття: надійшла до редакції 23.11.2024 р.; перероблена 23.11.2024 р.; прийнята до друку 26.11.2024 р.; надрукована 30.12.2024 р.

For citation: Onofrijchuk JA, Svintsitskyi IA, Solovyova GA. Gut microbiome composition and frequency of small intestinal bacterial overgrowth in patients with irritable bowel syndrome with constipation and hypothyroid Hashimoto's thyroiditis: a pilot single-center, cross-sectional study. Endokrynologia. 2024;29(4):324-330. DOI: 10.31793/1680-1466.2024.29-4.324.

Correspondence address: Onofrijchuk Juliya Anatoliivna, juliya.onofrijchuk@gmail.com, Bogomolets National Medical University, 13, T. Shevchenko Blvd., Kyiv 01601, Ukraine.

Information about the authors: Onofrijchuk Juliya Anatoliivna, PhD Student of the Department of Internal Medicine of the Faculty of Dentistry, ORCID: 0000-0002-7762-6218; Svintsitskyi Igor Anatoliiovych, Cand. Sci. (Medicine), Associate Professor of the Department of Internal Medicine of the Faculty of Dentistry, ORCID: 0000-0002-9303-4132; Solovyova Galyna Anatoliivna, Dr. Sci. (Medicine), Prof., Acting Head of the Department of Internal Medicine of the Faculty of Dentistry, ORCID: 0000-0001-8245-3051.

Personal contribution: Onofrijchuk J.A. – data collection, analysis of results, writing the article; Svintsitskyi I.A. – analysis of results, writing and editing the article; Solovyova G.A. – concept and design of the study, editing the article.

Funding: the article was prepared at the authors' own expense.

Declaration of ethics: the authors have declared no conflicts of interest or financial obligations.

Article: received November 23, 2024; revised November 23, 2024; accepted November 26, 2024; published December 30, 2024.