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Age peculiarities of intestinal microbiocenosis disorders in the patients with ulcerative colitis and Crohn's disease

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Abstract. ***Background.*** *Inflammatory bowel diseases (IBD) such as ulcerative colitis (UC) and Crohn's disease (CD) remain one of the most difficult and challenging gastroenterology problems. The impact of intestinal microflora and its changes on the development and progression of IBD has not been studied enough. The most dominant etiological hypothesis is that IBD is the result of an abnormal immune response to an altered intestinal microbiota caused by an environmental factor or pathogenic microorganisms in a genetically predisposed host. Altered gut microbiota dysbiosis in IBD is generally recognized, but the dependence of this change on the age still needs to be studied. The purpose of the study is to investigate the peculiarities of intestinal dysbiosis and the frequency of small intestinal bacterial overgrowth (SIBO) in patients with IBD depending on nosology and age.* ***Materials and methods.*** *One hundred and twenty patients with IBD aged 19 to 79 years (average (43.90 ± 1.40) years) were examined; among them 83 patients had UC, and 37 ones had CD. All patients were divided into two groups according to nosology and age. The patients underwent a hydrogen breath test to detect SIBO, bacteriological examination of feces, and short-chain fatty acid (SCFAs) chromatography in coprofiltrate.* ***Results.*** *The profound qualitative and quantitative changes of the colon microflora and high frequency of SIBO in patients with IBD were revealed. The dependence of changes in the microflora composition of the small and large intestine in a patient on age and nosology was discovered. The decrease in the concentration of Bifidobacteria in the content of the colon was found mostly in young patients with CD, while the decrease in the number of Lactobacilli was mostly found in elderly patients in both groups. The frequency of hemolytic biovars of Escherichia coli, opportunistic enterobacteria, and fungi of the genus Candida in the colon increased with age. There were changes in both the total content and indices of some SCFAs in patients of both groups versus healthy persons that indicated the suppression of the metabolic activity of normal microflora in patients. Decreased levels of acetic and butyric acid indicated the severity of suppression of the production of these metabolites.* ***Conclusions.*** *The elderly patients were found to have a greater tendency to develop SIBO, a decrease in the colon Lactobacilli concentration, as well as an increased frequency of detection of conditionally pathogenic flora and fungi of the genus Candida. In young patients, there is mainly a subcompensated form of dysbiosis with a decrease in the concentration of Bifidobacteria. With age, there is also suppression of acetic and butyric acid production. The results of this study will allow clinicians to select therapeutic tactics in these patients more carefully, namely, will influence the choice of drugs that modulate the intestinal microbiota, taking into account not only the nosology but also the patient's age.*

Keywords: *inflammatory bowel disease; intestinal microflora; small intestinal bacterial overgrowth; short-chain fatty acids; ulcerative colitis; Crohn's disease*

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Introduction

Crohn's disease (CD) and ulcerative colitis (UC), known as chronic inflammatory bowel disease (IBD), are multifactorial, potentially debilitating diseases with probable genetic heterogeneity and unknown etiology.

The steady increase in morbidity and prevalence of IBD on almost all continents make researchers consider IBD as one of the main important global health problems [1].

Unfortunately, the exact etiology of IBD remains unclear, and effective treatment is still not found. Today, the most accepted hypothesis of the pathogenesis of CD is the complex interactions between environmental factors, the immune system, and the microbial flora in a genetically predisposed person, which lead to aberrant nominal reactions and chronic inflammatory bowel disease [2]. It is believed that an inappropriate immune response to altered microbiota (or pathogenic microorganisms) under the influence of environmental factors contributes to the development of IBD.

It is known that the intestinal microbiota in healthy people has many benefits for the health of the host, in terms of protection against pathogens, for the nutrition, metabolism, and the immune system. Microbiota with more than 100 trillion microorganisms is involved in the fermentation of complex undigested polysaccharide polymers, the production of short-chain fatty acids (SCFAs), the synthesis of vitamins, energy production, the integrity of the intestinal mucosa, and pathogens. Numerical studies have shown that a patient with IBD shows significant changes in the composition of the microbiota compared with a healthy individual [4, 5].

The patients with UC and CD have a higher content of opportunistic and pathogenic flora (*Bacteroides* spp., *Eubacterium* spp., and others) in conditions of chronic inflammation and reduced content of beneficial bacteria that maintain the stability of the normal microflora of the gastrointestinal tract [6]. As a result, the production of some metabolites, including short-chain fatty acids, such as butyrate, propionate, and acetate, is reduced. These SCFAs are associated with the excitation of anti-inflammatory and antitumor reactions that promote the growth of intestinal epithelium. Butyrate is considered to be the main source of energy for the intestinal epithelium and helps to produce mucin (gel-like inner layer) in the lumen, which sets the physical barrier. SCFAs deficiency leads to atrophy of the epithelium and inflammation of the mucosa [7]. Recently, the most informative and reliable method of diagnosing intestinal dysbiosis (90–95% reliability) is the method of gas chromatography to determine the absolute and relative content of SCFAs in coprofiltrate, which allows in a short time to assess structural changes and metabolic activity of intestinal microflora [8].

Another manifestation of intestinal dysbiosis in patients with IBD is the syndrome of small intestinal bacterial overgrowth (SIBO). The causes that can lead to a violation of the microbiocenosis of the small intestine may be such as dysfunction of the ileocecal valve (common in patients with CD), taking nonsteroidal anti-inflammatory drugs, starvation, stress, infectious, and noncommunicable diseases, enzymopathy (lactase, gluten deficiency) and some other factors [9]. Diagnosing SIBO is quite long and troublesome. An alternative to the costly and painstaking aspiration method for detecting SIBO, which requires special equipment and culture, is the hydrogen breath test (HBT) with glucose loading. The test is quite simple to perform and has a high specificity, which successfully allows introducing this method in routine clinical practice.

It should be noted that the intestinal microbiota changes not only under the disease influence but also with age. Studies show that the species composition of the intestinal microbiota in elderly people differs from the composition in young ones. There is also no chronological threshold or age at which the composition of the microbiota suddenly changes; the changes occur gradually under the influence of the external factors (environment, stress, diet, and health, as well as under the influence of drugs, etc.) [10].

Given that current therapy for IBD is focused mainly on suppressing the immune system and is not always effective, there is a need to develop and apply other treatment methods. Some authors believe that dietary recommendations, with a known ability to modulate the intestinal microbiome, as well as the use of prebiotics, probiotics, antibiotics, and/or fecal transplants, are a unique opportunity to improve IBD treatment outcomes [11, 12].

In connection with the above, the **aim** of our study is to determine the severity of dysbiotic disorders of the quantitative and qualitative composition of the colon microflora, as well as the SIBO frequency in patients with IBD depending on nosological forms and age.

Materials and methods

We examined 120 patients with IBD aged 19 to 79 years (average (43.90 ± 1.40) years), among them 83 patients with UC and 37 ones with CD.

All patients were divided into two groups according to nosology and age (according to the WHO classification: from 25 to 44 years — young age, 45–59 years — middle age, 60–75 years — old age). The young group included 66 patients, the middle age group consisted of 30 patients, and the elderly group included 24 patients.

To determine the state of the microbiota of the small intestine, namely SIBO presence, a hydrogen breath test with glucose loading was performed using a gas analyzer Gastro$^+$ Gastrolyzer from Bedfont Scientific Ltd (UK). The method is based on measuring the concentration of hydrogen in the air exhaled by a patient after ingestion of glucose solution (50 g per 250 ml of water), at regular intervals (0, 15, 30, 45, and 60 minutes). Hydrogen (H_2), which is formed in the intestinal lumen as a result of metabolic activity of the existing microflora, absorbs, enters the systemic bloodstream, and then excreted by the lungs as a component of exhaled air. The threshold level of hydrogen evolution is 10 ppm. In the presence of an increased amount of anaerobic microflora, there is an increase in the concentration of H_2 in the exhaled air. An increase in its level compared to the initial by 10 ppm or more indicates that a patient has a syndrome of bacterial overgrowth. The study was conducted under the standards [13].

Table 1 — Indicators of HBT in the studied patients (ppm), M ± m

Measurement time, min	IBD (n = 120)			UC (n = 83)			CD (n = 37)		
	young age (n = 66)	middle age (n = 30)	elderly age (n = 24)	young age (n = 43)	middle age (n = 22)	elderly age (n = 18)	young age (n = 23)	middle age (n = 8)	elderly age (n = 6)
0	10.3 ± 2.1	7.2 ± 2.1	6.7 ± 2.1	7.5 ± 1.1	8.2 ± 2.6	8.1 ± 2.0	6.5 ± 3.6	7.4 ± 2.9	11.5 ± 1.9
15	19.7 ± 1.6	15.8 ± 1.7	15.8 ± 1.7	14.9 ± 2.7	16.1 ± 1.2	16.1 ± 1.2	14.9 ± 1.4	13.5 ± 1.3	14.3 ± 2.1
30	27.8 ± 2.6	16.7 ± 1.9	36.7 ± 1.9	24.3 ± 2.6	22.2 ± 1.9	28.2 ± 1.9	22.2 ± 1.8	14.3 ± 2.1	25.1 ± 3.3
45	23.4 ± 2.2	28.2 ± 3.2	39.2 ± 3.2	29.6 ± 2.5	28.1 ± 3.0	39.1 ± 3.0	20.1 ± 3.3	15.1 ± 3.3	41.6 ± 2.8
60	17.5 ± 2.9	12.5 ± 2.1	22.5 ± 2.1	18.7 ± 3.2	14.6 ± 2.8	34.6 ± 2.8	15.7 ± 2.8	11.6 ± 2.8	32.4 ± 2.7
Mean	21.8 ± 2.3*	14.1 ± 2.4	24.4 ± 2.4	21.4 ± 3.1*	17.8 ± 2.3	25.2 ± 2.3	24.6 ± 2.6*	12.4 ± 2.7	25.4 ± 2.9

*Note. * — p < 0.05 — significance of differences between HBT indices in patients with UC and CD depending on age.*

Microbiological research methods

The studies of the species and quantitative composition of the colon microflora were performed by sowing ten-fold dilutions (10^{-1}–10^{-9}) on a standard set of selective and differential diagnostic nutrient media for the isolation of aerobic and anaerobic microorganisms. Gradation of deviations in the composition of the intestinal microflora was carried out in three stages: I degree — compensated dysbiosis (DI), mild; II degree — subcompensated (D II), average; III degree — uncompensated (D III), severe dysbiosis.

Short-chain fatty acid chromatography in the patient's coprofiltrate was performed on a Crystal-5000 chromatograph according to the method of Guohua Zhao (2006). The control values of the content of QLC in the feces were: acetic acid (C2) — 0.013–0.028 μl/ml, propionic acid (C3) — 0.0043–0.0057 μl/ml, butyric acid (C4) — 0.00068–0.0008 μl/ml.

Statistical methods

To optimize the findings and automate data processing, the obtained indicators were entered into a database management system built using an integrated application package Statistica for Windows 6.0.

Descriptive and inductive statistics were used for statistical data analysis. The comparison of the average values of the variables was carried out using parametric methods (Student's *t*-test) with a normal distribution of these features, expressed in the interval scale. Differences between the two indicators were considered probable at $p < 0.05$. The conformity of the type of distribution of the features of the normal distribution was checked using the Shapiro-Wilk method. In other cases, a nonparametric method (Mann-Whitney U test) was used. The χ^2 test was used to compare the particle distribution of two or more variables. The correlation analysis was performed according to Pearson (for data expressed in interval scales) and according to Spearman (for data expressed not in interval scales). All calculations were performed in SPSS 9.0 for Windows.

All measuring equipment used in the work were metrologically verified in the prescribed manner.

Results

The analysis of the frequency of SIBO detection showed that the changes in the state of the microflora of the small intestine were observed in 62.5 % of patients with IBD in equal proportion by nosology.

The analysis of HBT indicators depending on age showed that the largest changes in the concentration of hydrogen in exhaled air were observed in elderly patients (Table 1).

At the same time, significant differences were concerned with the compared results of young and elderly patients with UC and CD ($p < 0.05$).

The frequency of SIBO was 95.8 % of elderly patients, almost 2 times less in young and middle-aged patients (51.5 and 60.0 %, respectively) (Fig. 1).

Thus, a larger number of patients with IBD are characterized by disorders in the microbiocenosis of the small intestine in the form of SIBO, which were significantly dependent on age and prevailed in elderly patients.

The study of the state of the colon microbiocenosis was performed in 114 patients with IBD. Among them, there were 80 patients with UC and 34 patients with CD. The young group included 62 patients, the middle-age group consisted of 30 patients, and 22 men were in the elderly group.

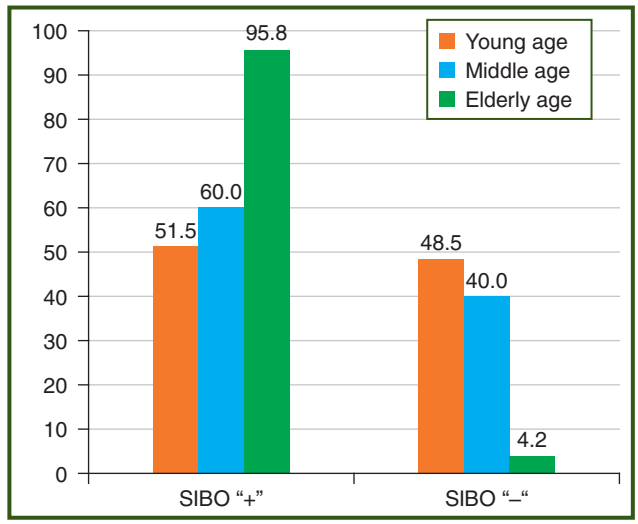

Figure 1 — Frequency of SIBO depending on age

The results of the microbiological studies of the colon content in patients with IBD showed the presence of profound changes in the qualitative and quantitative composition of the microflora in 99.1 % of patients.

As can be seen from Table 2, the patients with subcompensated and decompensated forms of dysbiosis predominated among young patients, while subcompensated and decompensated forms of dysbiosis were defined in the same number of patients in elderly individuals.

According to the nosological feature, 75.0 % of patients with CD had a compensated form of dysbiosis, 44.4 % of patients with IBD experienced subcompensated dysbiosis.

The distribution of patients depeding on age and nosology is shown in Table 2.

The average number of microorganisms in the colon content depending on age and nosology are shown in Table 3. According to the obtained data, there are significant differences in the composition of the patients' normal colon flora in all study groups. The decrease in the concentration of *Bifidobacteria* in the colon content was found mostly in young-aged patients with IBD, while the decrease in the number of *Lactobacilli* was revealed in 90.9 % of elderly patients, namely in all patients with CD and in 88.9 % of elderly patients with UC.

The frequency of isolation of yeast-like fungi of the genus Candida was almost the same in patients with IBD. However, it should be noted that in patients with UC the frequency of detection of fungi of the genus Candida increased with increasing age of patients. Besides, in the group of elderly patients, the frequency of detection of conditionally pathogenic flora was higher.

Study of the content of short-chain fatty acids in feces

We investigated the content of SCFAs C2-C4 in the feces for a more detailed study of intestinal microbiocenosis disorders in patients with IBD. Using gas chromatography, we studied coprofiltrates in 49 patients with IBD, among them, there are 35 patients with UC and 14 individuals with CD. There are 24 patients in the young-aged group, 12 patients in the middle-aged, and 13 men in the elderly groups.

Table 2 — The state of colon microbiocenosis in patients with IBD depending on age and nosology

Group		Patients (N — absolute number, and %)									
		Total		Norm		Grade of colon microbiocenosis					
						the first		the second		the third	
		N	%	N	%	N	%	N	%	N	%
IBD (n = 114)	young age	62	100	1	1.6	18	29.0	30	48.4	13	21.0
	middle age	30	100	0	0	9	30.0	10	33.3	11	36.7
	elderly age	22	100	0	0	6	27.2	8	36.4	8	36.4
CD (n = 34)	young age	22	100	1	4.5	6	27.3	10	45.5	5	22.7
	middle age	8	100	0	0	1	12.5	2	25.0	5	62.5*
	elderly age	4	100	0	0	3	75.0	0	0	1	25.0
UC (n = 80)	young age	40	100	0	0	12	30.0	20	50.0	8	20.0
	middle age	22	100	0	0	8	36.4	8	36.4	6	27.2
	elderly age	18	100	0	0	3	16.7	8	44.4	7	38.9

Note. * — $p < 0.05$ — the difference between the groups of patients of young and middle age with CD grade III dysbiosis ($\chi^2 = 4.18$; $p < 0.05$).

Table 3 — The patients with altered concentrations of microorganisms depending on age and nosology

Microorganism	Frequency of revealed disorders (%)								
	IBD (n = 114)			CD (n = 34)			UC (n = 80)		
	young age (n = 62)	middle age (n = 30)	elderly age (n = 22)	young age (n = 22)	middle age (n = 8)	elderly age (n = 4)	young age (n = 40)	middle age (n = 22)	elderly age (n = 18)
Bifidobacterium < lg8.0 CFU/g	30.7	23.3	13.6	31.8	50.0	0	30.0	13.6	16.7
Lactobacillus < lg6.0 CFU/g	82.3	86.7	90.9	68.2	87.5	100.0	90.0	86.4	88.9
Candida ≥ lg4.0 CFU/g	35.5	40.0	36.4	36.4	62.5	0	35.0	31.8	44.4
Conditionally pathogenic flora ≥ lg5.0 CFU/g	37.1	36.7	40.9	50.0	50.0	25.0	30.0	31.8	44.4

Table 4 — The content of SCFAs in the coprofiltrate of young patients with IBD, μg/μl

Index	Control (n = 7) M ± m	IBD (n = 24) M ± m	UC (n = 15) M ± m	CD (n = 9) M ± m
Acetic acid	0.200 ± 0.003	0.057 ± 0.015***	0.048 ± 0.017***	0.072 ± 0.020***
Propionic acid	0.0045 ± 0.0002	0.033 ± 0.007***	0.024 ± 0.007**	0.048 ± 0.016
Butyric acid	0.080 ± 0.001	0.058 ± 0.012	0.051 ± 0.013*	0.07 ± 0.01
Σ (C2-C4)	0.008 ± 0.001	0.04 ± 0.01*	0.039 ± 0.010*	0.06 ± 0.01***

*Notes: * — p < 0.05 — probability of changes compared with the control group; ** — p < 0.01 — probability of changes compared with the control group; *** — p < 0.001 — probability of changes compared with the control group.*

Table 5 — The content of SCFAs in the coprofiltrate of middle-aged patients with IBD, μg/μl

Index	Control (n = 7) M ± m	IBD (n = 12) M ± m	UC (n = 9) M ± m	CD (n = 3) M ± m
Acetic acid	0.200 ± 0.003	0.026 ± 0.011***	0.03 ± 0.01***	0.011 ± 0.005***
Propionic acid	0.0045 ± 0.0002	0.012 ± 0.004***	0.014 ± 0.006	0.007 ± 0.001
Butyric acid	0.080 ± 0.001	0.061 ± 0.019	0.010 ± 0.022**	0.058 ± 0.008*
Σ (C2-C4)	0.008 ± 0.001	0.03 ± 0.01*	0.21 ± 0.01***	0.020 ± 0.001***

*Notes: * — p < 0.05 - probability of changes compared with the control group; ** — p < 0.01 — probability of changes compared with the control group; *** — p < 0.001 — probability of changes compared with the control group.*

Table 6 — The content of SCFAs in the coprofiltrate of elderly-aged patients with IBD, μg/μl

Index	Control (n = 7) M ± m	IBD (n = 13) M ± m	UC (n = 11) M ± m	CD (n = 2) M ± m
Acetic acid	0.200 ± 0.003	0.041 ± 0.015**	0.049 ± 0.017**	0.010 ± 0.002**
Propionic acid	0.0045 ± 0.0002	0.018 ± 0.005*	0.018 ± 0.007	0.016 ± 0.004*
Butyric acid	0.080 ± 0.001	0.042 ± 0.024	0.046 ± 0.028	0.024 ± 0.018*
Σ (C2-C4)	0.008 ± 0.001	0.03 ± 0.01*	0.03 ± 0.01*	0.010 ± 0.009

*Notes: * — p < 0.05 — probability of changes compared with the control group; ** — p < 0.01 — probability of changes compared with the control group.*

Depending on the age of patients with IBD, there was the suppression of the metabolic activity of normal microflora, which manifested itself in the changes of both the total content and indices of some SCFAs versus healthy individuals (Tables 4–6).

Thus, the level of acetic acid (C2) in 100 % young-aged, middle-aged, and elderly patients with IBD was reduced versus control ($p < 0.001$). This fact indicated a pronounced inhibition of the producers of this metabolite, which was confirmed microbiologically. Hemolytic *Escherichia coli* biovars were sown in patients with IBD, moreover, their domination over *Escherichia coli* with normal enzymatic activity was observed. It should be noted that the decrease in acetic acid was significant with age. Indices of propionic acid (C4) in all groups tended to increase in comparison with the control, and butyric acid (C4) decreased in middle-aged and elderly patients.

An increased anaerobic index (AI) indicates the shift in the redox balance aside of oxidized acids. (Note. AI is the ratio of the sum of concentrations (C) of reduced acids to less reduced: (C propionic + C butyric) / C acetic (Gunzalus I., Steiner R., 1963)). In our opinion, such AI changes

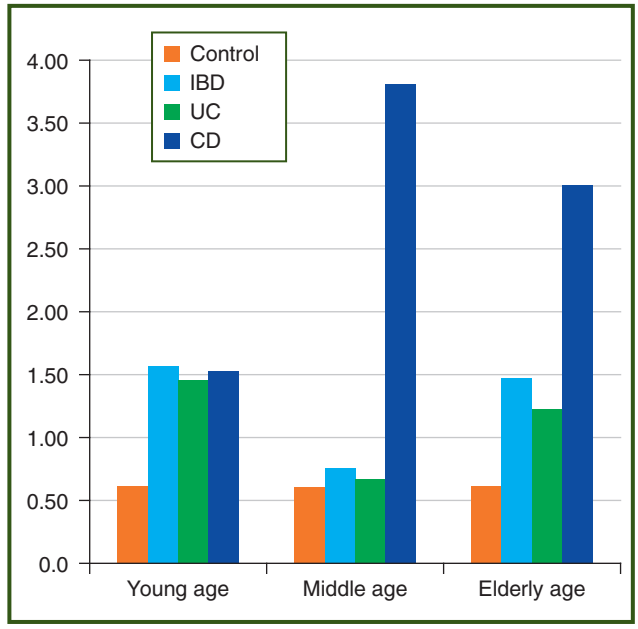

Figure 2 — Anaerobic index of patients with IBD depending on age

can be explained by the simultaneous suppression of the production of all SCFAs, which means structural and metabolic intestine imbalance because of disease progression. In young-aged and elderly patients, the AI increased and was 1.57 and 1.46, respectively, which reflected the suppression mainly of acetic acid (*E. coli* and anaerobic populations) (Fig. 2).

It was determined that synthesis, absorption, and utilization of SCFAs with the length of carbon atoms C2-C4 was disrupted in patients with IBD, regardless of nosology, but depending on age. That is why the content and especially the ratio of individual SCFAs in coprofiltrate had different changes.

Therefore, multidirectional deviations of these metabolites from the control can be the biochemical markers of structural and functional disorders of the intestinal microbiocenosis. Taking into account the above, the determination of SCFAs can have diagnostic and prognostic significance.

Conclusions

The profound changes in the qualitative and quantitative composition of the colon microflora were in 99.1 % of patients and SIBO in 62.5 % of ones with IBD. The dependence of microflora changes of the small and large intestine in patients on age and nosology was revealed. 95.8 % of elderly patients had SIBO, which was revealed almost 2 times less in middle-aged and young-aged patients.

There was subcompensated dysbiosis in young-aged patients, while middle-aged and elderly patients had more often decompensated dysbiosis. The decrease in the *Bifidobacteria* concentration in the colon was found mostly in young-aged patients with CD, while the reduced *Lactobacillus* level was mostly found in elderly patients in both nosology groups. The frequency of hemolytic biovars of *Escherichia coli*, conditionally pathogenic flora, and fungi of the genus Candida also increased with age.

Depending on the age of patients with IBD, there were changes in both the total content and indices of some SCFAs compared with healthy people, which indicated the suppression of the metabolic activity of normal microflora. Thus, 100 % of patients had a reduced level of acetic acid (C2) versus control, which indicated a pronounced inhibition of the production of this metabolite, namely *Escherichia coli* with normal enzymatic activity. Butyric acid (C4), which is an energy substrate for colon epitheliocytes, was reduced in middle-aged and elderly patients that indicated the need for an additional source of this metabolite for this age group.

The results of this research will allow clinicians to select therapeutic tactics in these patients more carefully, namely, will influence the choice of drugs that modulate the intestinal microbiota, taking into account not only the nosology form but also the patient's age.

Conflicts of interests. Authors declare the absence of any conflicts of interests and their own financial interest that might be construed to influence the results or interpretation of their manuscript.

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Вікові особливості порушень мікробіоценозу кишечника в пацієнтів із неспецифічним виразковим колітом і хворобою Крона

Резюме. ***Актуальність.*** Хронічні запальні захворювання кишечника (ХЗЗК), а саме неспецифічний виразковий коліт (НВК) і хвороба Крона (ХК), залишаються однією з найбільш складних і актуальних проблем гастроентерології в усьому світі. На цей час залишається недостатньо вивченим питання про вплив мікрофлори кишечника та її змін на розвиток і прогресування запального процесу. Однак найбільш домінуюча етіологічна гіпотеза говорить про те, що ХЗЗК є результатом аномальної імунної відповіді на змінену мікробіоту кишечника під впливом факторів довкілля або патогенних мікроорганізмів у генетично схильного хазяїна. Зміни мікробіоти при ХЗЗК загальновизнані, але залежність цих змін від віку пацієнтів ще потребує дослідження. ***Мета дослідження:*** вивчити особливості дисбіозу кишечника й частоти синдрому надлишкового бактеріального росту (СНБР) у пацієнтів із ХЗЗК залежно від нозології та віку. ***Матеріали та методи.*** Обстежено 120 пацієнтів із ХЗЗК віком від 19 до 79 років, у середньому (43,90 ± 1,40) року; серед них 83 хворих на НВК, 37 — ХК. Усі хворі були розділені на групи залежно від нозології та віку. Хворим були проведені водневий дихальний тест для виявлення СНБР, бактеріологічне дослідження калу й хроматографія коротколанцюгових жирних кислот (КЖК) в копрофільтратах. ***Результати.*** Встановлені наявність глибоких змін якісного і кількісного складу мікрофлори товстої кишки і висока частота виявлення СНБР у пацієнтів із ХЗЗК. Виявлена залежність змін складу мікрофлори тонкої і товстої кишки у хворих від віку та нозології. Зниження концентрації біфідобактерій у вмісті товстого кишечника виявляли найчастіше в пацієнтів молодого віку з ХК, тоді як зниження кількості лактобактерій частіше визначалося у хворих похилого віку в обох нозологічних групах. Із віком зростала частота виявлення гемолітичних біоварів кишкової палички, умовно-патогенних ентеробактерій і грибів роду *Candida*. Спостерігалися зміни як сумарного загального змісту, так і показників окремих КЖК порівняно зі здоровими особами, що свідчило про пригнічення метаболічної активності нормальної мікрофлори. Зниження рівнів оцтової та масляної кислоти вказувало на виражене пригнічення продуцентів цих метаболітів. ***Висновки.*** Виявлено, що хворі похилого віку більш схильні до розвитку СНБР, зниження концентрації лактобактерій у вмісті товстої кишки, а також збільшення частоти виявлення умовно-патогенних ентеробактерій і грибів роду *Candida*. У хворих молодого віку переважно виявляється субкомпенсована форма дисбіозу зі зниженням концентрації біфідобактерій. Із віком також спостерігається пригнічення продуцентів оцтової і масляної кислоти. Результати цих досліджень дадуть можливість клініцистам більш ретельно підбирати терапевтичну тактику, а саме вплинуть на вибір препаратів, які модулюють мікробіоту кишечника, з урахуванням не тільки нозологічної форми, а й віку пацієнта.

Ключові слова: хронічні запальні захворювання кишечника; мікрофлора кишечника; синдром надлишкового бактеріального росту; коротколанцюгові жирні кислоти; неспецифічний виразковий коліт; хвороба Крона

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Возрастные особенности нарушений микробиоценоза кишечника у пациентов с неспецифическим язвенным колитом и болезнью Крона

Резюме. ***Актуальность.*** Хронические воспалительные заболевания кишечника (ХВЗК), а именно неспецифический язвенный колит (НЯК) и болезнь Крона (БК), остаются одной из наиболее сложных и актуальных проблем гастроэнтерологии во всем мире. В настоящее время остается недостаточно изученным вопрос о влиянии микрофлоры кишечника и ее изменений на развитие и прогрессирование воспалительного процесса. Однако наиболее доминирующая этиологическая гипотеза говорит о том, что ХВЗК являются результатом аномального иммунного ответа на измененную микробиоту кишечника под воздействием факторов окружающей среды или патогенных микроорганизмов у генетически склонного хозяина. Изменения микробиоты при ХВЗК общепризнаны, но зависимость этих изменений от возраста пациентов еще нуждается в исследовании. ***Цель исследования:*** изучить особенности дисбиоза кишечника и частоты синдрома избыточного бактериального роста (СИБР) у пациентов с ХВЗК в зависимости от нозологии и возраста. ***Материалы и методы.*** Обследовано 120 пациентов с ХВЗК в возрасте от 19 до 79 лет, в среднем (43,90 ± 1,40) года; среди них 83 больных НЯК, 37 — БК. Все больные были разделены на группы в зависимости от нозологии и возраста. Больным были проведены водородный дыхательный тест для выявления СИБР, бактериологическое исследование кала и хроматография короткоцепочечных жирных кислот (КЖК) в копрофильтратах. ***Результаты.*** Установлены наличие глубоких изменений качественного и количественного состава микрофлоры толстой кишки и высокая частота выявления СИБР у пациентов с ХВЗК. Выявлена зависимость изменений состава микрофлоры тонкой и толстой кишки у больных от возраста и нозологии. Снижение концентрации бифидобактерий в содержимом толстого кишечника выявляли чаще всего у пациентов молодого возраста с БК, тогда как снижение количества лактобактерий чаще определялось у больных пожилого возраста в обеих нозологических группах. С возрастом росла частота выявления гемолитических биоваров кишечной палочки, условно-патогенных энтеробактерий и грибов рода *Candida*. Наблюдались изменения как суммарного общего содержания, так и показателей отдельных КЖК относительно здоровых лиц, что свидетельствовало об угнетении метаболической активности нормальной микрофлоры. Снижение уровней уксусной и масляной кислоты указывало на выраженное угнетение продуцентов этих метаболитов. ***Выводы.*** Выявлено, что больные пожилого возраста более склонны к развитию СИБР, снижению концентрации лактобактерий в содержимом толстой кишки, а также увеличению частоты выявления условно-патогенных энтеробактерий и грибов рода *Candida*. У больных молодого возраста преимущественно выявляется субкомпенсированная форма дисбиоза со снижением концентрации бифидобактерий. С возрастом также наблюдается угнетение продуцентов уксусной и масляной кислоты. Результаты данных исследований предоставят возможность клиницистам более тщательно подбирать терапевтическую тактику, а именно повлияют на выбор препаратов, которые модулируют микробиоту кишечника, с учетом не только нозологической формы, но и возраста пациента.

Ключевые слова: хронические воспалительные заболевания кишечника; микрофлора кишечника; синдром избыточного бактериального роста; короткоцепочечные жирные кислоты; неспецифический язвенный колит; болезнь Крона