

Features of Chemical Elements in Various Forms of Irritable Bowel Syndrome

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Abstract. The prevalence of IBS is very high and varies between 10-20% in different countries. Deviations in the body's intake of macro and micronutrients can reduce or increase IBS ability to adapt and resist. In this regard, in medicine, more and more attention is paid to the study of the micronutrient status of the human body and the development of methods to correct IBS disorders in various diseases. The composition of 25 chemical elements in the hair of patients with IBS was determined: K, Na, Ca, Mg, P, Fe, Zn, Cu, Se, I, Mn, Co, Cl, As, Sn, B, Li, N, V, S, Hg, Pb, Cd, Be, Al. Decreased K, Na, Ca, Mg, P, Zn, Cu, I, Mn, B, Sn, Si, Li, Hg, Pb, Cd in patients with IBS compared with healthy people and a reliable increase in P, Se, As, Ni detected.

Key words: irritable bowel syndrome, elemental balance, essential and toxic elements.

Introduction. Irritable bowel syndrome (IBS) is the most diagnosed gastrointestinal disease in the 21st century, as well as the most common cause of referral to gastroenterology clinics. Various mechanisms and theories related to IBS etiology have been proposed, but currently the most accepted biopsychological model for IBS is that IBS is the result of an interaction between psychological, behavioral, social, and environmental factors. There are no specific tests for the diagnosis of IBS (Hanyukov A.A., Fedorova N.S., 2017).

The prevalence of this pathology is very high and varies from 10–20% in different countries (Lovell R.M., 2012). The complexity of managing IBS patients is related to the heterogeneity of clinical manifestations that require a differential approach in the treatment of different patients (Soares R.L., 2014). This makes the study of this problem very relevant (Lee Y.J., Park K.S., 2014).

A recent revision of the Rome IV consensus (2016) identified time criteria and diagnostic criteria for IBS - recurrent abdominal pain, at least once a week for the previous 3 months, associated with 2 or more symptoms / factors: 1) defecation; 2) change in stool frequency; 3) change in the form of feces. However, anamnestic symptoms should be noted in the last 6 months or more, in the absence of clear anatomical and physiological limitations during routine clinical examination (Drossman DA, Hasler WL, 2016, Brian E and et al, 2016).

The complexity of treating patients with IBS is that the factors that cause the disease and the mechanisms of development are individual. The most important risk factors for IBS are:

female gender (risk is 4 times higher); age (30-40 years); place of residence (megacities); education (higher, humanitarian); professional affiliation (mental workers and cultural workers); social environment (non-full-blooded families, orphanages); low levels of social support (Truxan D.I., 2016).

Deviations in the intake of macro- and micronutrients into the body can reduce or increase IBS ability to adapt and resist (Skolnyy A.V., 2010). In this regard, in medicine more and more attention is paid to the study of the micronutrient status of the human body and the development of methods to correct IBS disorders in various diseases (Tarmaeva I.Yu., 2016).

To study the elemental state, it is necessary to have an idea of what tissue and in what form the element under study is found in the maximum amount, because the deposition of chemically important elements is closely related to their biochemical functions (Gres N.A. et al., 2013).

Thus, the study of risk factors and the main etiopathogenetic mechanisms of the formation of intestinal affect syndrome among the population is of particular importance due to their prevalence and serious psychoemotional disorders. According to the study, nonspecific manifestations of ionic balance in the tissues of the gastrointestinal tract, liver and fluid environment in experimental gastric ulcers, according to the authors, in the ulcer zone, an increase in the concentration of Se in the intestine, gastric juice - Se, Mg, Si, chromium (Cr), blood - Ca, in the gastric and intestinal juice - Zn, in the small intestine - Mg, Na, Fe, Mn and a number of other important elements.

The purpose of the study. To study the status of chemical elements in patients with different forms of IBS based on regional characteristics.

Material and research methods. The study was conducted in the gastroenterology department of BRMMC (Bukhara Regional Multidisciplinary Medical Center) and all patients treated with IBS in an inpatient setting for 2017-2019 were selected. The diagnosis of IBS was made based on IV Roman criteria (2016), using the Bristol fecal forms scale to determine the clinical form of IBS (Blake M.R., Raker J.M., Whelan K., 2016). Determination of the composition of chemical elements was carried out in the laboratory of the Institute of Nuclear Physics of the Academy of Sciences of the Republic of Uzbekistan.

Criteria for inclusion: Conformity of the diagnosis of IBS to the IV Roman criteria, age - from 18 to 45 years, a letter of written consent.

Exclusion criteria: patients older than 45 years, "anxiety symptoms" (weight loss; onset of disease in old age; nocturnal symptoms; colon cancer, celiac disease, ulcerative colitis and Crohn's disease among relatives, persistent severe abdominal pain as the only symptom of gastrointestinal tract injury) , fever, hepatitis - and splenomegaly, anemia, leukocytosis, increased

ECG, the presence of occult blood in the stool, changes in the biochemical analysis of blood, steatorrhea and polyphagia).

A total of 121 patients and healthy people were examined. Patients were divided into 2 groups: the first group were patients with IBS, which were divided into 3 subgroups: IBSD (diarrhea) - 40 patients (17 men and 23 women), IBSc (constipation) - 44 patients (22 men and 22 women), IBSm (mixed) - 37 patients (18 men and 19 women). The control group included 20 healthy volunteers (6 males and 14 females) who underwent prophylactic screening as part of the examination of gastrointestinal tract pathology at BRMMC. The mean age of the control group was 25.75 ± 4.02 years.

Esophagofibrogastroduodenoscopy in all patients (FUGINON. FUGI FILM EPX-2500, 2014, Japan; FUGI FILM-EG-530PF, 2014, Japan), colonoscopy (FUGI FILM-EG-530FL, 2014, Japan), organ ultrasound examination, stool dissection (Vivid S-60, 2014, Norway), micronutrient status testing (mass spectrometry method, perkinelmer inc., Shelton, CT 06484, USA) and a special survey to determine quality of life - GSRS.

The composition of 25 chemical elements in the hair of patients with IBS was determined: K, Na, Ca, Mg, P, Fe, Zn, Cu, Se, I, Mn, Co, Cl, As, Sn, B, Li, N, V, S, Hg, Pb, Cd, Be, Al. Mass spectrometry method with inductively coupled plasma (ICP-MS) for the detection of chemical elements Nexion 300D (perkinelmer Inc., Shelton, CT 06484, USA), autosamplers ESI SC-2 DX4 (Elemental Scientific Inc., Omaha, NE 68122, USA) is equipped with. This practice also included Dynamic Reaction Cell (DRC) technology to eliminate most of the interference without compromising the sensitivity of analysts.

Preparation of the ICP-DRC-MS system was carried out using the manufacturer's specifications. The system is calibrated using standard solutions containing 0.5, 5, 10, and 50 mg / l copper and zinc from the Universal Data Acquisition Kit (perkinelmer Inc., Shelton, CT 06484, USA). Internal online standardization was also performed using the yttrium-89 isotope (10 mg / l, pure element Yttrium (Y) Standard, perkinelmer Inc., Shelton, CT 06484, USA).

Laboratory quality control was performed using a GBW09101 certified human hair certificate (Shanghai Nuclear Research Institute, Sinica Academy, China). Laboratory quality control practices were performed routinely before and after each analysis set.

Results and discussion. Biomaterial (hair) collection to determine the amount of chemical elements in the tissues was performed on the day the patients were hospitalized. Data obtained on the composition of chemical elements in tissues provide information on elemental balance in the broad clinical manifestations of IBS symptoms.

Among men and women, the transient type of IBS with a predominance of diarrhea was more common in women. With the predominance of constipation, the transient and mixed type

were identified to the same extent in both sexes (Fig. 1).

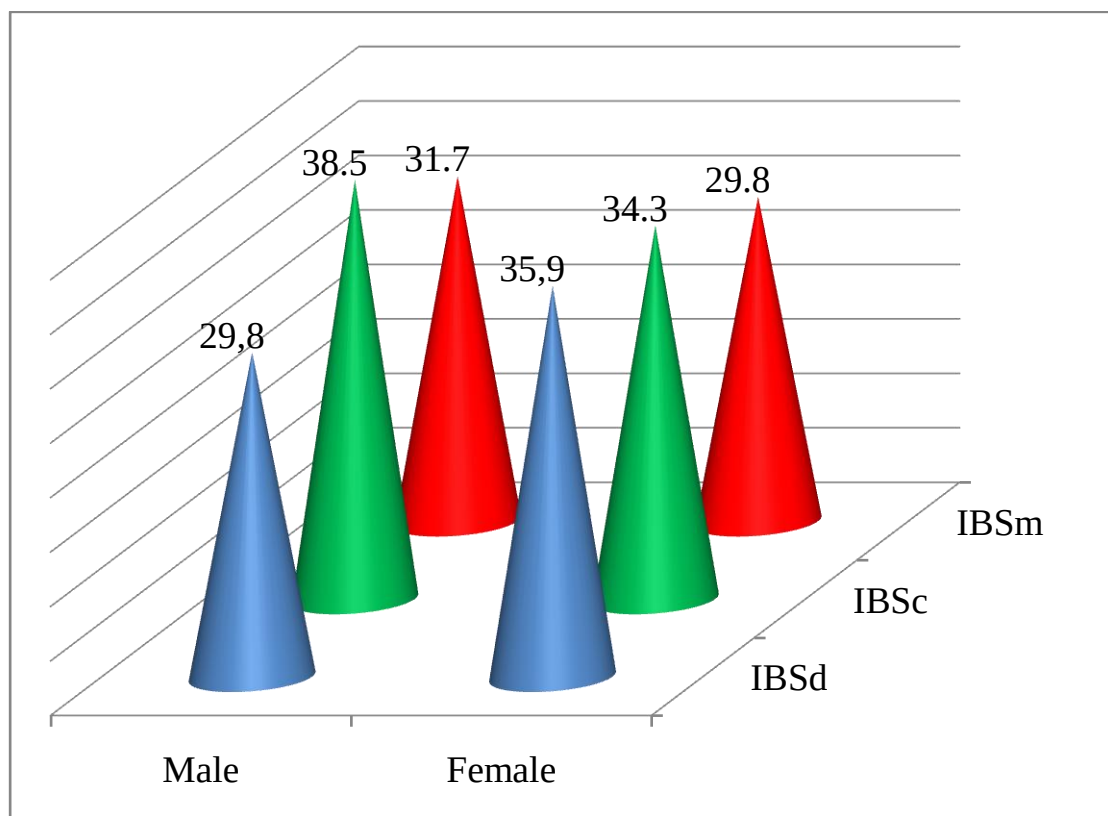


Figure 1. Gender-related incidence of different forms of IBS, %.

The association between disease onset and stress was observed in 65 (53.7%) patients with IBS, 36 (29.7%) reported symptoms after infection and antibiotics, and 20 (16.5%) reported disease. appeared against the background of non-compliance with diet, alcohol consumption and exercise. The duration of the disease averaged 4.18 ± 2.11 years, ranging from 1 to 15 years (table 1).

Table 1.

The degree of occurrence of etiological factors in different forms of ITS

Etiological factors	IBSd	IBSc	IBSm
Stress	28,2	15,4	10,1
Infection and taking antibiotics	9,2	10,3	10,2
Pala partish diet and consumption of alcoholic beverages	5,2	5,2	5,4

A comparison of the elements content of the elements in patients with different forms of IBS is given in table 2.

The analysis of the table shows that in the type of IBS with a predominance of diarrhea, the elemental composition of the hair of patients is significantly reduced compared to other types of vital and toxic chemical elements. Of the 25 elements studied, 16 (K, Na, Ca, Mg, P, Zn, Cu, I,

Mn, B, Sn, Si, Li, Hg, Pb, Cd) were found to be relatively reduced in patients with IBSd. No difference was found between the different forms of IBS in terms of the amount of 5 elements (Fe, Co, Cr, Be, V).

Table 2.**The composition of chemical elements in different forms of ITS**

№	Elements		IBSd	IBSc	IBSm	Normal limit (mkg / g)
Essential (vital) chemical elements						
1	K	Potassium	217,6	234,6	375,4	40-2000
2	Na	Sodium	436,5	546,2	489,7	50-2000
3	Ca	Calcium	1453,1	1602,3	1464,8	200-2000
4	Mg	Magnesium	65,2	84,6	70,3	20-200
5	P	Phosphorus	250,4	260,8	256,2	120-200
6	Fe	Iron	28,2	27,8	28,1	7-40
7	Zn	Zinc	120,4	125,7	128,6	125-400
8	Cu	Copper	8,4	8,6	8,5	9-40
9	Se	Selen	2,0	1,9	2,1	0.25-2
10	I	Iodine	4,2	5,3	4,8	0.15-10
11	Mn	Manganese	0,55	0,67	0,63	0.15-2
12	Co	Cobalt	0,23	0,21	0,18	0.004-0.3
13	Cr	Chrome	0,1	0,08	0,09	0.004-1
Toxic, relatively toxic and relatively essential chemical elements						
14	As	Arsenic	0,8	1,0	0,9	<1
15	Sn	Olovo	0,7	0,9	0,8	<3
16	B	Bor	1,01	1,8	1,6	<5
17	Li	Lithium	0,04	0,06	0,03	<0/1
18	Ni	Nickel	1,1	1,2	0,8	<2
19	V	Vanadium	0,05	0,03	0,06	0.005-0.1
20	Si	Silicon	14,5	18,2	21,5	11-70
21	Hg	Mercury	0,4	0,6	0,4	<1
22	Pb	Lead	1,6	2,1	1,8	<5
23	Cd	Cadmium	0,2	0,18	0,13	<0.25
24	Be	Beryllium	0,001	0,003	0,001	<0.003
25	Al	Aluminum	14,4	18,2	11,7	<25

The results after comparing the chemical elements in the hair of patients with IBS and the control group (20 healthy citizens) are presented in table 3. The data presented showed that the element content in patients with IBS was significantly reduced compared to healthy people.

Table 3.

The composition of chemical elements in the hair of patients with IBS and the control group

№	Elements		IBS (n=121)	Control group (n=20)	P
Essential (vital) chemical elements					
1	K	Potassium	275,8	387,3	0,001
2	Na	Sodium	490,8	673,8	0,01
3	Ca	Calcium	1506,7	276,4	0,001
4	Mg	Magnesium	73,3	237,1	0,01
5	P	Phosphorus	255,8	187,6	0,001
6	Fe	Iron	28,03	28,2	0,008
7	Zn	Zinc	124,9	346,9	0,001
8	Cu	Copper	8,5	34,4	0,001
9	Se	Selen	2,0	1,2	0,0001
10	I	Iodine	4,7	8,4	0,01
11	Mn	Manganese	0,61	3,6	0,001
12	Co	Cobalt	0,20	0,18	0,0001
13	Cr	Chrome	0,09	0,08	0,06
Toxic, relatively toxic and relatively essential chemical elements					
14	As	Arsenic	0,9	0,012	0.0001
15	Sn	Olovo	0,8	0,574	
16	B	Bor	1,47	2,13	
17	Li	Lithium	0,043	0,095	0,001
18	Ni	Nickel	1,03	0,208	0,05
19	V	Vanadium	0,046	0,045	0,001
20	Si	Silicon	18,06	14,92	
21	Hg	Mercury	0,46	0,88	0,002
22	Pb	Lead	1,83	3,65	0,05
23	Cd	Cadmium	0,17	0,14	0,03

24	Be	Beryllium	0,0016	0,0014	
25	Al	Aluminum	14,83	13,08	0,001

According to the study, 16 of the 25 chemical elements (K, Na, Ca, Mg, P, Zn, Cu, I, Mn, B, Sn, Si, Li, Hg, Pb, Cd) were significantly more common in patients with IBS than in healthy people. was found to be significantly reduced (due to the predominant type of IBS diarrhea). No quantitative differences were found between only 5 elements (Fe, Co, Cr, Be, V) in the hair of patients and control group. It was found that the amount of the remaining 4 chemical elements (P, Se, As, Ni) increased compared to healthy people. Changes in the quantitative composition of chemical elements in tissues in IBS are determined by a complex of functional disorders of the gastrointestinal tract, including motor-evacuation, impaired intestinal absorption and selection of chemical elements, which eventually leads to the appearance of clinical signs.

Increased levels of the chemical elements As and Se in patients with IBS require separate analysis. It is known that As affects the motility of the gastrointestinal tract and exacerbates spastic symptoms. Parallel increase in Se is a compensatory reaction of the organism, Se has a pronounced antioxidant property due to its inclusion in the group of antagonists of neurotoxic elements (Hg, Cd, Pb, Ni, etc.), neutralizes the effects associated with an increase in As, enhances their elimination affects.

Conclusion

1. As a result of the study, the imbalance of the elements in the tissues of patients with IBS was detected using the method of mass spectrometry in the hair.

2. Decreased levels of K, Na, Ca, Mg, P, Zn, Cu, I, Mn, B, Sn, Si, Li, Hg, Pb, Cd in patients with IBS compared to healthy people, and the elements P, Se, As, Ni are reliable. found to increase

3. Patients with IBS were corrected with element-preserving drugs such as Ca, Mg after the detection of element imbalance in the tissues.

4. Positive results were obtained after complex treatment, and As in the tissues was reliably reduced.

5. Correction of elemental imbalance has been found to eliminate pain syndrome in all forms of IBS when used in conjunction with a standard treatment method.

List of used literature

1. Xanyukov A.A., Fedorova N.S. Possibilities and perspectives in the diagnosis of functional pathology of the intestine. O zdorove rebenka. Ukraine. 2017-12-2.1-57-61.
2. Lovell R. M., Ford A. C. Global prevalence of and risk factors for irritable bowel syndrome: a

- meta-analysis // Clin Gastroenterol Hepatol. 2012; 10 (7): 712–721.
3. Soares R. L. Irritable bowel syndrome: a clinical review // World J Gastroenterol. 2014; 20 (34): 12144–12160.
 4. Lee Y. J., Park K. S. Irritable bowel syndrome: emerging paradigm in pathophysiology // World J Gastroenterol. 2014; 20 (10): 2456–2469.
 5. Drossman DA, Hasler WL. Rome IV - Functional GI disorders: disorders of Gut-Brain interaction. Gastroenterology, 2016, 150 (6): 1262–79.
 6. Brian E. Lacy, Fermin Mearin, Lin Chang et al. Bowel Disorders. Gastroenterology, 2016, 150: 1393–407.
 7. Truxan D.I. At the reception of a patient with irritable bowel syndrome. Meditsinskiy sovet. 10.21518 / 2079-701X-2016-17-95-99
 8. Skalnyy A.V. Microelements: bodrost, zdorove, dolgoletie. M.: Exmo. 2010; 288 s.
 9. Tarmaeva I.Yu. Assessment of imbalance of chemical elements in patients with arterial hypertension. Kazanskiy meditsinskiy zhurnal. 2016, 97: 4, 501-507.
 10. Gres N.A., Yuraga T.M., et al. Informativeness of hair spectroscopy during the study of microelemental disorders in the human body. Medicinal news. 2013, 4, 77-80.
 11. Blake M.R., Raker J.M., Whelan K. Validity and reliability of the Bristol Stool Form Scale in healthy adults and patients with diarrhoea-predominant irritable bowel syndrome. 2016 Oct; 44 (7): 693-703. doi: 10.1111 / apt.13746. Epub 2016 Aug 5.