Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 392 - 400
Received 15 December 2020; Accepted 05 January 2021.

Influence of Changes in the Microelemental Composition of Blood on the Development and Progression of Myopia

Durbek Azizbekovich Ikramov, Botir Tolqinovich Buzrukov,
Azizbek Fazilovich Ikramov, Otabek Azizbekovich Ikramov
(ikramov.o.a.@mail.ru)
Andizhan state medical institute

Abstract. This article provides data on the methods for determining and assessing the trace element status of blood in patients with myopic refraction of varying severity. The paper presents the results of examination of 140 (280 eyes) patients aged 18 to 45 years with various degrees of myopia in order to assess the role of the trace element composition of blood serum, as well as the content of 25 (HO) D in the development and progression of myopia by comparative study of the content of trace elements in serum and their excretion in patients with myopia and emmetropia.

The analysis of the data obtained allows us to draw both theoretical conclusions related to the pathogenesis of progressive myopia and some practical conclusions about the use of the studied parameters as diagnostic criteria in clinical practice when choosing a treatment strategy for patients with progressive myopia.

Key words: myopia, microelemental composition, blood plasma

The urgency of the problem. Myopia is one of the most common eye diseases in the world. It is an eye condition in which parallel rays are focused in front of the retina rather than directly on its surface. The increasing prevalence of myopia is likely to lead to an increase in the development of potentially vision-threatening complications associated with myopia in the elderly [2, 4]. Myopia affects 1.6 billion people worldwide. Myopia is expected to continue to rise in the coming years, reaching 2.5 billion by 2020. Oxidative stress is one of the pathways for the development of myopia [1].

Axial myopia of a high degree is associated with numerous histological changes in the posterior pole of the eyeball [8]. Changes in scleral biomechanics during the development of myopia are associated with changes in matrix components, mainly with a reduced collagen content. The decrease in the accumulation of collagen in the sclera in myopic eyes is a result of both a decrease in collagen synthesis and accelerated collagen degradation. Numerous studies have shown that trace elements - zinc (Zn), copper (Cu), selenium (Se) and manganese (Mn) - play an important role in antioxidant processes [1, 3, 10] and in the biochemical restoration of the sclera. There are reports of disturbances in the metabolism of Zn, Cu, Se and Mn in myopia; however, there are very few publications devoted to the analysis of the content of trace elements in the blood serum of children with myopia, and the results of studies are sometimes contradictory [11, 9, 6].

The purpose of the study is to determine the role of the trace element composition of blood in the development and progression of myopia through a comparative study of the content of trace elements in the blood serum and their excretion in patients with myopia and emmetropia.

Materials and research methods. The paper presents the results of examination of 140 (280 eyes) patients aged 18 to 45 years with varying degrees of myopia, who were treated in the department of

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 392 - 400
Received 15 December 2020; Accepted 05 January 2021.

eye diseases of the clinic of the Andijan State Medical Institute. The average age was 25 ± 1.2 years. For comparison, a control group of 100 patients (200 eyes) with mild to moderate emmetropia and hyperopia was taken. Children with hyperopia or astigmatism, as well as patients suffering from other pathologies of the organ of vision of any genesis, were excluded from the study.

The distribution of patients depending on gender, age and degree of myopic refraction is presented in Table 1.

Table 1.

Gender and age distribution of patients with different degrees of myopic refraction

Age group	Men		Women		Total:	
					Number of patients	
	Abs	%	abs	%	abs	%
from 18 to 25 years old	37	61,7	57	71,2	94	67,1
26 to 35 years old	19	31,7	20	25,0	39	27,9
36 to 45 years old	4	6,6	3	3,8	7	5,0
Total:	60	100	80	100	140	100

Among the examined patients, patients with acquired myopia accounted for 84.3%, with congenital 15.7%.

Of all examined patients, in 85 (61%) cases, progressive myopia was observed and in 55 (39%) cases with stationary.

The distribution of patients depending on the degree of myopia showed that a weak degree of myopia was found in 81 (29%), an average 107 (38%) and a high degree in 92 (33%) cases, respectively (Fig. 1).

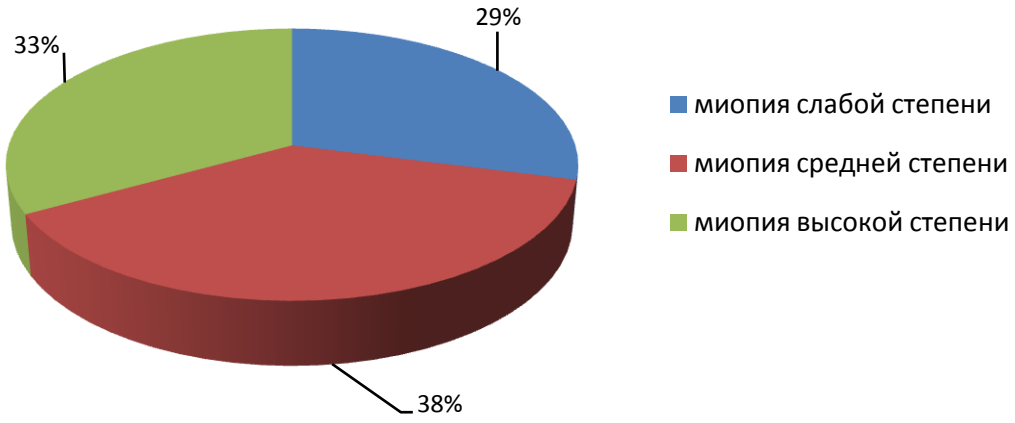


Fig. 1. Distribution depending on the degree of myopia

The generally accepted ophthalmological examination in all patients included both standard techniques and special apparatus research methods. Namely, along with visiometry, ophthalmoscopy,

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 392 - 400
Received 15 December 2020; Accepted 05 January 2021.

skiascopy, biomicroscopy, ophthalmotonometry and perimetry, all children underwent autorefractometry and echobiometry (A-scan).

Biochemical analysis of blood for trace elements was carried out by the colorimetric method in the Central Research Laboratory of the AGMI. Determination of the content of trace elements in blood serum was carried out using atomic emission spectral analysis. Trace element analysis was carried out using gamma-spectrometric equipment. In lacrimal fluid samples, the total protein content was determined by the method of M.M. Bradford. The level of 25-hydroxy-cholecalciferol 25 (OH) D was determined by chemiluminescence immunoassay on microparticles, the content of 25 (OH) D in blood serum was estimated.

Statistical studies were carried out on the basis of standard clinical guidelines using modern standard statistical data processing packages Statsoft STATISTICA 6.0. The methods of variational parametric and nonparametric statistics were used with the calculation of the arithmetic mean of the studied indicator (M), standard deviation, standard error of the mean (m), relative values (frequency,%), the statistical significance of the obtained measurements when comparing the mean values was determined by Student's test (t) with the calculation of the probability of error (P) when checking the normal distribution. The correlation coefficient was calculated using the Pearson method.

Results and its discussion. When determining the trace element composition of blood in patients with myopia, a significant decrease in the content of iron (Fe), copper (Cu) and calcium (Ca) ions in the blood was revealed, the content of zinc (Zn) ions, on the contrary, was increased (table 2.)

Table2.

The blood content of iron (Fe), copper (Cu) and calcium (Ca), zinc (Zn) ions in the blood of patients with myopia and the control group

Trace element	Control group	Low myopia	Moderate myopia	High myopia
Fe (μmol / l)	21,3±1,2*	20,9±1,2	18,7±1,99*	15,9±1,3*
Cu (μmol / l)	19,9±1,5**	16,4±1,4	14,2±1,0**	11,1±1,99**
Ca (μmol / l)	2,4±0,8***	2,2±0,2	1,9±0,25***	1,8±0,2***
Zn (μmol / L)	15,5±1,2***	16,1±1,8	18,2±1,4****	19,1±1,7****

Note: The difference between the mean values marked with * and *, ** and **, *** and ***, **** and **** are statistically significant ($p < 0.05$).

The difference in the trace element composition of blood in patients with emmetropia and in patients with myopia of varying degrees was revealed. Thus, in patients with mild myopia, there was no significant difference in the content of Fe, Cu, Ca, and Zn ions in the blood compared with the content of these trace elements in patients with emmetropia. In moderate and high myopia, a significant decrease in the content of Fe, Cu, and Ca ions in the blood is observed in comparison with their content in patients

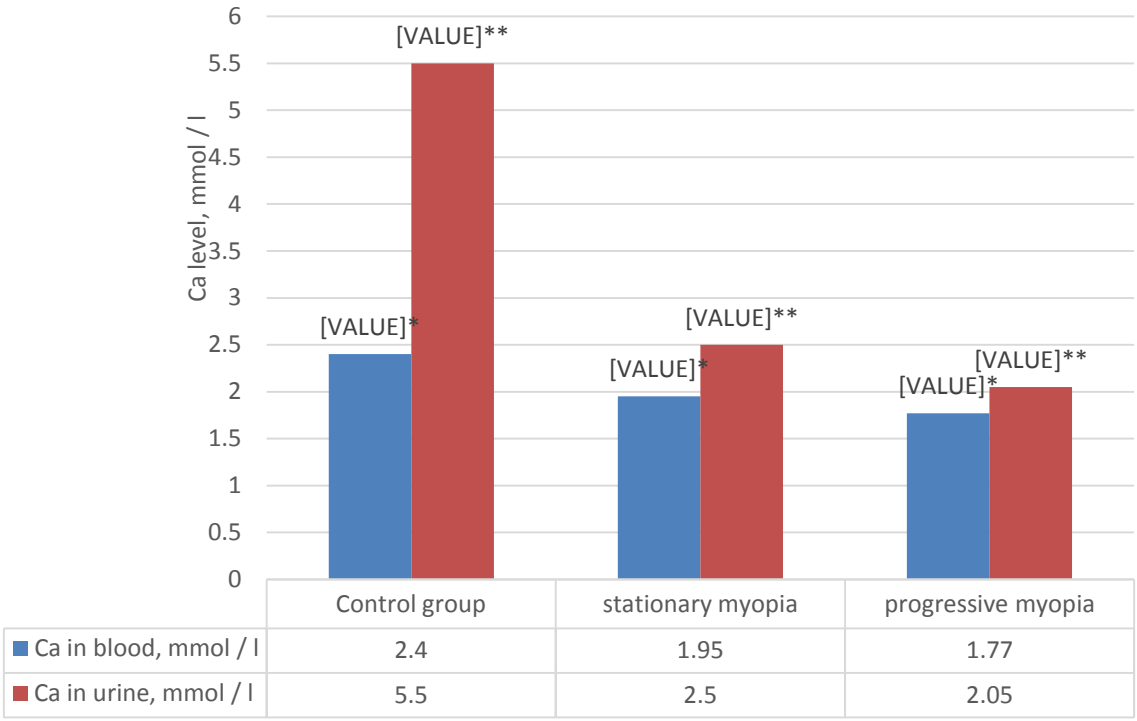
Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 392 - 400
Received 15 December 2020; Accepted 05 January 2021.

with emmetropia. Their average indicators were 17.3 ± 1.6, respectively; 12.7 ± 1.5; 1.85 ± 0.2 mmol / l; in the control group, their level was, respectively, 21.3 ± 1.2; 19.9 ± 1.5; 2.4 ± 0.8 mmol / L.

The levels of total and ionized calcium, as well as inorganic phosphorus in the blood serum and their excretion in the urine make it possible to assess the supply of saturation processes of the supporting tissues of the body (connective tissue) with calcium salts and phosphoric acid.

A decrease in the content of total and ionized calcium, phosphorus in the blood serum with a simultaneous decrease in calcium excretion and an increase in the excretion of phosphorus in the urine indicate insufficient saturation of supporting tissues with calcium salts and phosphoric acid, while an increase in the levels of total and ionized calcium, phosphorus in the blood serum, and calcium excretion , a decrease in phosphorus excretion - about increased saturation.

The results of the conducted studies showed that not only the level of Ca in the blood serum (1.85 ± 0.2), but also the excretion of Ca (2.3 ± 0.6 mmol / L) with urine in patients with myopia is significantly lower in comparison with indicators in the control group (2.4 ± 0.8 and 5.5 ± 1.4 mmol / l, respectively) (Fig. 2.). All this indicates an insufficient saturation of the supporting tissues of the body with them. In addition, a significant decrease in these indicators was revealed in progressive myopia.



Note: The difference between the mean values marked with * and *, ** and ** are statistically significant ($p < 0.05$).

Fig. 2. The content of total calcium in blood serum in patients with myopia and control group patients

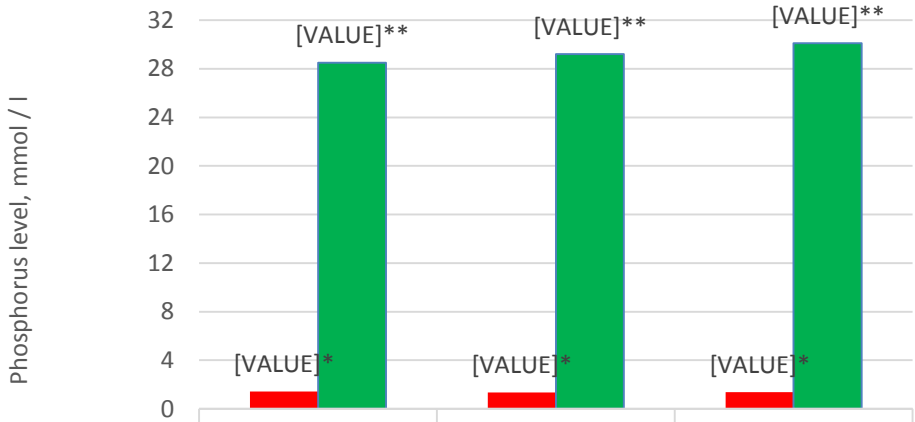
The analysis of the correlation relationship between the content of calcium in the blood serum and the indicator of its excretion in patients with stationary and progressive myopia. An average direct relationship was found between the content of calcium in the blood serum and the rate of its excretion in children with stationary myopia (r = 0.65) and with progressive (r = 0.33) myopia, which indicates a

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 392 - 400
Received 15 December 2020; Accepted 05 January 2021.

better compensatory mechanism, with stationary myopia, directed to maintain the constancy of this indicator.

Thus, patients with stationary myopia suffer less from a lack of calcium saturation of the connective tissue.

Comparative analysis of the level of phosphorus in the blood serum and its excretion with urine in patients with stationary and progressive myopia in relation to the control group revealed a tendency towards a decrease in its content in the blood serum and an increase in excretion in urine, but the difference between the indicators was insignificant, which is possible may indicate an imbalance in phosphorus-calcium metabolism (Fig. 3).



	Control group	stationary myopia	progressive myopia
Phosphorus in blood, mmol / l	1.43	1.34	1.36
Phosphorus in urine, mmol / l	28.5	29.2	30.1

Note: The difference between the mean values marked with * and *, ** and ** are statistically significant ($p < 0.05$).

Fig. 3. The content of total calcium in blood serum in patients with myopia and control group patients

Thus, in patients with myopia, indicators of phosphorus-calcium metabolism indicate a decrease in the saturation of connective tissue with calcium salts and phosphoric acid.

Recently, some research on myopia has focused on finding a link between the vitamin D content in the blood of patients, time spent outdoors and the progression of myopia. It is known that the level of 25-hydroxy-cholecalciferol 25 (OH) D is the most reliable and specific indicator of the supply of the human body with vitamin D [5, 7]. There is also a link between myopia and being outdoors: patients with myopia spend less time outdoors than children without myopia.

From the anamnesis, it was revealed that patients with myopia spent about 12.5 ± 1.5 hours a week in the open air, of which patients with progressive myopia 11.1 ± 1.1 hours a week, and patients in the control group, on average, 17. 1 ± 1.2 hours per week. At the same time, on average 8.3 ± 2.5 hours were spent on sports in the control group patients, in the main group 5.1 ± 3.1 hours per week.

We carried out a comparative analysis of the content of 25 (HO) D in blood serum, as well as the content of calcium and phosphorus in patients of both groups (table 3).

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 392 - 400
Received 15 December 2020; Accepted 05 January 2021.

Table3.
Comparative analysis of the content of 25 (HO) D, calcium and phosphorus in blood serum in patients of both groups

Indicators	Control group	Main group	
		Stationary myopia	Progressive myopia
25 (HO) D in blood, ng / ml	21,0 ± 5,11*	16,0 ± 5,11**	13,9 ± 3,75**
Ca in blood, mmol / l	2,4±0,8*	1,95±0,15**	1,77±0,3**
Phosphorus in blood, mmol / l	1,43 ±0,45	1,34±0,3	1,36±0,7

Note: Differences between indicators * and **, * and *** are significant, p <0.05

An assessment of the correlation relationship between the parameters of the anteroposterior volume (PZO), the content of 25 (HO) D, calcium and phosphorus in the blood serum in patients with stationary and progressive myopia was carried out (Table 4.).

Table4.
Correlation between PZO parameters, 25 (HO) D, calcium and phosphorus content in blood serum in patients with stationary and progressive myopia

Indicators	Main group	
	Stationary myopia	Progressive myopia
PZO – 25 (HO) D	r=-0,8	r=-0,76
25 (HO) D in blood, ng /ml; Ca in blood, mmol / l	r=0,65	r=0,90
25 (HO) D in blood, ng /ml; Phosphorus in blood, mmol/ l	r=0,68	r=0.91

The analysis of the correlation relationship in both groups showed a strong negative relationship between the PZO values and the level of 25 (HO) D in the blood, showed that a low level of 25 (HO) D blood serum is associated with a higher PZO value and therefore a higher risk of myopia. Between the levels of 25 (HO) D in the blood (ng / ml) and Ca (mmol / L) in the blood, as well as 25 (HO) D in the blood (ng / ml) and phosphorus (mmol / L) in the blood, there is also a strong a positive relationship in progressive myopia and an average relationship in stationary myopia, showing that myopia is accompanied by both a decrease in 25 (HO) D and a decrease in calcium and phosphorus, which leads to the progression of the process.

Thus, the analysis of the obtained data allows us to draw both theoretical conclusions related to the pathogenesis of progressive myopia and some practical conclusions about the use of the studied

parameters as diagnostic criteria in clinical practice when choosing a treatment strategy for patients with progressive myopia.

Conclusions:

1. When assessing the trace element composition of blood in patients with myopia, a decrease in the content of iron (Fe), copper (Cu) and calcium (Ca) ions was revealed, while the content of zinc ions (Zn), on the contrary, was increased. In moderate and high myopia, a significant decrease in the content of Fe, Cu, and Ca ions in the blood is observed in comparison with their content in patients with emmetropia.
2. Analysis of the research results showed that not only the level of Ca in the blood serum, but also the excretion of Ca in the urine in patients with myopia is significantly lower than in the control group, which indicates insufficient saturation of the supporting tissues of the body with them.
3. Comparative analysis of the level of phosphorus in the blood serum and its excretion with urine in patients with stationary and progressive myopia in relation to the control group revealed a tendency towards a decrease in its content in the blood serum and an increase in excretion with urine, but the difference between the indicators was insignificant. which may possibly indicate an imbalance in phosphorus-calcium metabolism.
4. Between the levels of 25 (HO) D (ng / ml) and Ca (mmol / L), as well as phosphorus (mmol / L) in the blood, there is a strong positive relationship in progressive myopia and an average relationship in stationary myopia, indicating that myopia is accompanied both by a decrease in 25 (HO) D and in the content of calcium and phosphorus, which can significantly affect the progression of myopic refraction.

References:

1. Aprelev A.E., Setko N.P., Isserkepova A.M., Pashinina R.V. Features of the influence of microelements on the state of the organ of vision in students // Medical Bulletin of Bashkortostan.-2016.-T.11, No. 1 (61) .- P.154-157
2. Korsakova N.V., Alexandrova K.A. Axial progressive myopia: modern aspects of etiopathogenesis // Ophthalmosurgery.-2017.-№2.p.67-73
3. Cassagne M, Malecaze F, Soler V (2014) Pathophysiology of myopia: nature versus nurture. J Fr Ophtalmol 37:407–414
4. Czepita D, Żejmo M, Czepita DA, Łodygowska E (2013) Myopiaepidemiology, pathogenesis, treatment. Okulistyka 1:74–78
5. Holick MF, Binkley NC et all (2011). Evaluation, treatment, and prevention of vitamin D deficiency: an Endocrine Society clinical practice guideline. J Clin Endocrinol Metab96(7): 1911-30.
6. Huo M, Liu H, Cao J (2006) The relationship between serum zinc, copper, selenium and the visions of middle school students. Chin J Sch Health 4:318–319
7. Institute of Medicine, Food and Nutrition Board. Dietary Reference Intakes for Calcium and Vitamin D. Washington, DC: National Academy Press, 2010.
8. Jonas JB, Xu L (2014) Histological changes of high axial myopia. Eye 28:113–117
9. Li J, Peng Y, Li X (2005) An analysis of microelements in patients with high myopia. Journal of Guangzhou University of Traditional Chinese Medicine 3:197–199
10. Rahman MA, Rahman B, Ahmed N (2013) High blood manganese in iron-deficient children in Karachi. Public Health Nutr 16:1677–1683
11. Wang L (2009) Variation analysis of six kinds of common microelements contents of blood in myopic primary school students in Dongguan district. Cent Chin Med J 1:20–21

12. Bazarova D. Some problems of counteracting crimes related to laundering of illegal proceeds in Uzbekistan Journal of Advanced Research in Dynamical and Control Systems. Volume 11, Issue 7, 2019, Pages 873-885
13. Ismailova, Z., Choriev, R., Ibragimova, G., Abdurakhmanova, S., & Abdiev, N. (2020). Competent model of Practice-oriented education of students of the construction profile. Journal of Critical Reviews. Innovare Academics Sciences Pvt. Ltd. https://doi.org/10.31838/jcr.07.04.85
14. Ismailova, Z., Choriev, R., Musurmanova, A., & Aripjanova, M. (2020). Methods of training of teachers of university on advanced training courses. Journal of Critical Reviews. Innovare Academics Sciences Pvt. Ltd. https://doi.org/10.31838/jcr.07.05.85
15. Ismailova, Z., Choriev, R., Salomova, R., & Jumanazarova, Z. (2020). Use of economic and geographical methods of agricultural development. Journal of Critical Reviews. Innovare Academics Sciences Pvt. Ltd. https://doi.org/10.31838/jcr.07.05.84
16. Isakov, A., Tukhtamishev, B., & Choriev, R. (2020). Method for calculating and evaluating the total energy capacity of cotton fiber. IOP Conference Series: Earth and Environmental Science, 614(1), 012006
17. Davirov, A., Tursunov, O., Kodirov, D., Baratov, D., & Tursunov, A. (2020). Criteria for the existence of established modes of power systems. IOP Conference Series: Earth and Environmental Science, 2020, 614(1), 012039
18. Obidov, B., Choriev, R., Vokhidov, O., & Rajabov, M. (2020). Experimental studies of horizontal flow effects in the presence of cavitation on erosion-free dampers. IOP Conference Series: Materials Science and Engineering, 883(1), 012051
19. Khasanov, B., Choriev, R., Vatin, N., & Mirzaev, T. (2020). The extraction of the water-air phase through a single filtration hole. IOP Conference Series: Materials Science and Engineering, 2020, 883(1), 012206
20. Shokhrud F. Fayziev The problem of social stigma during a pandemic caused by COVID-19 International Journal of Advanced Science and Technology Vol. 29, No. 7, (2020), pp. 660-664 http://sersc.org/journals/index.php/IJAST/article/view/13965/7188
21. Fayziyev Shokhrud Farmonovich Medical law and features of legal relations arising in the provision of medical services. International journal of pharmaceutical research Volume 11, Issue 3, July - Sept, 2019 P. 1197-1200 doi:10.31838/ijpr/2019.11.03.088 http://www.ijpronline.com/ViewArticleDetail.aspx?ID=11016
22. Bryanskaya Elena, Fayziev Shokhrud, Altunina Anna, Matiukha Alena Topical Issues of an Expert Report in the Process of Proving in a Criminal Examination. International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-9 Issue-1, October 2019 5345-5349 DOI: 10.35940/ijeat.A2946.109119
https://www.ijeat.org/wp-content/uploads/papers/v9i1/A2946109119.pdf
23. Fayziev Shokhrud (2019) Legal Aspects of Transplantology in the Republic of Uzbekistan. Systematic Reviews in Pharmacy, ISSN: 0976-2779, Vol: 10, Issue: 2, Page: 44-47 doi:10.5530/srp.2019.2.08
http://www.sysrevpharm.org//fulltext/196-1575419211.pdf?1586863081
24. Tulaganova, G.Some issues of observance of international legal norms of fight against legalization of criminal incomes in the Republic of UzbekistanJournal of Advanced Research in Dynamical and Control Systems 12(2 Special Issue), c. 143-155

25. Bekchanov D; Kawakita H; Mukhamediev M; Khushvaktov S; JuraevM. Sorption of cobalt (II) and chromium (III) ions to nitrogen- and sulfur- containing polyampholyte on the basis of polyvinylchloride /Polymers for Advanced Technologies 2021 https://doi.org/10.1002/pat.5209
26. Davron, B., Mukhtar, M., Nurbek, K., Suyun, X., Murod, J. Synthesis of a New Granulated Polyampholyte and its Sorption Properties. *International Journal of Technology*. Volume 11(4), pp. 794-803. ., (2020) https://doi.org/10.14716/ijtech.v11i4.4024
27. Mukhamediev, M.G., Bekchanov, D.Z. New Anion Exchanger Based on Polyvinyl Chloride and Its Application in Industrial Water Treatment. Russ J Appl Chem 92, 1499–1505 (2019). https://doi.org/10.1134/S1070427219110053
28. Mukhamediev, M.G., Auelbekov, S.A., Sharipova, Z.T. et al. Polymer complexes of gossypol and their antiviral activity. Pharm Chem J 20, 276–278 (1986). https://doi.org/10.1007/BF00758817
29. Ikramova, M.E., Mukhamediev, M.G., Musaev, U.N. Complexation of hydrazine- and phenylhydrazine-modified nitron fibers with iodine/ Plasticheskie Massy: Sintez Svojstva Pererabotka Primenenie, (12), стр. 41–45 (2004)
30. Gafurova, D.A., Khakimzhanov, B.S., Mukhamediev, M.G., Musaev, U.N. Sorption of Cr(VI) on the anion-exchange fibrous material based on nitron. Russian Journal of Applied Chemistry, 75(1), стр. 71–74, (2002)
31. Rustamov, M.K., Gafurova, D.A., Karimov, M.M. et al. Application of ion-exchange materials with high specific surface area for solving environmental problems. Russ J Gen Chem 84, 2545–2551 (2014). https://doi.org/10.1134/S1070363214130106