



SCIENTIFIC RESEARCH OF THE SCO COUNTRIES: SYNERGY AND INTEGRATION

上合组织国家的科学研究：协同和一体化

Materials of the
International Conference

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这些会议文结合了会议的材料 – 研究论文和科学工作者的论文报告。它考察了职业化人格的技术和社会学问题。一些文章涉及人格职业化研究问题的理论和方法论方法和原则。

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These Conference Proceedings combine materials of the conference – research papers and thesis reports of scientific workers. They examines tecnical and sociological issues of research issues. Some articles deal with theoretical and methodological approaches and principles of research questions of personality professionalization.

Authors are responsible for the accuracy of cited publications, facts, figures, quotations, statistics, proper names and other information.



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Foreword

We thank all participants of our conference "Scientific research of the SCO countries: synergy and integration" for the interest shown, for your speeches and reports. Such a wide range of participants, representing all the countries that are members of the Shanghai Cooperation Organization, speaks about the necessity and importance of this event. The reports of the participants cover a wide range of topical scientific problems and our joint interaction will contribute to the further development of both theoretical and applied modern scientific research by scientists from different countries. The result of the conference was the participation of 48 authors from 7 countries (China, Russia, Uzbekistan, Kazakhstan, Azerbaijan, Tajikistan, Kyrgyzstan).

This conference was a result of the serious interest of the world academic community, the state authorities of China and the Chinese Communist Party to preserve and strengthen international cooperation in the field of science. We also thank our Russian partner Infinity Publishing House for assistance in organizing the conference, preparing and publishing the conference proceedings in Chinese Part and English Part.

I hope that the collection of this conference will be useful to a wide range of readers. It will help to consider issues, that would interest the public, under a new point of view. It will also allow to find contacts among scientists of common interests.

Fan Fukuan,

Chairman of the organizing committee of the conference

"Scientific research of the SCO countries: synergy and integration"

Full Professor, Doctor of Economic Sciences

前言

我们感谢所有参加本次会议的“上海合作组织国家的科学研究：协同作用和整合”，感谢您的演讲和报告。代表所有上海合作组织成员国的广泛参与者都谈到此次活动的必要性和重要性。参与者的报告涵盖了广泛的主题性科学问题，我们的联合互动将有助于不同国家的科学家进一步发展理论和应用的现代科学研究。会议结果是来自7个国家（中国，俄罗斯，乌兹别克斯坦，哈萨克斯坦，阿塞拜疆，塔吉克斯坦，吉尔吉斯斯坦）的83位作者的参与。

这次会议的召开，是学术界，中国国家权力机关和中国共产党对维护和加强科学领域国际合作的高度重视的结果。我们还要感谢我们的俄罗斯合作伙伴无限出版社协助组织会议，准备和发布中英文会议文集。

我希望会议的收集对广大读者有用，将有助于在新的观点下为读者提供有趣的问题，并且还将允许在共同利益的科学家中寻找联系。

范福宽，
教授，经济科学博士，中国科学院院士，会议组委会主席“上合组织国家科学研究：协同与融合”

UDC 336.7

俄罗斯伊斯兰金融模式的发展
DEVELOPMENT OF THE ISLAMIC FINANCE MODEL IN RUSSIA

Grischenko Dmitry Anatolyevich

Postgraduate of 3-rd year

North Caucasus Federal University (NCFU)

Cherkessk

注解 这篇文章揭示了在俄罗斯联邦开发伊斯兰金融模式的可能性，在国内实践中使用伊斯兰银行的基本原则。在俄罗斯形成伊斯兰金融模式时，应该记住，在伊斯兰世界，他们能够在宗教，道德方面和商业之间找到平衡。

关键词：银行，介绍，研究所，伊斯兰教，模式，发展，金融。

Annotation. *The article reveals the possibility of developing a model of Islamic finance in the Russian Federation, using the basic principles of Islamic banking in domestic practice. When forming the Islamic model of finance in Russia, it should be remembered that in the Islamic world they are able to find a balance between religion, moral aspects and business.*

Keywords: *banking, introduction, institute, Islam, model, development, finance.*

Islamic banking is a relatively new phenomenon in modern economic life. From the exotic form of business in the sphere of finance that once existed as separate foci of a specific model of the “Islamic economy” in countries with a predominantly Muslim population, this type of financial institutions is gradually becoming a phenomenon, more and more noticeable on a global scale, including in countries with an absolute predominance of the non-Muslim population.

In recent years, Islamic finance has occupied a significant niche in the global economy. The number of Islamic banks, which fully comply with the requirements of the Islamic economic model, has significantly increased. The increased interest in financial products based on Sharia requirements in recent years has led to the fact that today Islamic financial institutions are being created not only in Islamic countries, but also around the world, and Islamic windows are opening in traditional European credit institutions. According to the head of KPMG's international practice of providing services to financial sector companies J. Anderson, Islamic finance has tremendous potential for growth and expansion in the future. Some

experts, not without reason, assure that if the principles of the Islamic economy were applied on a larger scale, then perhaps the financial crisis of the 2000s could be avoided [1, p.209].

The ban from the point of view of Islamic law to the majority of generally accepted financial transactions and institutions throughout the world has led to the emergence and spread of new types of financial institutions and products that have been defined as "Islamic" because Islamic norms are fundamental. Most traditional financial institutions aim to maximize profits, while Islamic ones find a balance between religion, moral aspects and business. Islamic financial institutions are obliged to adhere to the norms of Shari'a and, accordingly, in their activities, they refused to collect loan interest, to conclude transactions in which there is a lot of uncertainty regarding the subject of the contract, to conduct operations with derivative financial instruments (options, forwards, futures and other securities), application of traditional insurance and bond issuance [5]. The main difference between Islamic banks and traditional ones is the absence of any interest on loans and deposits. Any collection of *ryba* (percent) is prohibited, and is understood by the Shariah as usury and, therefore, sinful.

The work of Islamic banks is based on religious norms, that is, the activities of such banks must fully comply with the standards that are spelled out in the Koran. Thus, the fulfillment of its obligations, and partnership with customers, the bank stands on justice, trust, honesty, and mutual benefit.

Accepting a contribution from a client, the bank undertakes to invest these funds in a third-party business project. In advance, the project itself is negotiated with the client: what is the project, what is the estimated profit, probability and amount of losses on the investments that the partners will share among themselves in certain shares. In fact, the bank is a co-investor, therefore, it is interested in investing in a profitable business.

Lending, in turn, occurs in a similar pattern. The bank purchases the necessary goods for its customer at its own expense, and resells it with a small mark-up. The LIBOR (London Interbank Offer Rate) is often used to determine the amount of mark-up for Sharia products, since there is no Islamic base rate. Thus, the client buys this product with a surcharge and gradually pays the bank the money spent by him. The goods become the property of the client only after the final payment.

At the state level, Islamic bonds are of great interest - sukuk, which provide unsecured income from the profits of the funded event. When buying sukuk bonds, the investor initially knows why the funds are attracted and what they will be spent on.

Prospects for the introduction of the Islamic economic model in Russia have a number of problems. The first one, and the main one, is an obstacle to activity in Russian legislation (civil, banking, tax). Russia is already working on this, and perhaps the necessary legal framework will soon appear.

Over the past 5 years, a big step has been made to meet - a pilot project was launched in Kazan. This event is unique for our country. Kazan became the first city in which the institution appeared providing financial services according to Sharia law. Also, many people use the term “partner bank” rather than “Islamic” bank, since there is no definite confessional affiliation in the work of these organizations.

For the study of questions about the transformation of traditional banks into Islamic banks, or the opening of traditional windows in Islamic banks, Pakistani experts of Tawun are ready to help us. They provide consulting services and are ready to share the experience of promoting Islamic banking products for the state, consumer, agricultural, corporate sectors, as well as loans and loans for infrastructure projects, document management, IT systems development. In addition, Tawun specialists conduct personnel training and provide consulting services for managing liquidity and interbank cash transactions in accordance with the Shariah.

Cooperation of the parties will allow meeting the need of financial institutions in the Russian and CIS markets today for qualified support in the development of Islamic banking, insurance and leasing, management of investment funds and provision of Sharia audit services.

The second problem of the Islamic economic model is the low financial literacy of the population, which greatly hinders the development of the financial market as a whole, so the promotion of Islamic banking will be slow and difficult. Also, the misunderstanding of such a term as “Islamic banking” aggravates the situation. Even in the financial sphere, not all financially literate people understand what this term means [2, 3].

However, there is certainly an interest in Islamic banking in Russia, and this is highly expected, since about 20 million Muslims live with us. In addition, Russia is actively engaged in economic cooperation with Muslim countries.

The right of Muslims to receive financial services consistent with their creed must be respected in any democratic society, including our country. Chairman of the Central Bank of the Russian Federation E. Nabiullina emphasized that our country is interested in the principles of Islamic banking, and one of the tasks is to understand how these principles can be adapted to the Russian financial system [4, p.1]

The pilot project in Kazan gave a good start in the development of Islamic banking in the country. As a result of the launch of this project, the society has shown interest in Islamic banking products. In addition to the public, representatives of the banking sector also became interested. For example, in 2018, Sberbank published the news that in the near future they plan to launch a pilot project in the capitals of Tatarstan, Chechnya and Bashkortostan. In this pilot project, deposit

products according to Islamic banking standards will be offered through Islamic windows. Upon successful completion of the project, it is planned to issue special plastic cards to finance the customer's consumer needs.

If the pilot project ends successfully in Kazan, these banks can be opened in regions where Islam is the predominantly official religion, which in turn will affect the economic growth of these regions.

There is no unified model of Islamic banking. Examples of its implementation show that there are countries that have changed the system for this product, but there are also countries that work on the basis of the established rules, thereby simply adapting to new realities. Therefore, representatives of the Islamic world are confident that Russia should not have problems with the introduction of Islamic banking.

Thus, in Russia there is a good ground for the introduction of this system: Islamic banks are available not only to Muslims, they have a very good degree of reliability and sustainability, as demonstrated by the World Financial Crisis, also minimal risks, benefits for SMEs, and simply attracting clients through the moral and ethical side.

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燃料和能源集群活动战略规划的特点
**FEATURES OF STRATEGIC PLANNING OF ACTIVITY
OF A FUEL AND ENERGY CLUSTER**

Faskevich Nina Vasilyevna

*graduate student of the Siberian state space
university of the academician M.F. Reshetnyov, Krasnoyarsk,
Russian Federation*

Myullerson Alyona Anatolyevna

*graduate student of the Siberian state space
university of the academician M.F. Reshetnyov
Krasnoyarsk, Russian Federation*

注解 燃料和能源集群的发展前景预先决定了地区的产业政策。区域级产业政策管理面临战略规划实施的严重问题。关于计算燃料和能源组活动的战略规划综合指数的建议,在此基础上,可以选择有效的发展战略,在文章中提供。

关键词: 燃料和能源集群, 产业政策, 发展战略, 产业政策管理。

***Annotation.** Perspectives of development of fuel and energy clusters predetermine industrial policy of regions. Management at the regional level of industrial policy faces serious questions on implementation of strategic plans. Recommendations about calculation of the integrated index of strategic planning of activity of a fuel and energy cluster; on the basis of which it is possible to select the effective development strategy are provided in the article.*

***Keywords:** fuel and energy cluster; industrial policy, development strategy, management of industrial policy.*

It is known that industry influences the priorities of economic development. In Russia, industrial policy has a regional focus. Most regions in the structure of the economy have a significant share of industrial production.

Each region has its own peculiarities in the development of industrial production, which predetermines industrial policy [1]. Currently, researchers do not have a unified approach to assessing the role and prospects for the implementation of industrial policy. There are opinions that during the implementation of industrial policy with the help of an administrative-state resource, there are possible distortions in its implementation, resulting in support of individual industries at the expense of the others [2].

At the same time, most scientists have a high estimate of the prospects for the realization of the industrial potential of the regions in improving the competitiveness of Russian business [3]. Since 1990, a transformation of industrial policy focused on a market economy gradually took place. Everything has changed - forms, tools and priorities for the development of production.

Regions face such challenges, as:

- adaptation of the institutional mechanism for the implementation of priority programs for the development of industrial production;
- development of market mechanisms for provision the production process with financial and human resources;
- creation of conditions and tools for intersectoral and interterritorial interaction.

Each region solves problems of the implementation of industrial policy in the direction of their production specialization. Of particular interest are regions that have fuel and energy clusters, including industries involved in the chain of power generation, on their territory [4].

Industrial clusters exist in many regions and the most important problem is the selection of the most effective methods for implementation of industrial policy. The development of fuel and energy clusters is not the only factor that affects the regional economy, but regional authorities also actively influence the development of cluster industries.

Almost all regions have no evidence base for forecasting the activities of the fuel and energy sectors within the regional cluster for effective planning of their activities. The expediency of planning cannot be doubted, but to justify effective actions to improve the planning of production processes of fuel and energy clusters, each region should have a clear idea of the problems and opportunities of all enterprises in the cluster.

On the example of the Republic of Khakassia, which has a fuel and energy cluster in the structure of the economy, which occupies almost 60% (in the structure of GRP). A SWOT analysis was conducted to identify prospects and development problems using the example of the fuel and energy cluster of the Republic of Khakassia (Table 1).

Table 1

SWOT analysis of the state of enterprises of the fuel and energy complex

Internal factors	External factors
Positive properties	Opportunities
- communication with Russian suppliers and consumers; - reserves of efficiency growth; - qualified personnel	- operational adjustment of production activities; - a wide range of choice of suppliers of equipment and services; - expansion of network links; - support of regional authorities
Disadvantages	Threats
- presence of negative production factors; - innovative activity is not permanent; - poor staff motivation to improve technological processes; - weak connection with the innovation processes of the enterprise	Loss of competitive advantages due to the inability of the planning system to adequately assess and respond in time to significant changes, such as: - increased uncertainty of multidimensional network connections; - change of the pricing policy for the industry; - changes in consumer requirements for product quality indicators

Analysis of the possibilities and internal factors of the fuel and energy cluster allows us to identify the conditions that determine the future development of the industry.

To assess the conditions for the implementation of plans for the development of industrial production in the framework of the fuel and energy cluster, it is proposed to use the integral index of strategic planning, which is defined as the product of the coefficients for evaluating production factors and the planned result:

$$I_{ou} = K_{\phi} \cdot K_{nl},$$

where K_{ϕ} – coefficient of evaluation of factors of development of fuel and energy cluster; K_{nl} – coefficient of implementation of plans for industrial development..

To identify the factors of industrial production development in the framework of the fuel and energy cluster, it can be considered according to the following criteria:

- technical-technological;
- resource-material;
- organizational-economic.

Technical-technological factors are estimated on the basis of the analysis of the functioning of the cluster industries. Resource-material factors are displayed in reporting documents of enterprises within the cluster structure. Organizational-economic factors are assessed by management and economic indicators of the cluster

The coefficient of evaluation of development factors of the fuel and energy cluster is calculated by the formula:

$$K_{\phi} = \sqrt[3]{K_{mm} \cdot K_{pH} \cdot K_{o\phi}}$$

where K_{mm} , K_{pH} , $K_{o\phi}$ – respectively, the coefficients characterizing the state of technical-technological, resource-material and organizational-economic factors.

The rate of implementation of industrial development plans is calculated by the formula:

$$K_{nl} = \frac{\sum (I_{ni} - \Delta)}{\sum I}$$

where I_{ni} – plan target indicator; Δ – pledged level of deviation from the target indicator; $\sum I$ – total target (plan) indicators.

As a result of the research and on the basis of the obtained values of the coefficient of completeness of the factor assessment, four levels of planning of the fuel and energy cluster activities were distinguished: reproduction, rationalization, innovation and modernization. They are distinguished by a sufficient assessment of production factors, the quality and quantity of implemented decisions, the level of staff motivation to create and master innovative measures aimed at reducing negative production factors.

Thus, by completing the calculations of the integral index of strategic planning, it is possible to assess the prospects for the development of the fuel and energy cluster in the structure of the regional economy.

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团结社会空间是长期上合组织成员国的条件
**SOLIDARITY SOCIAL SPACE AS A CONDITION
FOR LONG-TERM SCO MEMBER STATES**

Khristolyubova Natalya Yevgen'yevna

Researcher

Central Economics and Mathematics Institute, RAS,

Russia, Moscow

抽象。 该文章探讨了国际一体化和区域化的现代过程，作为克服过渡期世界经济技术结构新一轮社会-经济和政治问题的工具。 在成员国之间建立和发展联合空间的条件下，在上海合作组织框架内保持和发展长期稳定的关系是可能的。

关键词：团结，科技进步，一体化，上海合作组织，生活质量，安全，可持续发展。

Abstract. *The article examines the modern processes of international integration and regionalization as a tool to overcome the socio-economic and political problems of the transition period to the new wave of the technological structure of world economy. The preservation and development of long-term, stable relations within the framework of the SCO is possible under the condition of the formation and development of a joint space between the member countries.*

Keywords: *Solidarity, scientific and technical progress, integration, SCO, quality of life, security, sustainable development.*

All countries of the world at the present stage of socio-economic development are under pressure from new institutional processes, phenomena and events, the basis of which is the transition to a new wave of technological development based on digitalization and information technologies not only in all spheres and sectors of production of goods, but also covering all aspects of vital activity and life of each person and society as a whole. Historical experience and economic theory claim that changes in all economic subjects are accompanied by large-scale crisis phenomena, depressive phenomena and simultaneous search for innovations necessary for scientific and technical training. Under these conditions, of the objectively necessary reforming by countries of their socio-economic and political space, on the one hand, initially exacerbates traditional and new problems (dangers) that worsen the quality of institutional space, both of individual countries, their unions, and the whole world. There is a violation and revision of established

norms, relationships, goals, motives for activities and traditions, which leads to the search for and the establishment of new ones. But at the same time, on the other hand, “windows of opportunities” open up before the countries, quickly taking advantage of which, by establishing technological leadership, countries can more efficiently and relatively safely manage their economies to integrate into the updated world reproduction process and maximize the benefits of international cooperation for a long period of time [1,2,3].

International integration and regionalization of countries in the global economy is an effective tool for jointly overcoming the inevitable difficulties of the transition period. Countries are committed to sustainable, ongoing socio-economic international relations that will, through the exchange of goods, services and more rational movement of production factors, increase productivity, improve their efficiency, reduce the uncertainty of the future, the costs of interaction (transactional), the level of real and potential hazards.

Russia is currently also setting itself the goals and objectives of the earliest restructuring of the socio-economic space, but its feature is that these processes over the past five years (since 2014) are taking place in the context of growing sanctions and isolation policies pursued by the EU, America, Canada, Japan and other countries and forced retaliatory Russian counter-sanctions. Moreover, some of the countries supporting the sanctions against Russia were in the past the main trade and economic partners of the country for a long time.

Currently, 62 states are conducting sanctions policy towards Russia, which apply 159 restrictive measures to Russian goods (in 2018, Russia managed to minimize 32 trade restrictions in the amount of 330 million dollars). According to experts, the EU's share in Russia's trade has decreased in principle from 46.3% in 2013 to 37.3% in 2017 [4]. According to the Ministry of Economic Development, the damage from restrictive trade measures (for example, the abolition of the construction of South Stream), including sanctions imposed against Russia, amounted to 6.3 billion dollars. The greatest damage was caused by countries and their associations: the EU - 2.42 billion dollars (25 restrictions), the USA - 1.168 billion dollars (9 restrictions), Ukraine - 775 million dollars (22 restrictions), Turkey - 713 million dollars (12), India - 377 million dollars. (16 restrictions), Iran - 320 million dollars, China - 175 million dollars. A long-time reliable partner and ally of Russia and the post-Soviet country - Belarus also applies 13 restrictions and barriers against Russia, causing damage to the Russian economy of 42 million dollars. The biggest losses are: metallurgical industry - 4 billion dollars, agriculture - 1.104 billion dollars, chemical industry - 640 million dollars and autobuilding. [5,6,7]. Also, contrary to the ideas of globalization, the world has cyclically aggravated the ideas of protectionist policies and such authoritative international organizations as the UN and the WTO have actually ceased to fully perform their functions of regulating international relations.

From the period of Russia's transition to a system of market relations, and the destruction of the production and economic ties established in the Soviet economy on the basis of specialization and cooperation in the production, exchange, distribution and consumption of goods, the processes of international integration and regionalization became relevant as a reaction to the increased level of danger for the state and all its subjects. In the transitional period, at the stage of reforming the socio-economic space, the importance of having the political, economic, and psychological benevolent environment of the allies and like-minded countries increases. During this period, Russia was integrated, both with post-Soviet countries, and with other neighboring countries and even other remote countries. Modern Russia has now entered and is a member of such international associations and organizations as: the Customs Union (CU), the Commonwealth of Independent States (CIS), the Union of Russia and Belarus (SGRB), the Collective Security Treaty Organization (CSTO), the Eurasian Economic Community (EurAsEC), Eurasian Economic Union (EAEU), Shanghai Cooperation Organization (SCO), Shanghai Five, Asian-Pacific Economic Cooperation (APEC), a group of five countries - Brazil, Russia, India, Itay, South Africa (BRICS) and others.

Russia in search of partners since 2001 has become a member of the regional international organization of the Shanghai Cooperation Organization (SCO), which at first, apart from Russia and China, included four post-Soviet countries - Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan. In 2017, the organization expanded, two more countries entered - India and Pakistan, which gave the SCO a new impetus and transcontinental character. The SCO also has in its composition: four observer countries (Belarus, Iran, Mongolia, Afghanistan); countries applying for observer status (Armenia, Azerbaijan, Bangladesh, Syria and Sri Lanka); and six dialogue partner countries - Armenia, Azerbaijan, Cambodia, Nepal, Turkey and Sri Lanka.

At the present stage, the SCO is already a representative international structure with a large-scale aggregate potential. Thus, according to the World Bank for 2017, the SCO unites 3.1 billion people (including observer countries 3.2 billion), has a territory of 37.53 million sq. km or 61% of the Eurasian continent. Member countries have created cumulative GDP (at current prices) 15.24 trillion dollars (for comparison, the EU is 16.46 trillion dollars, the United States - 18.62 trillion dollars) or 20.09% of world GDP. In 2018, President of the Russian Federation V.V. Putin, in an interview with the Chinese Media Corporation, informed that the SCO countries account for 23% of the territory and 43% of the world's population, as well as 25% of world GDP [8]. The SCO budget is formed from the annual assessed contributions of the participating countries. According to the data for 2018, the contributions of Russia and China are 20.6% each, Kazakhstan - 17.6%, Uzbekistan - 14.6%, Kyrgyzstan - 8.8%, Tajikistan -6%, India and Pakistan 5.9% each.

Thus, the SCO is becoming the largest (by territory, population, natural resources, produced GDP) organization not only in the region, but also in the world, as well as participation in it, as key members, the major powers of the world - Russia and China (which, although they are currently in the world as objects of sanctions), are permanent members of the UN Security Council, all this objectively creates prerequisites for reaching the leading positions of the SCO in the system of international relations.

The activities of the SCO are currently combining solutions for collective confrontation and security and for trade, economic and social cooperation. The SCO does not position itself as a military-political bloc. Since the creation of the SCO, urgent tasks to ensure intra-regional security, such as suppressing terrorism, extremism, separatism in Central Asia, fighting international drug addiction, which, apart from the destruction of a person, his personality and society, financially nourished international negative forces, have come to the fore. At the same time, starting from 2003, in parallel, economic cooperation is activated, on the basis of a special Program of multilateral trade and economic cooperation, calculated until 2023. Now the economic relations of the participating countries have spread to many of the most important sectors and spheres of the state and society, such as energy, agriculture, transport, culture, education, scientific and technological development, tourism, humanitarian and others, which is reflected in the creation in 2018 the year of the new version of this Program (“On the development of a new version of the Program of multilateral trade and economic cooperation of the member states”).

But in order for the relations within the SCO framework to be mutually beneficial, long-term, sustainable and the participating countries could realize in the present and future the potential that they already have, and the expected potential that they will get from the synergy effect in the integration process, there must be common interests between the countries, needs and motives for joint indissoluble activities in the international system of division of labor and social relations. Therefore, at present, the search for such economic, social and political objectively insurmountable, unifying, attractive factors is relevant for the SCO member countries. For such international integration, the SCO member states at this stage of development do not have so many prerequisites that contributed to their rapprochement. So the SCO member states, first, do not yet have a close level of economic development and quality of life of the population. Many international organizations, such as the World Bank, the United Nations, the Organization for Economic Cooperation and Development, the International Monetary Fund, make up the ranking of countries in the world in terms of GDP at purchasing power parity. According to the IMF for 2018, out of 195 countries in the world, China is in first place, ahead of USA by one position, India is third, Russia is sixth, while Kazakhstan is 43, Uzbekistan 64, Tajikistan 139, Kyrgyzstan 145. Secondly not

all countries have territorial proximity and common infrastructure development, thirdly, there is no unifying common language space, despite the fact that the SCO from eight member countries, except Russia, includes four post-Soviet republics (Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan), previously obligatory Russian language in these countries after the collapse of the USSR and subsequent democratization processes, is actually not supported at the state level and soon after the change of the current generation, it may be lost. Fifth, there is no historically traditional cultural, ethnic, or religious-social mentality.

The experience of the indestructible existence of more than seventy-five years of the USSR in the recent past, where fifteen republics based on the joint cooperative production of the same goods, works and services for each other, to a certain extent, have been preserved in their modern economic mechanism even today. creates a fundamental basis for new solidarity in life.

In the space of the SCO member countries, the inevitability of creating a joint space has already been realized. This confirms the creation of a common for the member countries and observer countries of the SCO Network University, the creation of the SCO Youth Council, and the holding of national democracy events. A reliable pillar of strategic partnership is the younger generation in these countries. We believe that participation in such projects by people of college age is very important, but already belated, because by the age of 18 people are actually formed as a person and it is difficult to change his outlook and lifestyle, thinking and actions. Therefore, we believe that it is rational to create joint projects and programs that are equally relevant for all SCO countries, covering children of school age, and possibly preschool age. At this age, to foster trust, tolerance and mutual respect for national and religious characteristics is real (this was shown by the Soviet experience).

Solidarity between the participating countries is formed and developed on the basis of culture, through the general system of educational standards. It is rational to create and use such a common and unified system of training in the SCO space (by analogy with the European - Bologna education system), which synthesizes the best general cultural and professional competences from the national and European education systems. The common educational space will also bring together the scientific and technical level, which in turn will form common interests, needs and motives for activity, and will also create the basis for raising the level of security and quality of life common within the SCO and for a joint and mutually beneficial scientific and technological breakthrough.

The loss of unification space of solidarity, the emergence of parallel and divergent interests and needs of the participating countries, especially during the period of reform and changes in the composition and structure of the institutional environment, is dangerous by launching a counter disintegration process. An example is the ongoing processes in the most progressive at the moment international integration association of the EU [9].

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关于在北高加索联邦区内实现双重教育制度的观点
**PERSPECTIVES OF THE REALIZATION
OF THE DUAL EDUCATION SYSTEM IN THE TERRITORY
OF THE NORTH-CAUCASIAN FEDERAL DISTRICT**

Rastegaeva Darya Alexandrovna

postgraduate student

State autonomous educational institution of higher education

«Nevinnomyssk State Humanitarian-Technical Institute»

Lyudmila Andreevna Filimonyuk

Doctor of Pedagogic Sciences

North-Caucasus Federal University,

Nevinnomyssk State Humanitarian-Technical Institute

注解 该文论述了在现代条件下兼顾生产和教育两个方面的专业人才培养问题。介绍了北高加索地区实行双重教育制度的特点和前景。

关键词：专业培训，双重教育，制造企业，高中。

Annotation. *The article deals with the problem of dual education, which in modern conditions will solve the problem of training professional personnel taking into account the interests of both production and educational spheres. The features and prospects for implementing the system of dual education for the North Caucasus region are described.*

Keywords: *professional training, dual education, manufacturing enterprises, high school.*

Describing the modern system of the Russian professional education, it should be noted the processes combining high-quality changes of the system and the nature of its interaction with the production sphere.

First of all, based on the experience of domestic and foreign researchers of this problem (issues of dual education are updated in the works of E. A. Korchagin, G. V. Mukhametzyanova [2], A. M. Novikova, V. V. Zemlyansky and others), It is important to note that the dual education system is a kind of learning model, in which theoretical training is carried out on the basis of an educational organization, and practical - at manufacturing enterprises. Germany, Great Britain, Japan where training of experts is everywhere carried out on the terms of integration of educational process and practice by right are considered as the countries advanced in this regard.

In Russia the certain experience of realization of model of dual education

is accumulated since 2014: Kaluga, Yaroslavl, Ulyanovsk, Sverdlovsk, Nizhny Novgorod, Volgograd and Moscow regions, Perm and Krasnoyarsk regions and also Republic of Tatarstan. Implementation of the program for the development of dual education in these regions was made possible by the Agency for Strategic Initiatives with the support of the Ministry of Education, the Ministry of Industry and Trade and the Ministry of Labor of Russia. In addition program participants receive consulting assistance from the World Bank and the Russian-German Chamber of Commerce.

According to the order of the Government of the Russian Federation "About the statement of a package of measures, directed to improvement of a system of secondary professional education, for 2015 - 2020" [4], the initiative group offered the "Creation of the Regional (District) Educational and Methodical Center of Dual Training in North Caucasus Federal District" project.

From the point of view of the implementation of the practical part of the educational process From the point of view of the implementation of the practical part of the educational process. The specifics of development of territorial industrial systems of the North Caucasus consist in absence in a number of regions of the acts stimulating creation of conditions for development of innovative activity; lack of interest in an industrial complex of the region from the financial organizations; low innovative activity and also existence of outdated technological ways in the territorial industrial systems of the region. As base for practice and employment of graduates contracts on interaction with JSC Russian Railways, LLC Stavrolen, "The Nevinnomyssk profile", "Sweet technologies", other firms and the enterprises.

In Stavropol Region in February, 2016 the road map of the "Development of Professional Education in the City, Georgiyevsk, by Introduction of Elements of Dual Training at Base of the Federal Innovative Platform" project was approved. The performer is the state educational institution "Georgievsky regional college" "Integral". As part of the interregional sectoral regional center, there is interaction between 25 educational organizations of the North Caucasian Federal District: 10 educational organizations of secondary vocational education and one higher educational institution on the territory of the Stavropol Territory, two educational organizations of secondary vocational education of the Kabardino-Balkarian Republic, Karachay-Cherkess Republic, 3 organizations of the secondary vocational education, 3 educational organizations of secondary vocational education of the Republic of North Ossetia- Alania, 2 educational organizations of secondary vocational education of the Republic of Dagestan, the Republic of Ingushetia is represented by 1 educational organization of secondary vocational education, 3 educational organizations of secondary vocational education are located on the territory of the Chechen Republic.

Prerequisites for the introduction of dual education in the region include: an

agreement between the “Georgievsky regional college“ Integral“ and the Crafts Chamber of Leipzig, involving, in perspective, the creation of a center for dual training in the North Caucasus Federal District, training for teachers and students in the educational technology center of the Leipzig Crafts Chamber; agreement with the Chamber of Commerce and Industry of the Stavropol Territory; obtaining by the college of the status of a federal innovation platform for the introduction of elements of dual training in the educational process in the region.

Let's note that the educational organizations called above belong to number of average special educational institutions. Thus, the higher school of the region as to Russia in general, in processes of receiving dual education it is presented poorly. Work in this direction within the innovative project (program) "Models, mechanisms and technologies of development of practice of dual education in the professional educational organizations and the educational organizations of the higher education of Stavropol Region" is carried out by "The Nevinnomyssk state humanitarian and technical institute".

In North Caucasus it is necessary for the organization of further activities for introduction of dual training, first of all: a possibility of use of an administrative resource of the Ministry of North Caucasus, regional governing bodies of education for involvement of employers bases the practician from the most popular and relevant industries of production for the region; the authorities' motivation to take effective measures to improve the investment climate in the North Caucasus; control of target use of financial, material and other means; extended coverage in media of information on the events held in the field of realization of elements of dual education; carrying out the analysis of results of work on the description of the most effective technologies of training of skilled workers and their distribution in other educational organizations and regions; identifying the best practices of regional authorities of the subjects of the North Caucasus Federal District, which allow to achieve the best results for the development of the investment climate and job creation.

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现代大学的社会文化主导者，是形成竞争专家的一个因素
**SOCIO-CULTURAL DOMINANTS OF THE MODERN UNIVERSITY,
AS A FACTOR IN THE FORMATION
OF A COMPETITIVE SPECIALIST**

Kalimullina Olga Anatolyevna

Doctor of Pedagogic Sciences, Full Professor

Kazan State Institute of Culture

Sirotkina Olga Vasilyevna

Kazan National Research Technological University

注解 这篇文章谈到了现代大学的社会文化环境，能够形成一个有竞争力的专家，以科学为基础的思想的整体，以及形成学生观众的专业和公民职位的过程。 对一个主题的科学观点和研究进行分析，研究“大学的社会文化环境”概念的基本基础。

关键词 现代大学, 学生青年, 学生观众, 社会文化环境, 社会文化dominants, 教育过程.

Annotation. *The article talks about the socio-cultural environment of a modern university, capable of forming a competitive specialist, the totality of scientifically based ideas, and the process of forming the professional and civil positions of the student audience. The analysis of scientific views and research on a topic that examines the basic foundations of the concept of the “socio-cultural environment of the university” is carried out.*

Keywords. *Modern university, student youth, student audience, socio-cultural environment, socio-cultural dominants, the educational process.*

Modern society is increasingly interested in how to take paradigmatic approaches to educational activities out of the outdated framework of pedagogical dogmas and give the opportunity to develop according to non-linear synergetic principles that allow the university’s socio-cultural environment to be used as a scientific and methodological platform for the formation of a competitive young man. или After all, it is known that modern information and communication technologies today often work not for the good, but to the detriment of the modern young generation. And those informational attacks that modern students withstand, plunging into the virtual field of social networks, often act as direct competitors of the university’s socio-cultural environment, which contains all the necessary socio-pedagogical vectors that can bring the young generation to the

high competitive level that is necessary today, and civil position, responsible for the image of generation of Russian citizens in the world. In pedagogical theory and practice, different approaches to the formation of a competitive young generation are revealed. Innovative pedagogical technologies are introduced into the pedagogical process of educational institutions at school and extracurricular time, based on modern socio-cultural technologies, which make it possible to improve well-known methods and procedures for assessing the level of self-organization of a young person. Consequently, a set of scientifically based ideas has developed in pedagogical science about the process of forming professional and civil positions among the student audience.

What do we mean when we talk about the socio-cultural dominants of a modern university? It is known, that a modern university is a complex synergistic non-linear system of relationships and interdependent educational and academic activities, the ultimate goal of which is the identity of the future specialist, on about any field of activity. This may be both technical and humanitarian, depending on the institution, but the goal and objectives of all universities are almost identical and declare such basic positions, as: formation of a competitive specialist and a formation of a competitive specialist with high moral qualities, serious professional baggage, civil position and, and who is, of course, a patriot of Russia

In this regard, under the modern conditions of the university, interest in studying and attracting all the possibilities of the social environment of the university, which dominates in the process of education and upbringing and is a powerful basic factor in the formation of a competitive specialist, has significantly increased. или Recently, such concepts as “humanitarian environment”, “cultural environment”, and “sociocultural environment” have appeared in literature. Introducing new concepts, scientists diverge in their meaningful interpretation and propose different methodological approaches. или For example, Russian researchers E. Belozertsev and A. Usachev understand the “cultural environment” as a carrier of the new, including and negative information that affects the thoughts, feelings, emotional sphere of a person, his faith and, thus, ensures his access to new knowledge [1].

Most actively this concept was used by researchers in the context of pedagogical knowledge (S. Shatsky, S. Molozhavy, V. Shulga, M. Krupenina, L. Novikova, etc.), understanding the “educational environment” in a broad sense as a system of factors that included upbringing and education, and in a narrow way, as a system-forming factor of a particular educational system.

Yu. Kulyutkin considers the sociocultural environment from sociological points of view and, relying on the theory of systems, he defines the sociocultural environment as a system of material and spiritual conditions in which the personality is formed and realized [1].

A socio-cultural environment can be interpreted as a social environment, but always with a cultural content. In another way, it can be interpreted as a sociocultural environment is a social environment in which attention is focused on values and norms of culture.

O.A. Kalimullina, in her monograph "Shaping the creative focus of student youth in terms of leisure activities: a synergistic approach," states that "... a person is a reflection of the environment in which it is forced to be. The behavior, manners, and views of the individual will, for the most part, be identical to the needs and culture of the society in which the personality is located, the personality, as it were, identifies itself with the society in which it is located" [3]. And we agree with this statement of the author, because it is the dominant socio-cultural conditions that can help to set the correct guidelines for the future specialist and make him competitive.

The concept of "sociocultural environment" is quite widespread in modern literature [2,4,6,7]. We consider the concept of "sociocultural environment of the university" in a broad sense, which is different from the concepts of "educational environment of the university" or "extracurricular environment of the university." In this case, we rely on the following definitions. The concept of "sociocultural" includes the entire set of relations between the subject (in this case, training) with the team, profession, society as a whole, the natural environment of life and artificially created objects of the technosphere, with culture или (in a broad sense) and is aimed at shaping the personality of the future specialist as an agent and carrier of culture in the sphere of professional activity [5]. Agreeing with the position of a number of scientists, we single out the following elements of the university's socio-cultural environment:

- system of extracurricular (educational) work; или
- socially significant activities of students and teachers; или
- system of scientific and methodological management of humanitarian education and educational (extracurricular) work;
- teacher training system; или
- system of psychological and pedagogical support of the educational process; или
- system of realization of artistic, moral, aesthetic and other aspirations of students, teachers and employees; или
- system of special personality development programs; или
- modern humanitarian and student-centered learning technologies; или
- the system of humanitarian schools (the second higher education in the humanities, centers of foreign languages, etc.).

Of course, this classification is very relative and is used solely for the purposes of scientific analysis, since real structures are very complex, due to diverse, not

always obvious connections, continuous interactions with various elements of the university's integral environment and society, elements of educational, extracurricular and partly labor activities, creating a unique, peculiar trajectory of the student's entry into the world of the profession. или The gradual complication of a student's sociocultural life can be viewed as self-changing in professional culture, as an ascent to professional self-identification. The sociocultural environment of a university is an organic combination of material (production) resources and intangible (non-production) assets of a university. или

The period of the formation of personality, moral character, life principles, professional qualities, values and internal cultural space, as a rule, coincides with the process of learning in a university. In this regard, the university acts as one of the most important environments in which the student's personality is formed. Thus, the socio-cultural environment of a university can be defined as a dominant, which integrates both cultural experience and human saturation, and the acquisition of knowledge and professional qualities of a student, making him competitive on the world market.

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现代学生的体育文化是国家未来健康的一个因素
**PHYSICAL CULTURE OF THE MODERN STUDENT
AS A FACTOR IN THE FUTURE HEALTH OF THE NATION**

Kalimullina Olga Anatolevna

Doctor of Pedagogic Sciences, Full Professor

Kazan State Institute of Culture

Khairullin Rafael Ravilevich

Associate Professor

Kazan State Institute of Culture

注解 现代社会需要一个健康和身体强壮的国家，今天的体育教育和体育是大学和鞑靼斯坦共和国和俄罗斯作为一个整体的领导水平的优先事项。因此，最终的结果取决于大学对此的重视程度。

关键词：现代学生青年，体育文化，体育，体能，高等教育机构。

Annotation. *Modern society needs a healthy and physically strong nation, physical education and sports today are priorities at the level of universities and the leadership of the Republic of Tatarstan and Russia as a whole. Therefore, the final result depends on how much attention is paid to this in universities.*

Keywords: *Modern student youth, physical culture, sports, physical capabilities, higher education institution.*

The increased attention of the leadership of the Russian Federation and Tatarstan to physical culture and sports is due to the deep understanding of that spending budget money on physical education and sports of citizens is a cost-effective investment in the preservation and development of human capital, as well as the improvement of the quality of citizen lives.

Physical culture is one important factor in resolving the situation related to the development of student youth, which is presented in legal documents as a humanitarian academic discipline of the university education system. It ensures the harmonious development of students, their full health, as well as the achievement of the required level of general physical fitness, high performance and functional capabilities (L.I. Lubysheva 2004, M. Ya. Vilensky, 1996; Yu.F. Kuramshin, 2010). During the period of study in universities, student youth should accumulate the greatest potential for further increasing the welfare of modern society and the state.

As the accumulated years of experience and research results show, a certain part of the students show an insufficient level of physical fitness and their physical development (V.G. Nikitushkin, 2001; V.I. Ilyinich, 2003; V.V. Feofilaktov, 2005). This leads to a decrease in their indicators of health and educational and professional performance. In addition, it has been proven that the existing system of physical education of university students does not yet fully provide a solution to the complex of educational and recreational tasks (N.V. Peshkova, 2003; V. V. Byankina, 2004, etc.). The need to develop innovative methods of physical education, providing an applied and health-oriented nature, contributing to increase in the level of physical development and physical fitness of the students, significantly increases. Therefore, special attention is paid to the mandatory implementation of the full-fledged individualization of the educational process on the basis of accounting the individual characteristics of students, their needs and motives for systematic physical culture.

The problem of overcoming the low level of physical fitness of students is extremely important, since a sufficiently large number of students in Russian universities have similar diseases. The organizational and methodological aspects of conducting physical education classes with this category of people are not properly worked out. There is no clear system of views on the construction of the training process, there are no justifications for the availability of physical activity for this state of students, and no rational planning options and fitness control parameters have been established.

Currently, the system of higher vocational education is developing according to the new federal standards of the third generation. Since 2011, universities carry out their educational activities on the basis of the Federal State Educational Standards for Higher Professional Education (FSES HPE) of the third generation, and since 2016 - FSES 3+. At the core of the third generation of the FSES HPE is a competence-based approach; physical culture belongs to the group of general cultural competences. In higher education institutions, it is presented as an academic discipline and an essential component of the holistic development of personality. Physical culture is a component of the general culture, mental and physical formation, as well as the student's professional training during the entire period of study; therefore, its importance to the discipline in shaping the general cultural competencies and professional preparedness of students is very high.

Modern educational process in universities is associated with significant mental stress. Studying, as a type of mental labor, is characterized by certain features: constantly growing volume, complexity and novelty of information necessary for mastering, time constraints, changing of sources as a result of swapping subjects and teachers, it requires the ability to creatively and logically solve problematic issues, strict quality control and the effectiveness of their knowledge and skills. Therefore, the mental performance of students should be considered as the interaction of hygienic, physical, psychological and personal factors.

Due to the high mental weight with the constant updating of scientific and technical information, conditions for students' psychophysical abilities are significantly increasing. Special studies have established that in the conditions of hypodynamia, the very next day productive mental activity decreases almost twice, the concentration of attention deteriorates sharply, the total time for performing mental operations increases. In this regard, of particular importance is the development of scientifically based recommendations for the rational organization of the educational process, the establishment of an adequate mode of work and rest, the active use of physical exercises in order to increase mental working capacity(V.L. Marischuk, 1982; I.V. Aulik, 1990; V.V. E.V. Lopatin, 2002; E.M. Slugachev, 2003; E.A. Loshkobanov, 2006 and others) [1,4,5,6].

Endaltsev B.V. believes that the choice and use of physical exercises, physical training of people should be based on the formation of the necessary properties of the organism based on modern provisions on the laws of physiological adaptations, which deeply and fully reveal the effect of various physical activities on the success of adaptive reactions and the effectiveness of professional activity [3].

According to V.K. Balsevich (2007), there are two stages of ontogenesis of human motor systems; at the first stage of training, the body accumulates abilities necessary for vigorous activity in the environment; and at the second stage, biomechanical systems are gradually brought into line with the actual requirements of the environment and changing internal conditions of the body

Thus, it should be noted that, despite the considerable amount of research conducted on the physical training of students in higher educational institutions, the problem of increasing its effectiveness currently remains highly relevant.

Certain means of physical training can form the body's adaptive capabilities at both the systemic and tissue levels and, accordingly, ensure the body's resistance to adverse factors, including stress, and, consequently, increase human performance. And it becomes clear that it is the physical culture of the modern student that is an important, and maybe even the basic factor for the future health of the nation.

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论外国医学生Microsoft Excel特色教学的特点
ON THE PECULIARITIES OF TEACHING FOREIGN MEDICAL
STUDENTS MICROSOFT EXCEL FEATURES

Djumagulov Eldar Kuvanchievich

Senior Lecturer

Chotbaeva Erkingul Aitmurzaevna

Candidate of Biological Sciences, Senior Lecturer

International School of Medicine, Bishkek, Kyrgyzstan

注解 目前,在使用计算机技术的医生的工作中存在一定的信息不足。在这方面,学生训练的工作-在计算机技术的未来医疗专业人员具有特别的相关性。本文致力于为高等医学院校的外国医科学生提供信息技术教学。作者介绍了作者的作业的例子,以及在Microsoft Excel的功能培训外国医学生的结果。

关键词: 计算机技术, 国外医学生, 面向职业的计算机技术培训, 微软Excel应用程序, 逻辑功能如果, 逻辑功能&。

Annotation. *Currently, there is a certain lack of information in use of computer technology in the work of a doctor. In this regard, the work of students training - future medical professionals in computer technology has a particular relevance. This paper is dedicated to the peculiarities of teaching information technologies to foreign medical students in the higher school of medicine. The authors presented the author's examples of assignments, as well as results of the training of foreign medical students in the capabilities of Microsoft Excel.*

Keywords: *computer technology, foreign medical students, vocational-oriented computer technology training, Microsoft Excel application, logical function IF, logical function &.*

Despite the abundance of research in the field of computer technology and their application in various fields of human activity, there is relatively little information in the post-Soviet space about their use in the work of a doctor. In medicine, there is a certain lag in the implementation of even the simplest improvements [4]. For example, so far, with the exception of large medical centers located in capitals and large megacities, all accounting information is mainly kept on paper. Meanwhile, special PC application software packages allow for an impressive speed of statistical calculations, high reliability and reliability of results, the ability to easily present data in analytical, graphical or tabular forms. Among such programs, Microsoft Excel is widely known, which includes the software package "Analysis Package" and a rich library of a large number of statistical functions [1].

It seems to us that the cause of the above problems lies not only in insufficient funding, but is largely due to the lack of specialists, who at one time were not trained to use the capabilities of computer equipment and special software packages in their work.

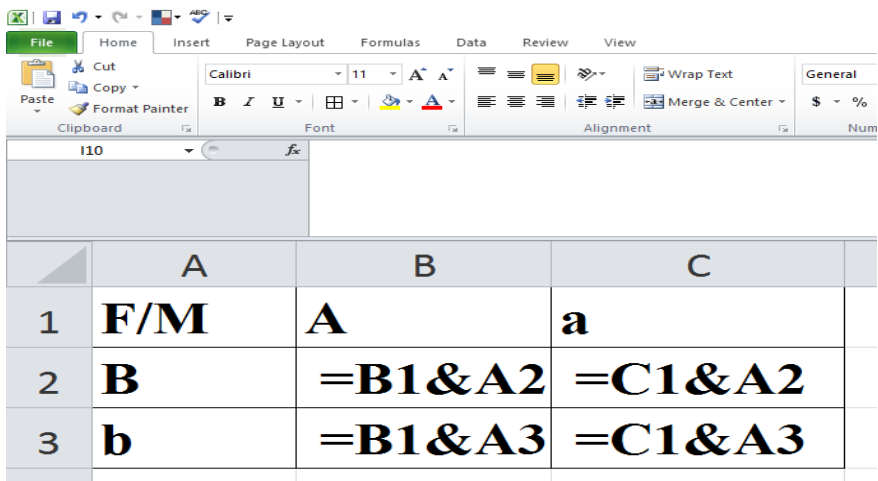
One of the important problems of teaching medical students to computer technologies is the choice of the optimal program, the method of teaching [2].

For a long time, medical students studied computer technologies using standard programs, i.e. on the same as in other faculties. However, at present there is a need for professional-oriented computer technology training for future specialists in various fields, including medicine.

According to A. Sannikova and Z. Kolenova, the future belongs to technical medicine. Tactically, the teaching of computer science at a medical university should ensure the absorption of the underdogs, the development of skills and the consolidation of skills in the subject [3].

In the process of teaching foreign medical students computer technologies at the International Higher School of Medicine (Bishkek, Kyrgyzstan), we found that the majority of students do not show much interest in the capabilities of MS Excel. In order to increase interest in the subject, we reviewed the tasks and tasks offered to students in practical classes.

During the study, 30 first-year medical students were divided into 3 groups of 10 people. Subject matter of practice: “MSExcel, Logic function IF (if), logic function & (concatenate)”.



The screenshot shows the Microsoft Excel interface with the following table content:

	A	B	C
1	F/M	A	a
2	B	=B1&A2	=C1&A2
3	b	=B1&A3	=C1&A3

Figure 1. The use of the function "&" (concatenate) in solving problems in genetics using the Pennet table

The screenshot shows an Excel spreadsheet with a periodic table of elements. The formula bar at the top displays the IF function for each element, such as `=IF(A2="H","Hydrogen",IF(A2="He","Helium",IF(A2="Li","Lithium",IF(A2="Be","Beryllium",IF(A2="B","Boron",IF(A2="C","Carbon",IF(A2="N","Nitrogen",IF(A2="O","Oxygen",))))))))`. The spreadsheet columns are labeled A and B, and rows are numbered 1 through 9. The elements listed are H, He, Li, Be, B, C, N, and O.

Symbol	Full Name
H	=IF(A2="H","Hydrogen",IF(A2="He","Helium",IF(A2="Li","Lithium",IF(A2="Be","Beryllium",IF(A2="B","Boron",IF(A2="C","Carbon",IF(A2="N","Nitrogen",IF(A2="O","Oxygen",))))))))
He	=IF(A3="H","Hydrogen",IF(A3="He","Helium",IF(A3="Li","Lithium",IF(A3="Be","Beryllium",IF(A3="B","Boron",IF(A3="C","Carbon",IF(A3="N","Nitrogen",IF(A3="O","Oxygen",))))))))
Li	=IF(A4="H","Hydrogen",IF(A4="He","Helium",IF(A4="Li","Lithium",IF(A4="Be","Beryllium",IF(A4="B","Boron",IF(A4="C","Carbon",IF(A4="N","Nitrogen",IF(A4="O","Oxygen",))))))))
Be	=IF(A5="H","Hydrogen",IF(A5="He","Helium",IF(A5="Li","Lithium",IF(A5="Be","Beryllium",IF(A5="B","Boron",IF(A5="C","Carbon",IF(A5="N","Nitrogen",IF(A5="O","Oxygen",))))))))
B	=IF(A6="H","Hydrogen",IF(A6="He","Helium",IF(A6="Li","Lithium",IF(A6="Be","Beryllium",IF(A6="B","Boron",IF(A6="C","Carbon",IF(A6="N","Nitrogen",IF(A6="O","Oxygen",))))))))
C	=IF(A7="H","Hydrogen",IF(A7="He","Helium",IF(A7="Li","Lithium",IF(A7="Be","Beryllium",IF(A7="B","Boron",IF(A7="C","Carbon",IF(A7="N","Nitrogen",IF(A7="O","Oxygen",))))))))
N	=IF(A8="H","Hydrogen",IF(A8="He","Helium",IF(A8="Li","Lithium",IF(A8="Be","Beryllium",IF(A8="B","Boron",IF(A8="C","Carbon",IF(A8="N","Nitrogen",IF(A8="O","Oxygen",))))))))
O	=IF(A9="H","Hydrogen",IF(A9="He","Helium",IF(A9="Li","Lithium",IF(A9="Be","Beryllium",IF(A9="B","Boron",IF(A9="C","Carbon",IF(A9="N","Nitrogen",IF(A9="O","Oxygen",))))))))

Figure 3. Using the IF function (if) using alphabetic variables when working with Periodic Table

As an assignment, tasks from the Biology course were used on the topic “Penne's Table”, from the general medicine course — the Blood Pressure Table, and from the Chemistry course — the Periodic Periodic Table. The first group of students was given a task in biology "Penne's Table" (Fig. 1), the second group - a task from the course of general medicine "Blood Pressure Table" (Fig. 2), the third - a task in chemistry "Periodic Table of Mendeleev" (Fig. 3). All three groups of students were given the task of applying the logical functions IF (if), & (concatenate)”.

Research results

As a result of the research, it was found that students, having appreciated the possibilities of MS Excel, show great interest in practical exercises. It was noted a significant increase in the motivation of students to study this subject, which is proved by the final results - all three groups of students completed the task as “excellent” and “good”. In this case, students could easily explain each other the work done, as well as independently demonstrate the solution of problems.

Conclusion

Thus, when using a professional-oriented method of teaching computer technology from foreign medical students, the interest in the subject increases significantly, which is reflected in the improvement of their academic performance. The desire of students to gain additional knowledge is also noted, which in our case was manifested in the desire to study additionally after hours in the possibilities of MS Excel. We can conclude that when teaching a course in medical informatics, it is advisable to teach students to solve specific tasks that will be necessary in their future professional activity in the field of medicine.

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球体方法作为儿童智力障碍学习的现代范式
**SPHERE APPROACH AS A MODERN PARADIGM
OF CHILDREN'S LEARNING WITH MENTAL RETARDATION**

Fedotova Galina Aleksandrovna

Doctor of Pedagogic Sciences, Full Professor

Babakina Elena Petrovna

Lecturer

Andrianova Elena Igorevna

Lecturer

Yaroslav-the-Wise Novgorod State University

注解 文章的内容揭示了sphere方法的发展的本质和动态,作为一种新的教学儿童智力低下的范式;揭示了情感-意志球体的表现形式的特殊性;提出了在纠正和发展儿童这一类的过程中使用sphere方法的工具包。

关键词: 球形方法, 智力迟钝, 训练;人文精神动力学理论的原则。

Annotation. *The content of the article reveals the essence and dynamics of development of the sphere approach as a new paradigm of teaching children with mental retardation; the peculiarities of the manifestation of the emotional-volitional sphere are revealed; toolkit of using the sphere approach in the process of correction and development of children in this category is proposed.*

Keywords: *sphere approach, mental retardation, training; principles of humanistic psychodynamic theory.*

A significant increase in the number of children with mental retardation in recent years indicates the need to find effective methods and approaches for the development of this category of students.

One of such approaches, in our opinion, can be the sphere approach. We proceeded from the following position: firstly, in such children the pathological immaturity of the emotional, intellectual, and affective-volitional spheres is most pronounced; secondly, the lack of academic motivation, a sense of duty and responsibility, expressed intellectual interests, the presence of infantile bravado by corrected behavior [1; 2].

Sphere approach, first proposed by L.M. Semashko as a system-sphere, included social, spiritual, organizational and technical spheres [3]. At the present stage of development of science, the spherical approach has been significantly enriched

with new conceptual conditions and has begun to act as the methodological basis for the development of society (or certain of its subjects), which, in turn, ensures the formation of society as structured, diverse and continuous [4].

Thus, O.A. Karpenko's studies revealed provisions for designing a system of civic-patriotic education of future specialists in the framework of the implementation of "sphere components", to which the author relates ethno-cultural, historical-cultural, socio-cultural and multicultural spheres [5]. Of particular interest in our study is the position of the author, that the totality of spherical components is the driving factor for the self-development of both the system itself and the components due to their intersection and interaction.

Let us consider, from the perspective of the sphere approach, the features of children with mental retardation. Note that there are four types of mental retardation (Fig. 1)

Let us analyze the possibilities of using the sphere approach in the process of influencing the correction and development of the child's emotional sphere.

The emotional state of the child has a special meaning in mental development. Emotions are a special class of mental processes and states that make up the relationship of a person experienced in various forms to objects and the phenomenon of reality. There are significant links between the level of verbal intelligence, attentional instability, focus on educational activities and the emotional-volitional sphere of children with DPD. The underdevelopment of the emotional-volitional sphere manifests itself in the child's transition to systematic learning.

In studies of M.S. Pevzner and T.A. Vlasova, it is noted that children with DPD are characterized primarily by lack of organization, uncriticality, and inadequate self-esteem. Emotions of children are superficial and unstable, as a result of which children are suggestible and prone to imitation. The game is characterized by poverty of imagination and creativity, monotony, monotony. These children have low working capacity as a result of increased exhaustion. The signs of immaturity in the emotional sphere manifest themselves in organic infantilism, and in the intellectual sphere, in the insufficient formation of certain cortical functions and in the underdevelopment of the regulation of higher forms of voluntary activity [6].

One of the forms of educational work with these children is the creation of a positive emotional state through the complex support of children:

- for children with chronic alarming negative mood, medical assistance is needed in the rehabilitation of their psychosomatic health;
- organization of psychorenewing technologies for psycho correction of students' mood;
- use of educational technologies aimed at creating the emotional well-being of each child;



Figure 1 - Types of mental retardation of the child

- humanistic style of pedagogical communication: non-judgmental acceptance of the student, complicity in listening to him, sincere self-expression in communicating with him, tactful expression to the mood of the child, an even patient attitude to the manifestation of negative emotions, feelings;
- saturation of the educational process and educational environment with emotional stimulants - play, competition, figurative presentation, positive emotions, confidence in the success of achieving the goal;
- creation of a favorable psychological microclimate, since In practice, it has been established that children with mental retardation learn from success, which is achieved through timely and tactful assistance of a teacher, and all corrective measures are carried out in a playful way, taking into account individual features;
- introduction of the pedagogical impact of the principles of the humanistic psychodynamic theory of individual and group process into practice, which is based on the following canons: personal growth takes place in a safe, supportive environment, which is created by the facilitators (teachers, parents, colleagues) and are genuine, warm, empathetic, open, honest, congruent and caring [7].

In conclusion, we note that the experimental implementation of the spherical approach to the teaching and development of children with mental retardation, on the one hand, was expressed in the positive dynamics of their development, and, on the other, new problems arose, which included the lack of readiness of teachers for this type of activity and the lack of scientific-methodical developments in this direction.

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病毒性丙型肝炎患者的肝外表现

**EXTRAHEPATIC MANIFESTATIONS IN PATIENTS
WITH VIRAL HEPATITIS C**

Rakhimova Visolakhon Shavkatovna

Tashkent Institute of Advanced Medical Studies Department of Infectious Diseases

Egamova Intizor Normuxammadovna, Sharipova Iroda Pulatovna

Scientific Research Institute of Virology

注解 目前,慢性丙型肝炎与各种肝外表现的关联正在成为局部。感染的广泛性使其难以及时诊断和治疗。冷球蛋白在肝外表现的发病机制中具有决定性的重要性。

关键词: 冷球蛋白, 慢性病毒性丙型肝炎, 肝外表现。

Annotation. *Currently, the association of chronic hepatitis C with various extrahepatic manifestations is becoming topical. The generalized nature of the infection makes it difficult to timely diagnosis and treatment. Cryoglobulins are of decisive importance in the pathogenesis of extrahepatic manifestations.*

Key words: *cryoglobulins, chronic viral hepatitis C, extrahepatic manifestations.*

Introduction. Viral hepatitis C is an actual problem of modern hepatology. Intensive study of HCV has been conducted since 1989, after a group of researchers led by prof. Houghton, was isolated the gene of the causative agent of the disease. Occupying a modest place in the etiological structure of acute viral hepatitis, it is leading in the development of chronic forms of liver damage, leading further to cirrhosis and hepatocellular carcinoma (from 50 to 80%) [1,4,8].

From the current point of view, mixed cryoglobulinemia (CG) is considered as a specific marker of chronic viral hepatitis C (CVHC) [1,7].

Viral hepatitis C is increasingly seen as a stimulator of cellular lymphoproliferative disorders, such as mixed cryoglobulinemia and non-Hodgkin lymphoma. Cryoglobulinemia after its first mentioning by M. Wintrobe and M. Buell (1933) constantly attracts the attention of researchers. Of particular interest to the study of this problem has arisen in recent years, when a close relationship was established with cryoglobulinemia (according to the classification of J. Brouet, 1974; Chernokhvostova, V. G., 1979) with infection with the hepatitis C virus. Since 1990, a large number of Researchers have shown that when mixed KG, antibodies to

hepatitis C virus are detected in 70–91%, serum viral hepatitis C RNA — 71–86%, and in cryoprecipitate — 93% - 99% of patients. [1,2,7,12]

In the pathogenesis of CVHC associated KG, the lymphotropic nature of the hepatitis C virus with the predominant involvement of B-lymphocytes is of crucial importance. The result of the interaction of virus antigens with specific receptors on the surface of B-lymphocytes (the interaction of HCV E2 with B81 lymphocytes is established) is poly / oligo / monoclonal proliferation of B-lymphocytes with increased production of a wide range of autoantibodies, formation of immune complexes, including mixed cryoglobulins creating a substrate of immunopathological reactions - cryoglobulinemic vasculitis, which underlies many systemic clinical manifestations of CVHC, [5,8,11]

The pathogenetic effect of the formation of cryoglobulins for the development of systemic pathology is associated with the formation of circulating immune complexes containing cryoglobulins, their sedimentation in the microvasculature of various organs, with the formation of deposits. As a result of the deposition of deposits on the walls of capillaries, a cascade of pathological reactions is initiated on the activation of the complement system and blood coagulation factors. Capillary microthrombosis and reactive thickening of the vascular basement membrane develops [8, 9, 10].

Clinical manifestations usually develop with the prolonged existence of cryoglobulinemia and high numbers [6,7]. The literature has widely demonstrated the association of CVHS and cryoglobulinemia with pathologies such as purpura, arthralgia, polyneuropathy, membranous proliferative glomerulonephritis, lesions of the gastrointestinal tract, heart, central nervous system, Raynaud, Shegren syndromes, pulmonary pathology, dermatomyositis [3,4,11,12], and the number and severity of clinical manifestations increases with increasing levels of CG [2,3].

Purpose. To study the level of cryoglobulins and the occurrence of extrahepatic manifestations in patients with viral hepatitis C.

Material and methods. The study included patients (n = 60) with chronic viral hepatitis C who were in inpatient and outpatient treatment at the Research Institute of Virology. The observation period is 2018.

Of these, women - 63.3% (n = 38), men - 36.7% (n = 22), the average age is 41.4 ± 2.5 years. Patients were examined: complete blood count, biochemical blood test, blood ELISA with anti-HCV determination, blood PCR with determination of HCV RNA level, virus genotype, abdominal ultrasound, fibroscopic examination of the liver, sedimentation method in 50 patients.

Results. Extrahepatic manifestations associated with cryoglobulinemia were associated with the following clinical manifestations. So the examined patients complained of pain in the joints in 21 cases (35%). Of these, most often, in the ankle joints - 7 (33.3%) and small joints of the hands - 8 (38.0%) people. In 10 (47.6%) patients, a combined joint damage of various localizations was observed, including the elbow, wrist, shoulder, hip joints and small joints of the feet. According to the objective examination, swelling of the joints was observed in 1 (7.6%) patient.

We diagnosed the following disorders of the endocrine organs: 4 cases with diabetes mellitus type 2 were (6.6%). In this case, all patients took sugar-lowering drugs, 2 of them took insulin. 13 patients with chronic hepatitis C in comorbidities was Sjogren's syndrome. In this category of patients, dry skin and dry mouth were observed.

One of the private complaints in patients with CVHS was fatigue syndrome. Cognitive impairment or, as it still has, fatigue syndrome. Many researchers draw parallels between fatigue and clinical and biological hepatic and extrahepatic manifestations [1,5,6].

In our study, cognitive impairment was observed in half of 30 patients (50%). Patients complained of weakness and decreased performance. All patients with fatigue syndrome noted chronic fatigue, headaches, facial pain, sleep disturbances.

When studying the specific complaints of patients with chronic hepatitis C disease, it was established that the highest frequency was observed in patients at stage 3-4 of fibrosis. At the same time, dyspeptic syndrome was most often noted: nausea in 60%, pain in the right hypochondrium in 52.5% was more frequently observed in stage 4 of fibrosis, while patients in stage 1 and stage 2 did not complain of nausea and pain. With the progression of the pathological process, patients report weight loss (54.1%) and, as a rule, complain of poor sleep in 54.1% of cases.

Numerous methods are used today to determine the stage of fibrosis of the liver. One of them is fibroscanning - liver elastography.

Liver fibroscanning is a non-invasive method for assessing liver fibrosis. Which can be considered as an alternative to liver biopsy in case of impossibility of its implementation. The basis of the Fibroscan apparatus is liver elastometry - a method for determining the degree of liver fibrosis using elastic waves. Fibroscopic liver is as follows. Ultrasonic signals are used to measure the speed of propagation of an elastic wave in the liver. Based on the speed, the elasticity of the liver is determined, the result is expressed in kilopascals (kPa) and allows you to estimate the stage of the disease from F0 to F4 using the METAVIR system. The procedure is painless and takes several minutes. The results are displayed on the monitor and recorded in the patient database.

Based on the total index according to the METAVIR scale, the degrees of activity of inflammatory-necrotic changes in the liver were determined.

Patients with fibrosis - stage 1 revealed 15 cases (25%), among this category of patients an increase in the liver was detected only in 3 (20%) patients (2 cm). Patients with stage 2 identified 22 patients (36.6) among these patients, the number of patients with hepatomegaly increased and amounted to 10 (45.5) patients. Patients with 3 and 4 stages of fibrosis were 13 and 10 patients, respectively. Among them, patients with hepatomegaly accounted for 6 (46.1%) and 7 (70%), respectively.

According to liver fibroscanning, a pronounced degree of fibrosis prevailed among patients with CG (F2 -23.3% F3-6.6%, F4-15.0%), while among patients with low or no CG, a high degree of fibrosis was detected in a minority (F0- 25%, F2 - 13.3% F3 - at 5.0%, F4- at 1.6%).

Conclusions. Thus, the data obtained from world literature suggests that one of the main extrahepatic manifestations of CVHC is articular pathology and asthenia syndrome, which can be considered as systemic manifestations of chronic hepatitis C, in the pathogenesis of which cryoglobulins have one of the leading values. CG is more often associated with liver fibrosis, which further determines the prognosis of the disease.

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评估纤维化进展的有创和无创方法测定肝纤维化的比较分析
**COMPARATIVE ANALYSIS OF INVASIVE AND NON-INVASIVE
METHODS FOR THE DETERMINATION OF LIVER FIBROSIS
IN ASSESSING THE PROGRESSION OF FIBROSIS**

Volkova Nadejda Nikolaevna
Egamova Intizor Normuxammadovna
Musabaev Erkin Isakovich
Asilova Muhayo Ubaevna
Sharapov Saidkhon Makhmudhanovich
Scientific Research Institute of Virology
Ministry of Health of the Republic of Uzbekistan

Relevance

In many developing countries, liver disease is among the top five, and cirrhosis and liver cancer are among the top ten causes of death.

Diagnosing and monitoring the dynamics of CKD is one of the most urgent tasks of modern hepatology. The main pathway for the progression of chronic diffuse liver diseases, leading to its damage, is the process of activating fibrogenesis [1, 2, 3, 8, 20].

The main etiological factors in the structure of the pathology of the liver are infections with hepatitis B and C viruses, alcohol abuse and non-alcoholic fatty liver disease. According to WHO experts, hepatitis C is one of the three most socially significant infectious diseases. According to various sources, 130-170 million people are infected with HCV infection in the world, which is about 3% of the world's population [11,12, 14, 17, 19, 22, 23, 25, 26, 27]. The prevalence of infection varies considerably depending on the geographical region and within the studied populations. According to the data of the Research Institute of Virology of the Ministry of Health of the Republic of Uzbekistan, the prevalence of HCV infection in the Republic is up to 5%.

Chronic HCV infection increases the risk of hepatocellular carcinoma by 17 times. Annually, hepatocellular carcinoma develops in 1–5% of HCV-infected individuals, and 20 years after the onset of the disease is registered in 4% of patients. [13, 14, 25].

In patients with diagnosed hepatocellular carcinoma, the risk of death in the first year is 33–53% [28].

The degree of fibrosis is a fairly sensitive non-specific marker of pathological changes in the liver. Over the past decades, the mass of both clinical and experimental studies has been devoted to the evaluation of AF. Attempts have been made to standardize rules for the management of patients with severe fibrosis and central nervous system, and the tactics of using a number of pathogenetic antifibrotic drugs have been determined. However, the issues of the progression of fibrosis remain unresolved, as a prognostic marker of fatal complications and methods for correcting such disorders. In many ways, the results of the research remain rather controversial, which significantly complicates the work of clinicians [2, 3, 16].

A number of authors propose to single out the stage of "reversible cirrhosis of the liver." There is experimental evidence for the reversibility of AF and cirrhosis [4, 15]. The progress achieved has led to the understanding that effective etiotropic and antifibrotic therapy will significantly change the management of such patients and provide a favorable prognosis even with an already developed CK.

The weighty arguments in favor of the need to study liver fibrosis are the following circumstances: patients with severe fibrosis are at high risk of developing complications of cirrhosis and liver cancer [6,7], severe fibrosis affects the effectiveness of the course of treatment, may lengthen the duration of therapy and contribute to the appointment of increased doses drugs [5, 21], and the possibility of reverse development of fibrosis during treatment is the main criterion for the effectiveness of drug therapy [4, 6, 21, 24].

In this regard, early diagnosis, determination of laboratory and genetic markers of fibrosis, development and implementation of minimally invasive, effective and affordable methods for assessing the severity and rate of progression of AF, as well as methods for its correction, are very important for modern practical hepatology [2, 9]. The solution of these problems makes it possible to diagnose the early stages of fibrosis, and therefore, to effectively treat it.

Materials and methods

WFA+-M2BP (M2BPGi) is a new biomarker reflecting liver fibrosis status in hepatitis patients. This biomarker focuses on the presence of glycosylation isomer of a serum protein, M2BP, which has altered glycan structure due to the liver fibrosis progression. M2BPGi is detected by sandwich assay between anti-M2BP antibody and WFA lectin and that value is relating to HCC development and survival in HCV, HBV and non-viral hepatitis patients.

A parallel comparative study of the sensitivity and specificity of the determination of liver fibrosis using transient elastometry and + WFA-M2BP compared with liver biopsy was conducted. TE was performed on the FibroScan apparatus (France). Biopsy was performed using automatic biopsy needles SURECUT-MENGHINI 17G (Japan). Determination of WFA+M2BP: the M2BPGi values were measured using HISCL M2BPGi kit (Sysmex, Kobe, Japan) on fully-automated immunoanalyzer, HISCL-800 (Sysmex). [10].

M2BP levels were indexed by the following equation:

$$\text{Threshold index (COI)} = \frac{([\text{WFA}+\text{M2BP}] \text{ sample} - [\text{WFA}+\text{M2BP}]\text{NC})}{([\text{WFA}+\text{M2BP}]\text{PC} - [\text{WFA}+\text{M2BP}]\text{NC})}$$

if [WFA+M2BP] sample — level of WFA+M2BP in sample, [WFA+M2BP] PC — positive control, [WFA+M2BP]NC — negative control. The positive control was supplied in the form of a calibration solution standardized to obtain a COI value of 1.0 [18].

The relationship between M2BPGi value distribution and the status of liver fibrosis was evaluated in 41 of HCV, 33 of HBV, 49 of Co-infection and 52 of non-viral hepatitis patients. The relationship between clinical findings (this means chronic hepatitis or liver cirrhosis) of each patient and M2BPGi value also analyzed in 62 of HCV patients, 74 of HBV patients, 53 of co-infection patients and 54 of non-viral patients. The M2BPGi value in each criteria (criteria means such as liver fibrosis stage, liver disease statement) was statistically analyzed by Wilcoxon test.

Results and discussion

In this study, it was possible to simultaneously conduct parallel testing of fibrosis indicators using TE and biopsy (Table 1). According to the liver biopsy, the patients ranked as follows: with 0 degree 32, with 1 degree 47 and with 2nd degree 31, with 3rd degree 31 and with 4th degree - 1. According to TE, patients were distributed as follows with 0 degree - 26, from the 1st 33, from the 2nd 22, from the 3rd - 12 and from the 4th degree - 18. A certain discrepancy of indicators is noted.

*Table 1.
The distribution of patients with varying degrees of fibrosis according to the results of TE and + WFA-M2BP testing*

Degree of liver fibrosis	TE					
+WFA-M2BP	0	1	2	3	4	Total
0	19	8	4	1		32
1	6	25	6	6	4	47
2	1		12	5	13	31
4					1	1
Total	26	33	22	12	18	111

Of the total number of patients, we managed to assess the degree of liver fibrosis in 31 patients using a liver biopsy and conduct a comparative assessment (Table 2)

Table 2.

The distribution of patients with varying degrees of fibrosis according to the results of TE, + WFA-M2BP and liver biopsy

Degree of liver fibrosis	TE				Total
+WFA-M2BP	0	1	2	3	
0	6	1		1	8
1	2	8	2	2	14
2	1		7	1	9
Total	9	9	9	4	31

According to the data from Table 2, after a comparison with liver biopsy, discrepancies between the index were significantly reduced, although an underestimate of liver fibrosis is characteristic for + WFA-M2BP, and an overestimation for TE. Then a comparison was made with the biopsy data, based on the evaluation of residual indicators (residual indicators after subtracting the index of the studied methods from the index of liver biopsy) (Table 3).

Table 3.

The distribution of indicators of liver fibrosis according to TE and + WFA-M2BP from the index of liver biopsy

+WFA-M2BP	TE						Total
	-2	-1	0	1	2	3	
-3	1	1					2
-1		1		1			2
0		1	7	1		1	10
1			1	3	1		5
2			1	1	7	1	10
3						4	4
Total	1	3	9	6	8	6	33

As can be seen from table 3, exactly the coincidence (indicator 0) is observed in both methods only in 7 cases, with TE, the match is 9 out of 33 cases, for the indicator + WFA-M2BP 10 out of 33. The discrepancy by 1 degree of fibrosis with TE is 9 cases out of 33, for + WFA-M2BP 7 cases out of 33. Discrepancy of 2 degrees or more with TE is 15 cases out of 33, for + WFA-M2BP 16 cases out of 33. Also, TE is characterized by an overestimation of liver fibrosis (curve to the left of the indicator 0), for the indicator + WFA-M2BP, a characteristic shift to the right is seen, which indicates an underestimation of the index of fibrosis Cheney (Fig. 1).

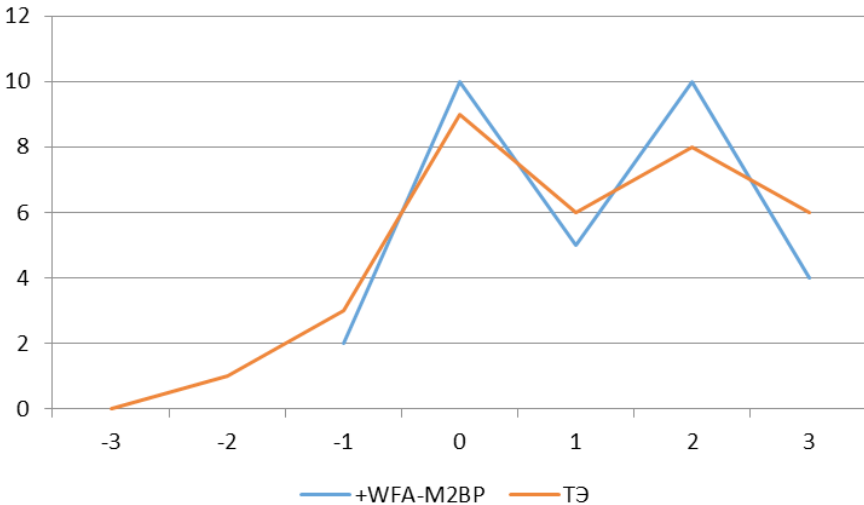


Fig. Graphic distribution of residual indicators of TE and + WFA-M2BP

A small number of patients with liver biopsy does not allow for an assessment of the accuracy of the TE and + WFA-M2BP methods compared to liver biopsy. But based on the obtained data, taking into account the error of the study, we can conclude that both compared tests are identical with each other, with a certain shift of the TE index towards the overestimation of the index and + WFA-M2BP towards an understatement, but both tests have a sensitivity indicator and specificity of 95% and 71 % respectively ($p < 0.05$).

The M2BPGi value was increased according to progression of the liver fibrosis stage in each disease. M2BPGi value (median) in mild fibrosis stage (F0 and F1), moderate fibrosis stage (F2 and F3) and severe fibrosis stage (F4) were 0.87, 2.00 and 6.56 in HCV patients, respectively. In case of HBV and non-viral patients were 0.67 and 0.77 in mild fibrosis stage, 0.92 and 1.07 in moderate fibrosis stage and 0.69 and 3.16 in severe fibrosis stage patients, respectively. Our data also showed similar result as other researchers reported. In case of co-infection patients, the M2BPGi values in mild, moderate and severe fibrosis stage were 1.11, 1.73 and 2.68, respectively, then these values are statistically higher than those of HBV patients. Additionally, the relationship M2BPGi value and disease progression (means from chronic hepatitis to cirrhosis) also investigated by each etiology. The median values of M2BPGi between chronic hepatitis and cirrhosis patients were significantly different. As we expected, the M2BPGi values in co-infection patients were almost the same as that of HCV patients.

Conclusion

We newly found that the M2BPGi value in co-infection patients was higher than that of HBV patients, and almost the same as that of HCV patients. If the M2BPGi value shows the prognosis in hepatitis patients, this is well concord with the clinical knowledge that the prognosis in co-infection patients are worth than HBV patients.

Therefore, this new biomarker would have the potential for clinical use, such as prognosis prediction and monitoring in co-infection patients and it will be revealed in further investigation.

For screening, initial examination and further monitoring of the state in dynamics, it is advisable to use non-invasive diagnostic methods. Among non-invasive methods, the serum marker of fibrosis M2BPGi has a high certainty, sensitivity and specificity. This approach can be reliably used for the first-line assessment of fibrosis in HCV-infected patients prior to the start of treatment with antiviral drugs, as well as for monitoring the dynamics of the liver condition against the background of antiviral treatment.

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阴道微生物群作为支气管哮喘母亲所生儿童过敏性疾病早期发病的表现遗传因素

**VAGINAL MICROBIOTA AS AN EPIGENETIC FACTOR
OF EARLY DEBUT OF ALLERGIC DISEASES IN CHILDREN BORN
FROM MOTHERS WITH BRONCHIAL ASTHMA**

Kosenkova Tamara Vasilievna

Doctor of Medical Sciences, Full Professor

National Medical Research Center named after V.A. Almazov

St. Petersburg

Novikova Valeria Pavlovna

Doctor of Medical Sciences, Full Professor

*St. Petersburg State Pediatric Medical University of the Russian
Federation*

St. Petersburg

Lavrova Olga Voldemarovna

Doctor of Medical Sciences, Full Professor

*First St. Petersburg State Medical University named
after Academician I.P. Pavlov*

St. Petersburg

Boitsova Elena Aleksandrovna

Postgraduate at the Department of Pediatrics

National Medical Research Center named after V.A. Almazov

St. Petersburg

注解 接触母体细菌(肠,皮肤,阴道,口腔,子宫,羊水等)。在自然分娩过程中,新生儿的皮肤,呼吸道,泌尿生殖道和肠道产生稳定的微生物群落。妊娠期的特征是阴道微生物群落的同质性及其稳定性。这有助于形成新生儿的正常微生物群落,并在产后期间在儿童中形成过敏病理学方面是阴道微生物群的保护作用。妊娠的病理过程可以改变母体阴道菌群的性质,结果破坏了婴儿甚至产前微生物的形成过程,这有助于胃肠,皮肤和呼吸系统过敏的早期表现。

关键词 孕妇, 阴道菌群, 儿童过敏性疾病。

Annotation. *Exposure of maternal bacteria (intestine, skin, vagina, oral cavity, uterus, amniotic fluid, etc.) during natural childbirth determines the creation of stable microflora of the skin, respiratory, urogenital tract and intestines of the newborn. The gestational period is characterized by the homogeneity of the microbial community of the vaginal microbiota and its stability. This contributes to the forma-*

tion of the normal microflora of the newborn and underlies the protective effect of the vaginal microbiota in relation to the formation of allergopathology in the child during the postnatal period. The pathological course of pregnancy can change the nature of the maternal vaginal microflora, and, as a result, disrupt the process of the formation of the microbiocenosis in a child even prenatally, which contributes to the early manifestation of gastrointestinal, skin and respiratory allergies.

Keywords. Pregnant woman, vaginal microbiota, allergic diseases in children.

In recent years, there has been noted not only an increase in the prevalence of allergopathology in childhood, but also its early debut (the first days and weeks of life), as well as the weighting of the course and the comorbid nature of the pathology [1, 2, 3]. At the same time, the starting point of the "allergic march" is food allergy (FA), and cow's milk proteins (CMP) are the main allergens in children of the first months and years of life. The formation of food sensitization in children depends on many factors. They can be conditionally combined into 2 large groups - hereditary factors and factors affecting the nature of the child's immune response. Despite the great role of genetic predisposition in the genesis of allergic diseases, only genetic factors cannot explain the increase in the prevalence of allergic reactions to food components. As is known, the environment has an epigenetic effect on the expression of the genes of the immune response in the mother, which in turn can influence the immune response of the child, increasing the risk that hereditary susceptibility to allergic diseases is realized in the disease itself [4, 5, 6, 7].

Important in the development of food allergies in young children is intestinal immaturity and violation of the digestive barrier, which selectively protects the body of the fetus and child from antigens. Changes in colonization of the intestines of newborns can occur due to the pathological course of pregnancy and childbirth, delayed first breastfeeding, supplementation with milk formulas in the first hours and days of life, early transfer to artificial feeding [8, 9, 10, 11]. At the same time, according to many authors, microbiological maladjustment of the newborn is associated with an increased risk of developing diseases such as asthma, obesity, type 1 diabetes, etc. [12, 13].

Initial colonization of the baby's intestines occurs long before the birth under the influence of intestinal, vaginal (*Lactobacillus species*), skin (*Staphylococcus*, *Corynebacteria*), the microflora of the mouth of mother (*Fusobacteriumnucleatum*, *Streptococcussuprofitum*, *Bergeyellasuprofitum*, *Porphyromonasgingivalis*, *Rothiadentocariosa*, *Filifactoralocis*). In this case, the bacteria of the vaginal microbiota are determined both in cord blood, and in the placenta, amniotic fluid, and fetal membranes. In natural childbirth, the bacterial composition of the intestine of a newborn is similar to the maternal one and is closest to the vaginal microbiota of the mother, dominated by such microorganisms as *Bifidobacterium longum*, *infantis*, *Bacteroidetes*, *Lactobacillus species*, *Prevotella*, *Atopobium* [14, 15, 16, 17].

Normal vaginal microflora of healthy women is characterized by a diversity of species composition and includes strict and facultative anaerobes and, to a lesser extent, aerobic microorganisms [18, 19]. A characteristic feature of vaginal microbiocenosis during gestation is not only homogeneity of the microbial community, but also its stability, which prevents not only the spread of ascending infection to the fetal membranes and fetal tissues, but also the risk of premature birth, bleeding in the third trimester of pregnancy, placenta previa, and sometimes antenatal fetal death [20-21]. At the same time, the molecular mechanisms by which the stability of the bacterial community contributes to the physiological course of pregnancy, the realization of protective potential in relation to fetal development, childbirth outcome and the state of health of the newborn are not yet fully established and need further study.

The purpose of the study is to study the nature of the vaginal microbiota in women with moderate bronchial asthma, depending on the characteristics of the course of pregnancy and to determine the influence of the composition of the vaginal microbiota on the debut of allergopathology in children.

Materials and research methods. A total of 37 couples of a pregnant woman and their child were included in the study. The age of pregnant women ranged from 25 to 35 years. Women were enrolled in the 38th week of gestation. Children were observed in the maternity hospital (1, 3, 4 days), then monthly until the child reaches the age of 1 year with the assessment of clinical symptoms. Quantitative and qualitative assessment of the vaginal microflora was carried out by the method of polymerase chain reaction (PCR). In the studied samples, the following indicators were determined by PCR: material collection control (MCC), total bacterial mass (TBM), absolute values of microorganisms with subsequent calculation of relative indicators. □ The absolute values of MBP, MCC and diagnosed microorganisms in the PCR results are presented as a decimal logarithm (lg), which is calculated by the number of the threshold cycle and roughly correspond to the amount of the desired DNA expressed in the equivalent genome in the sample (GE/sample). For a more objective analysis, relative quantitative indicators of the microbiota are calculated, reflecting the number of specific microorganisms in relation to the total bacterial mass. Relative indicators are presented as the difference of the decimal logarithms of the corresponding group of microorganisms and the total bacterial mass. The microorganism content in the values less than -2 was regarded as the proportion of these bacteria in TBM that is less than 1%. Values from -2 to -1, from -1 to -0.4, from -0.4 and above indicated the proportion of microorganisms in TBM 1-10%, 10-40% and more than 40%, respectively.

When evaluating the results of the study, all women were divided into two groups - the main one, in which obstetric-gynecological pathology (vomiting of pregnant women, threatened miscarriage at different periods, gestosis of pregnan-

cy, pre-eclampsia, anemia) occurred, and comparison, in which such pathology were not observed in women. A comparison of the composition of the vaginal microbiota in women whose children had allergic manifestations of the gastrointestinal tract and skin in the first 2-4 weeks (13 women, 35%) and in women, whose children had no signs of allergy was conducted. In addition, the nature of feeding of children in the first days after birth and the composition of the vaginal microbiota were analyzed.

Statistical data processing was performed on a personal computer using licensed computer programs Microsoft Excel 2007 and IBM SPSS Statistics 23. When analyzing the distribution of quantitative data, the average value and the confidence interval were determined. The non-parametric Mann-Whitney criterion was used to calculate the reliability of differences in small samples. The criterion for statistical significance was $p < 0.05$.

The results of the study. In the examined pregnant women, various microorganisms were identified in the vaginal secretions, the main of which are represented by anaerobic microflora.

When studying the nature of vaginal microbiota (VM) in pregnant women, depending on the characteristics of the course of pregnancy, it was found that women with vomiting pregnant (38%) had a change in the composition of the vaginal microflora due to **microaerophilic** (*Gardnerella vaginalis* and *Lactobacillus spp.*) And obligate **anaerobic gram-positive microorganisms** (*Eubacterium spp.*). An increase in the number of *Gardnerella vaginalis* and a decrease in *Lactobacillus spp.* was found, but no significant differences in the content of these microorganisms were obtained.

In the presence of pre-eclampsia (11%), the composition of VM also showed changes, mainly due to representatives of **microaerophilic bacteria** (*Gardnerella vaginalis* and *Lactobacillus spp.*): the content of *Gardnerella vaginalis* significantly increased ($p = 0.032$) and *Lactobacillus spp.* decreased (Differences in the level of *Lactobacillus spp.* ($p = 0.29$) were statistically significant: in pregnant women without preeclampsia: -0.09 (-0.009 ; -0.190) lg GE/sample., compared with pregnant women with developing preeclampsia: -0.3 (-0.97 ; -1.57) lg GE/sample). At the same time, an increase in obligate anaerobic gram-positive microorganisms (*Eubacterium spp.*) Was also noted, however, there was no significant difference in the indices.

In the presence of threatened abortion at various periods (47%), the composition of the VM also showed changes, mainly due to representatives of **microaerophilic bacteria** (*Gardnerella vaginalis*) and **obligate anaerobic gram-positive microorganisms** (*Eubacterium spp.*). At the same time, significant differences were obtained in relation to *Gardnerella vaginalis*, the number of which increased in the main group of patients ($p = 0.039$). Anemia during pregnancy did not reveal significant differences in the composition of the VM in the examined women.

It is known that in normal pregnancy the number of **microaerophilic bacteria** (*Gardnerella vaginalis* and *Lactobacillus spp.*) Is 2: 1 in favor of *Lactobacillus spp.* Studies have shown that with the pathological course of pregnancy (the threat of termination, preeclampsia), these ratios change - the number of *Lactobacillus spp.* mainly decreases, and *Gardnerella vaginalis* increases. Consequently, a change in the ratio of the main microaerophilic bacteria of the vaginal secretion in favor of *Gardnerella vaginalis* may be a prognostic criterion suggesting that a change in the biocenosis of the vagina of a pregnant woman will result in impaired development of the intestinal microbiota of the fetus and child, whose microbiota is similar to the maternal and most close to the vaginal microbiota of the mother with the dominance of such microorganisms as *Bifidobacterium longum*, *infantis*, *Bacteroidetes*, *Lactobacillus species*, *Prevotella*, *Atopobium* [14, 15, 16, 17]. And a change in the intestinal microbial landscape of a child can be the trigger that will commence the early debut of allergic diseases.

To test this hypothesis, we analyzed the composition of the vaginal microbiota and the age of the first intestinal and skin manifestations of allergy in children. When studying the obtained data, it was found that mothers of children whose skin manifestations of allergy debuted in the first 4 weeks of life, as a part of the vaginal microflora, had a reduced number of **microaerophilic bacteria** (*Lactobacillus spp.* ($P = 0.025$)) and an increased number of **obligate anaerobic gram-positive microorganisms** (*Gardnerella vaginalis* / *Prevotella bivia* / *Porphyromonas spp.*, *Eubacterium spp.* And *Megasphaera spp.* / *Veilonella spp.* / *Dialister spp.*), but significant differences were obtained only for *Eubacterium spp.* ($P = 0.025$).

In addition, we analyzed the composition of the VM of pregnant women with a gestational age of 36-38 weeks and the need to supplement with an adapted mixture of the child in the hospital in the first days of life. Studies have shown that vaginal microbiota in mothers whose children adapted prepared mixture in the hospital, there was increase in amount of **microaerophilic bacteria** (*Gardnerella vaginalis*) and **obligate anaerobic gram-positive microorganisms** (*Mobiluncus spp.*/*Corynebacterium spp.*), But significant differences were obtained for only *Mobiluncus spp.* /*Corynebacterium spp.* ($p = 0.044$).

Consequently, the vaginal microbiota of a pregnant woman can be a criterion for predicting lactation in the expectant mother, since an excess of these microbial communities can trigger the prostaglandin cascade, which determines not only the onset and development of parturition activity during any period of pregnancy [22, 23], but also, possibly, the nature (onset, duration) of lactation after birth, which is also very important for the vertical formation microbiota intestines of the child and may contribute to the early manifestation of the clinical symptoms of allergic diseases.

Thus, the studies performed suggest that:

✓ in pregnant women suffering from bronchial asthma, the identified vaginal microbiota is represented by normal flora (*Lactobacillus species*), as well as by a large variety of mainly anaerobic microorganisms;

✓ the greatest influence on the nature of the vaginal microbiota was rendered: the threat of abortion on various terms, as well as pre-eclampsia. If a pregnant woman was threatened or pre-eclampsia was observed, a decrease in the content of the *Lactobacillus* species and an increase in the *Gardnerella vaginalis* was observed in the subjects;

✓ normoflora (*Lactobacillus species*) and the anaerobic representative of the vaginal microflora (*Gardnerella vaginalis*) turned out to be the most sensitive to changes in the nature of the course of pregnancy ;

✓ in children born by mothers with bronchial asthma, with early manifestation of gastrointestinal and skin allergy symptoms (up to 4 weeks) there was a decrease in *Lactobacillus spp.* and increase of *Eubacterium spp.* ;

✓ at the 36-38th week of gestation in the vaginal microbiota of mothers whose children received the adapted mixture in the maternity hospital, there was an increase in the number of *Mobiluncus spp./Corynebacterium*, which can be regarded as a prognostic criterion for breast milk deficiency and the need for early use of infant formula;

✓ in pregnant women suffering from bronchial asthma, the threat of interruption and preeclampsia can be considered as epigenetic factors that, by altering the vaginal microbiota, can adversely affect the vertical development of the child's microbiome and contribute to the early manifestation of skin allergies;

✓ vaginal microbiota is a sensitive marker of microbiological disadaptation of the child and the early implementation of the clinical symptoms of allergy;

✓ as a prognostic marker of early implementation of atopic diseases in children, you can use the change in the ratio of *Lactobacillus species* and *Gardnerella vaginalis* (in favor of increasing the latter) in the vaginal secret of their mothers with gestational age of 36-38 weeks.

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细胞因子失衡在儿童龋病发病机制中的作用
CYTOKINE IMBALANCE IN THE PATHOGENESIS OF CARIES IN CHILDREN

Milekhina Svetlana Alekseevna

Candidate of Medical Sciences, Associate Professor

Gafurov Rakhim Shukurovich

Ivanova Yuliya Olegovna

Kharitonova Veronika Alekseevna

students

Pacific State Medical University

抽象。 研究的相关性。 龋齿是人类最常见的疾病之一，显着影响健康的状态。 根据研究材料，俄罗斯儿童人口中的牙齿发病率多年来一直很高 (Kuzmina E.M., 2010;Virabov KS, 2014;Mikhalchenko AV, 2014)。 许多研究人员认为，在纸张中的炎症过程的发展是与微生物的影响相关联 (Leontyev V.K. 等人 (1992))。 2007年，莫斯科夫斯基A.B., 2009年)。 临床和实验研究证实先天和/或适应性免疫受损因素与龋过程强度之间的关系 (Kiselnikova L.P., 2010;Markelova E.V., 2012)。

检查包括6-14岁的患者诊断为龋齿 (104人) 和健康的儿童完好的牙齿 (10人)。

根据牙科检查的结果，孩子们被分为两个主要群体: 消毒和不消毒。 根据 T.F.Vinogradova分类估计龋齿强度。 唾液是研究的材料。 使用“R&DDiagnostics Inc.”对促炎细胞因子IL-1 β 白细胞介素和抗炎细胞因子IL-10、IL-13进行了测定。“美国试剂和三明治-elisa的变化。 当地生产和分泌的细胞因子的口腔细胞的儿童龋齿的激活透露与增加的比例的促和抗炎细胞因子(白细胞介素-1 β /白细胞介素-10)。 IL-10和IL-13的Hyperproduction执行保护性-适应性作用，增强体液免疫和抑制细胞介导的反应。 IL-1 β /IL-10的促炎系数增加超过1.5可用作亚补偿龋齿的额外诊断标准。

关键词: 龋齿

唾液中的细胞因子

儿童

Abstract. *The relevance of research. Dental caries is one of the most common diseases of mankind, significantly affecting the state of health. According to research materials, the dental incidence among the children's population of Russia remains very high for several years (Kuzmina E.M., 2010; Virabov KS, 2014; Mikhalchenko AV, 2014). Many researchers believe that the development of the inflammatory process in the pulp is associated with the influence of microorganisms*

(Leontyev V.K. et al., 2007, Moskovsky A.B., 2009). *Clinical and experimental studies confirm the relationship between impaired factors of innate and / or adaptive immunity and the intensity of the carious process* (Kiselnikova L.P., 2010; Markelova E.V., 2012).

The examination included patients aged 6–14 years diagnosed with caries (104 people) and healthy children with intact teeth (10 people). According to the result of the dental examination, the children were divided into two main groups: sanitized and not sanitized. The intensity of caries was estimated in accordance with the classification of T.F. Vinogradova. Saliva was the material of the study. The determination of the pro-inflammatory cytokine IL-1 β interleukin and the anti-inflammatory cytokines IL-10, IL-13 was carried out using "R & D Diagnostics Inc." USA reagents and by sandwich-variation of ELISA. The activation of local production and secretion of cytokines by the oral cells of children with caries was revealed with an increase in the ratio of pro- and anti-inflammatory cytokines (IL-1 β / IL-10). Hyperproduction of IL-10 and IL-13 performs a protective-adaptive role, enhancing humoral immunity and inhibiting cell-mediated reactions. An increase in the pro-inflammatory coefficient of IL-1 β / IL-10 by more than 1.5 may serve as an additional diagnostic criterion for subcompensated caries.

Keywords: Caries cytokines in saliva children

Caries is the most common pathology of the teeth. The disease is still diagnosed among both children and adults. The dependence of prevalence of caries on age is scientifically confirmed. More often affects the teeth of people at a young age. The development of the pathological process begins immediately after teething. 90% of children with temporary teeth and almost 80% of high school graduates have caries at different stages of development [2, 4, 3].

Saliva plays an important role in maintaining oral homeostasis. Caries-resistance and caries-susceptibility largely depend on qualitative and quantitative changes in saliva, the nature of salivation, and pH. Microorganisms contained in dental plaque stimulate the production of cytokines, in turn, pro-inflammatory cytokines increase the permeability of the oral tissues, which is important in the pathogenesis of caries. However, there is no consensus on the role of pro- and anti-inflammatory cytokines in the development of caries. The permeability of enamel of temporary and permanent unformed teeth is much higher than the permeability of permanent formed teeth. In the earliest stages of caries, the enamel permeability increases dramatically (especially for temporary teeth). Enamel permeability increase is a sign of progressive demineralization of hard tooth tissues, but due to this property a reverse process develops - remineralization, which contributes to the caries suspension [1, 5].

In solving the problem of caries a significant place is given to the most important physiological property of enamel - permeability. This property of enamel depends on the characteristics of its structure and the chemical composition of the hardest, highly mineralized tissue that is not capable of regeneration. Permeability increases with caries already in the stage of a chalky spot, i.e. at the earliest stage of the pathological process (focal demineralization). The permeability of enamel for inorganic and organic substances is different. Calcium and phosphorus slowly penetrate the enamel and never overcome enamel-dentin connection. Organic matter penetrates the hard tissues of the tooth much faster. The permeability of an enamel of temporary and permanent unformed teeth is much higher than the permeability of permanent formed teeth. In the earliest stages of caries, the enamel permeability increases dramatically (especially temporary teeth). Enamel permeability increase is a sign of progressive demineralization of hard tooth tissues, but due to this property a reverse process develops, remineralization, which helps to stop caries [3,6, 7].

Saliva plays an important role in maintaining oral homeostasis. Caries-resistance and caries-susceptibility largely depend on qualitative and quantitative changes in saliva, the nature of salivation, and pH. Microorganisms contained in dental plaque stimulate the production of cytokines, in turn, pro-inflammatory cytokines increase the permeability of the oral tissues, which is important in the pathogenesis of caries. However, there is no consensus on the role of pro- and anti-inflammatory cytokines in the development of caries.

The aim of the study was to examine the level of pro-inflammatory (IL-1 β) and anti-inflammatory cytokines (IL-10, IL-13) in the mixed saliva of children, depending on their dental status.

Materials and methods

During the period of in-depth inspection, a dental examination of practically healthy children directed by a pediatrician was conducted. The examination included patients aged 6-14 years with an established diagnosis of caries (main group - 104 people) and healthy children with intact teeth (control group - 10 people). According to the result of the dental examination, the children were divided into two main groups: sanitized (33 people) and not sanitized (71 people). The intensity of caries was estimated in accordance with the classification of T.F. Vinogradovoy. The condition of the teeth of children of the 1st group corresponded to the I degree or to the compensated form of caries with single carious lesions. KPU, KPU + kp, kp are equal from 1 to 3. Children of the 2nd group (71 people) had multiple caries (II degree of caries). KPU, KPU + kp * are equal from 10 to 20, which corresponded to the subcompensated form of caries.

Saliva was the material of the study. Mixed saliva was obtained on an empty stomach, in the morning after rinsing the mouth with an isotonic (0.9%) solution of sodium chloride. After transportation, the saliva was frozen at $t = -76^{\circ} \text{C}$ until the time of the study.

Determination of the pro-inflammatory cytokine interleukin IL-1 β , anti-inflammatory cytokines IL-10, IL-13 was performed using specific reagents from "R & D Diagnostics Inc." USA and preformed by sandwich-variation of enzyme-linked immunosorbent assay. The results were recorded using an "Multiscan" immunoassay analyzer (Finland). The number was expressed in pg/ml. Statistical processing of the material was carried out using descriptive statistics methods. Results are presented as arithmetic mean (M) and confidence interval (σ). The significance of differences between groups was calculated using Student's criterion.

Results and discussion

When assessing the cytokine profile of mixed saliva in children with caries, it was established that the level of all investigated cytokines is statistically significantly higher than in the control group (Table 1).

At the same time, the ratio of pro- and anti-inflammatory cytokines (IL-1 β / IL-10) also increased by more than 2 times (1.97 ± 0.60 versus 0.46 ± 0.13 ; $p < 0.005$).

When children were divided into two main groups (sanitized and in need of treatment), an increase in IL-13 was recorded in the saliva of children of the 2nd group (see Table 1). The content of IL-1 and IL-10 on average differed little, however, when calculating the individual ratios of these cytokines, a significant increase in IL-1 β / IL10 was found in children in need of treatment for caries. This confirms the opinion of most researchers (Markelova E.V. et al., 2012) about the need to study not only the level of cytokines with different functional properties, but also their ratios, which makes it possible to assess the relative deficit or hyperproduction of the mediators under study.

Table 1
Cytokine profile of mixed saliva of children with caries [1]

№ p/p	Groups	Studied indicators (M \pm σ) PG / IL			
		IL-1 β	IL-10	IL-13	IL-1 β / IL10
1	The control group (healthy children with intact teeth) n = 10	25,27 \pm 5,51	167,22 \pm 50,07	61,31 \pm 28,09	0,46 \pm 0,13
2	Total group of children with caries n = 104	61,08 \pm 5,21***	457,63 \pm 84,89***	144,35 \pm 64,68**	1,97 \pm 0,60***
3	Children with caries (sanitized) n = 33	57,11 \pm 8,06***	429,77 \pm 149,24**	105,08 \pm 77,26*	0,54 \pm 0,16 p2-p3 < 0,01
4	Children with caries (not sanitized) n = 71	63,53 \pm 6,60***	469,65 \pm 103,00***	162,34 \pm 18** p3-p4 < 0,01	2,62 \pm 0,85** p2-p4 < 0,01 p3-p4 < 0,001

Note: the statistical significance of differences with the control group: $p < 0.05$ - *, $p < 0.01$ - **, $p < 0.001$ - ***, p1, p2, p3, p4 - compared groups.

[2] The intensity index reflects the degree of affection of the teeth by the caries of one child. In the permanent bite, the KPU index is calculated, in the replaceable one, $KPU + kp$ is calculated, where K - carious permanent teeth; P - filled permanent teeth; U - permanent teeth removed; k-carious temporary teeth; p - filled temporary teeth.

Accordingly, the relative hyperproduction of the proinflammatory cytokine IL-1 β was determined in not sanitized children with caries in saliva. One of the main properties of IL-1 is the ability to stimulate the activity of many types of leukocytes and lymphocytes during inflammation and immune response. It enhances the expression of contact molecules on endothelium cells (ICAM-1, VAMAM-1, E-selectin), activates osteoclasts, which contributes to the enhancement of bone permeability and resorption (Popova EV, 2018).

A subsequent analysis in which each group of children was distributed according to the degree of tooth damage into 2 subgroups: with compensated and subcompensated caries, allowed us to establish a number of regularities. The research results are presented in Table. 2

We did not reveal statistically significant differences in the level of IL-1 β in the saliva of children of the compared groups. While the content of IL-10 was significantly different. Its level in saliva was higher with a compensated course of caries both in the group of sanitized children and in the group in need of treatment (Table 2). In sanitized children with subcompensated caries, the content of IL-10 in saliva did not differ from its level in the control group ($p > 0.05$). IL-10 overproduction, with a level of about 1000 pg / ml, was recorded in children with untreated compensated caries. IL-10 is produced by macrophages and regulatory T-cells (Milekhina S.A. et al., 2012), inhibits the function of monocytes / macrophages, secretion of pro-inflammatory cytokines IL-1,6,8,12, TNF α , IFN γ by various cells. In the experiment, it was shown that IL-10 inhibits bone resorption in bone marrow cell culture (Owens J.M. et al., 1996). This is confirmed by an estimate of the ratio of IL-1 β / IL-10. With compensated caries, their ratio was close to the control values (see Table 2). With subcompensated caries, both in sanitized and especially in not sanitized children, its index increased, which statistically significantly confirms the role of cytokine regulation disorders in the pathogenesis of caries. To assess the contingency of the progressive course of caries and the ratio of IL-1 β / IL-10 χ^2 . was used. The analysis made it possible to establish that an increase in the coefficient of more than 1.58 may serve as an additional immunological criterion for the subcompensated course of caries.

Table 2
Indicators of cytokine profile of mixed saliva depending on the intensity of caries

№ p/p	Cytokines investigated (M ± σ)	Groups of children with caries			
		sanitized (n = 33)		not sanitized (n = 71)	
		compensated n = 26 (p1)	subcompensated n = 7(p2)	compensated n = 29 (p3)	subcompensated n = 42 (p4)
1	IL-1β pg/ml	53,50 ± 9,58***	65,72 ± 11,50*	68,95 ± 12,54**	63,51 ± 7,93**
2	IL-10 pg/ml	439,31 ± 186,53** p1-p2 < 0,05	166,82 ± 63,33 p2-p3 < 0,001	1011,91 ± 258,85*** p1-p3 < 0,05 p3-p4 < 0,001	288,90 ± 86,35* p1-p4 < 0,05 p2-p4 < 0,05
3	IL-13 pg/ml	115,34 ± 93,64* p1-p2 < 0,05	58,11 ± 40,65 p2-p3 < 0,05	276,12 ± 232,74** p1-p3 < 0,05 p3-p4 < 0,05	105,45 ± 54,32* p1-p4 < 0,05 p2-p4 < 0,01
4	IL-1β/IL-13	0,40 ± 0,13 p1-p2 < 0,05	0,95±0,44* p2-p3 < 0,05	0,51 ± 0,30 p1-p3 < 0,1 p3-p4 < 0,001	3,36 ± 1,12*** p1-p4 < 0,001 p2-p4 < 0,01

Note: the statistical significance of differences with the control group: p < 0,05 - *, p < 0,01 - **, p < 0,001 - ***;

p1 - children sanitized with compensated caries;

p2 - children sanitized with subcompensated caries;

p3 - children not sanitized with compensated caries;

p4 - children not sanitized with subcompensated caries.

The findings suggest that the anti-inflammatory cytokine plays an important protective role in preventing an increase in caries activity. IL-13 is an anti-inflammatory cytokine that is produced by activated T lymphocytes. It has an inducing effect on the expression of MHC Class II, CD23, CD71, CD72 on B - lymphocytes, activates the expression on monocytes MHC II, CD11b, CD18, CD29, CD49, stimulates the antigen - presenting function of macrophages. IL-13 helps to switch immunoglobulin synthesis from IgM to IgG4 or IgE, inhibits the expression on monocytes FcγR I, II, III and the production of pro-inflammatory IL-1, IL-6, TNFα, G-CSF, GM-CSF by macrophages, induces the synthesis of IFNγ naturally killer cells, but inhibits their response to IL-2 [Clare GM et al., 2004; Luis A. et al., 2006; Srefan Fichtner-Feigl et al., 2005]. When assessing its level in the saliva of children with caries, its decline was found with a subcompensated course in both sanitized and children in need of treatment (see Table 2). This probably reflects the activation of the cell-mediated immunity component in the oral cavity of children with subcompensated caries. Hyperproduction of IL-10 and IL-13 performs a protective-adaptive role, enhancing humoral immunity and inhibiting cell-mediated reactions. We have identified activation of local production and secretion of cytokines by oral cells of children with caries with an increase in the ratio of pro- and anti-inflammatory cytokines (IL-1β / IL-10). An increase in the pro-inflammatory coefficient of IL-1β / IL-10 by more than 1.5 may serve as an additional diagnostic criterion for subcompensated caries.

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乙型肝炎疫苗接种后医护人员免疫体液反应表现的特征
**FEATURES OF THE MANIFESTATION OF THE IMMUNE HUMORAL
RESPONSE IN HEALTH CARE WORKERS AFTER VACCINATION
AGAINST HEPATITIS B**

Mamkeev Eldar Hamzyaevich

*Candidate of Medical Sciences, Associate Professor
Kazan State Medical Academy
branch of Russian Medical Academy
of Continuing Professional Education*

Lokotkova Alla Ilinichna

*Candidate of Medical Sciences, Associate Professor
Kazan State Medical Academy
branch of Russian Medical Academy
of Continuing Professional Education*

Karpenko Luiza Gainutdinovna

*Candidate of Medical Sciences, Associate Professor
Kazan State Medical Academy
branch of Russian Medical Academy
of Continuing Professional Education*

注解 介绍了卫生保健工作者接种疫苗后免疫力的强度,以及接种疫苗后1-3个月,5年或更长时间的保护性抗体水平。确定疫苗接种后保护性抗体的水平。

关键词: 乙肝疫苗接种, 医务人员, 抗HBs的保护水平。

Annotation. *The results of the intensity of post-vaccination immunity in health care workers with a full course of hepatitis B vaccination and the level of protective antibodies in dynamics after 1-3 months, 5 years or more after vaccination are presented. The levels of protective antibodies after revaccination are determined.*

Keywords: *hepatitis B vaccination, medical workers, protective level of anti-HBs.*

The world experience of vaccine prophylaxis accumulated in recent years clearly demonstrates that in those regions where vaccination programs are fully implemented against various infections, the incidence of the population as a whole decreases and a significant economic effect is achieved. In special studies assessing the prophylactic efficacy of immunization against viral hepatitis B (HBV), it

was shown that vaccination leads to a decrease in the incidence of not only acute and chronic forms of disease, but also its terminal stage - hepatocellular carcinoma. In addition, the successful implementation of vaccine prevention programs against HBV of various populations, in particular health workers, illustrated the important role of creating an immune layer to ensure anti-epidemic efficacy, which is the absence of cases. In Russia, medical personnel began to actively vaccinate from 1996-1997. In this regard, at present the opportunity to assess the duration and intensity of post-vaccination immunity and return to the question of the need to introduce planned revaccination is an important task, both from a scientific and from a practical point of view.

Purpose of the study was to assess the intensity of post-vaccination humoral immunity in health care workers (MW) who had undergone a full course of vaccination against hepatitis B with monitoring of the level of protective antibodies in dynamics after 1-3 months, 5 or more years after revaccination.

Materials and methods. In the Republic of Tatarstan, immunization against HB, including MW, began in 1996. However, by the beginning of our studies, the immunological efficacy of vaccination, as well as the duration of preservation of the intensity of immunity against HB in MR, have not been studied. Blood serum was studied in 209 MW of Kazan, immunized against HB vaccines "EngerixB" from Klaxo-Smith Klein and HB-Vax-II from Merk-Sharp and Dome in a dose of 1.0 ml according to standard (0-1-6 months) immunization scheme from 1996 to 2004.

The titers of anti-HBs antibodies, qualitatively HBsAg, and anti-HBc antibodies were determined using Bio-Rad (France) and Vector-Best (Russia) ELISA kits.

The serum of 61 MW revaccinated against HB with "Engerix" vaccine from April to November 2005 was studied in dynamics. In the serum of this MW group, the indication of anti-HBs antibodies was carried out by ELISA with the test system of the "Vector-Best" company after 1-3 months and more than 5 years after the administration of the booster dose. The protective titer was considered to be the titer of anti-HBs antibodies equal to or more than 10 IU/L. Indicators below 10 IU/L were treated as lack of protection against HB.

Statistical processing of the research results was carried out using the methods - Student's t-test and Fisher's exact method.

Results and discussion. When analyzing the distribution of antibodies to the surface antigen in 209 MW vaccinated in 1996-2004. (Table 1) a significant percentage of individuals seronegative by anti-HBs with an antibody concentration less than 10 IU/L - 47.7% (99) was revealed, but with a predominance of individuals with protective antibody titers against HBs.

Table 1*Distribution of anti-HBs antibody titers in MW vaccinated in 1996–2004 in %*

The level of concentration of antibodies to the viral HB envelope antigen	The structure of the titers of anti-HBs antibodies in MW, vaccinated in 1996-2004	
	Abs.Num.	%
Less than 10 IU/L	99	47,4
More than 10 IU/l	110	52,6
Total	209	100

Taking into account that all employees were immunized in different years according to the standard scheme, we analyzed the distribution of anti-HBs antibody titers in MW blood serum depending on the timing of immunization.

Analysis of the distribution of titers of anti-HBs antibodies in serum of MW depending on the timing of immunization allowed us to establish the following (Fig. 1).

Among vaccinated from 1 month up to 1 year after the finished vaccination, the detection rate of anti-HBs in the protective concentration was 94.7%, among those vaccinated for 1-3 years - 76.9%, and among those vaccinated 3-5 years or more - 34.5% and 39, 0% respectively. The percentage of seronegatives, on the contrary, tended to increase from 5.3% among those vaccinated up to 1 year after complete vaccination to 61.0% and 65.1% among those vaccinated from 3-5 years or more, respectively.

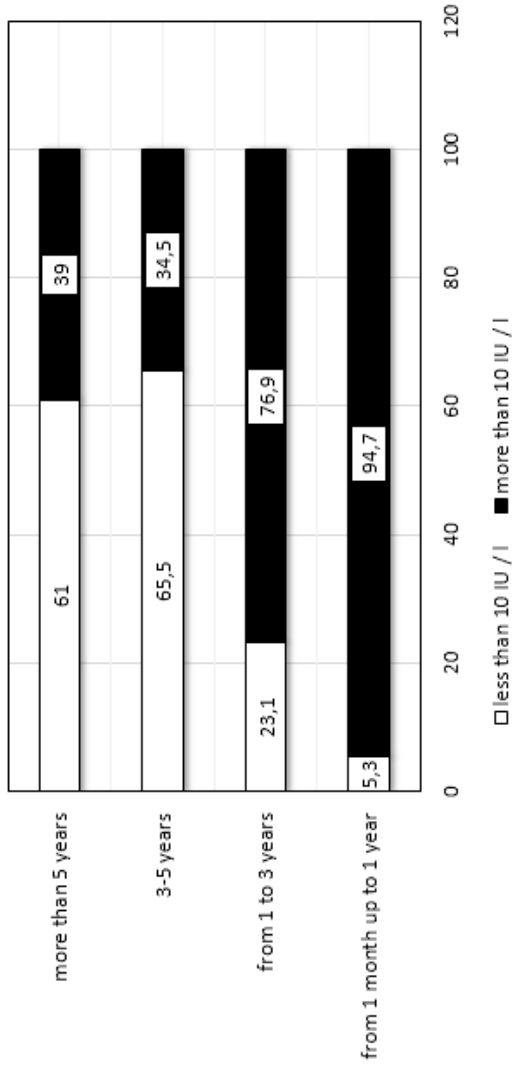
Considering the above, we determined the average duration of immunity (detection of anti-HBs) after a full course of vaccination in MW. Our calculations showed that from the end of vaccination until the time of absence or presence of antibodies below the protective titer (10 IU/l), 5.5 years pass, which necessitates revaccination.

When analyzing the distribution of titers to the surface antigen in MW serum depending on age at the time of the full course of vaccination, the following was obtained:

- Among those aged 20–29 years old, individuals with protective antibody titers against HB were prevalent in 66.7% of cases;
- From the age of 30-39 years, there is already a predominance of persons with the absence of protective antibodies in 67.7%, with preservation of seronegative persons aged 40-49 and 50 years and older in 61.0 and 56.3%, respectively, with a favorable trend of increase in seropositive persons from 32.3% to 43.7%.

Given the high percentage of individuals without a protective level of antibodies (47.4%), and the fact that it takes 5.5 years before the time for the absence or presence of antibodies is below the protective titer, booster was recommended - doses in a volume of 1.0 ml 109 MW hospital. In 61 MW, antibody titers were studied over a period of 1-3 months and more than 5 years after revaccination (Table 2).

The distribution of titers of anti-HBs antibodies depending on the timing of immunization in%



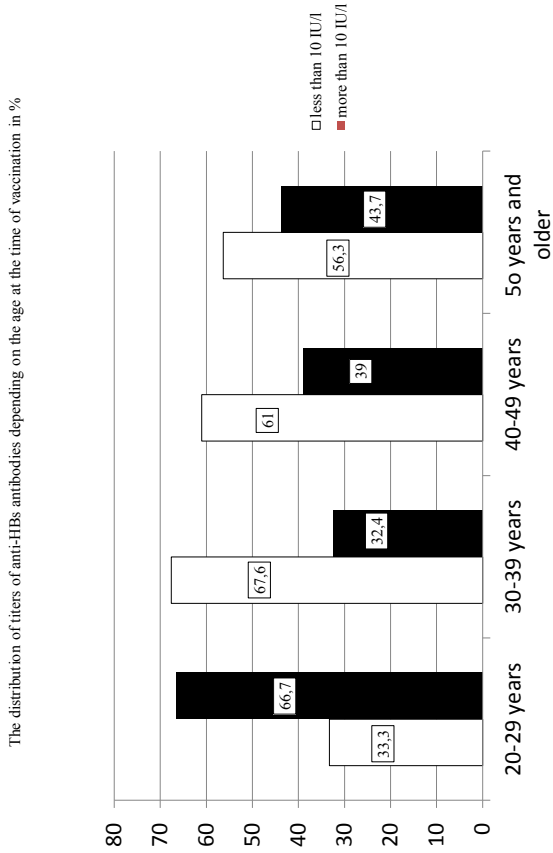


Table 2

The dynamics of the distribution of anti-HBs antibodies in the blood serum of health workers revaccinated against hepatitis B (%)

Antibody Level to HBV Envelope Antigen	Anti-HBs antibody titers in revaccinated health workers 1-3 months after revaccination		Anti-HBs antibody titers in revaccinated health workers more than 5 years after revaccination	
	Abs.Num.	%	Abs.Num.	%
Less than 10 IU/L	26	42,6	9	14,7
More than 10 IU/l	35	57,4	52	85,3
Total	61	100	61	100

1-3 months after revaccination, it was established that out of the total number of MW (61), only 35 (57.4%) had protective antibody titers. At the same time, in 26 MW (42.6%) the antibody titer remained below the protective one.

Analysis of the results of serum antibody display in these employees more than 5 years after receiving the booster dose allowed to establish a statistically significant decrease in the proportion of persons with no protection from 42.6% (26) to 14.7% (9) ($p < 0.001$). Attention is drawn to the distribution of anti-HBs antibodies in 26 MW, in which no antibodies were detected 1-3 months after revaccination. At the same time, more than 5 years later, in most of them (85.3%) antibodies were detected in protective titers.

Under indication of revaccinated MW serum for the presence of HbsAg and anti-HBc antibodies it was found, that over the entire observation period, none of them had HbsAg, while antibodies to the core antigen were detected in a stable manner in 3.3% of cases.

Conclusion. The results of long-term monitoring of the distribution of titers of anti-HBs antibodies in MW, vaccinated and received a single booster dose of HB vaccine, showed that in 47.4% of MW vaccination did not lead to sufficient production of protective antibodies. The decrease in antibodies below the protective level occurred on average 5.5 years after vaccination.

With increasing of MW age, the proportion of individuals with no protective antibodies against viral HB increased. It was shown that after the administration of the booster dose of HB vaccine in almost every second MW (42.6%), antibody titers remained below the “protective” level, but 5 or more years after revaccination, the proportion of seronegative MW decreased to 14.7% with an increase in the number of seropositive individuals.

The hospital staff as a result of vaccine prevention and receiving a single booster dose of HBV did not reveal a single newly registered case of infection by HBV, which indicates the effectiveness of immunization and its role in preventing nosocomial infection

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在雅库特的Setarioses入侵鹿
SETARIOSES INVASION OF DEER IN YAKUTIA

Kokolova Luidmila Michailovna

Doctor of Veterinary Sciences, Head of Helminthology Laboratory

Gavrileva Lubov Yurievna

Candidate of Veterinary Sciences, Senior Researcher

Stepanova Svetlana Maksimovna

Candidate of Veterinary Sciences, Researcher

Dulova Sargylana Vitalievna

Researcher

Yakovleva Svetlana Stepanovna

Postgraduate

Yakutsk Scientific Research Institute of Agriculture after M. G. Safronov

Yakutsk Russia

注解 驯鹿放牧的进一步发展,提高驯鹿放牧的生产力和盈利能力是不可能的,没有可靠的组织和有效的保护国内驯鹿对各种疾病,包括蠕虫感染和botfly入侵,这学习在国内驯鹿在雅库特setariosis目前是非常相关的。腹腔内26野生和156驯鹿的浆液复盖物的蠕虫学研究表明32.8%的网格入侵。根据腹腔helminthological研究的数据, setariosis入侵的扩展性比国内驯鹿血液测试的数据高出4.4%。集中入侵的强度主要是平均 3.3 ± 0.5 规格/头和从3.4到7.2规格/头在某些地区不等。值得注意的是,随着入侵的扩展性的增加,鹿体中setaria种群的密度增加。

关键词: 鹿, 野生, 国内, 塞塔里亚cervi, 鸡蛋, 幼虫, 雅库特。

Annotation. *Further development of reindeer herding, increasing the productivity and profitability of reindeer herding is not possible without reliable organization and effective protection of domestic reindeer against various diseases, including helminth infections and botfly invasions, which cause significant damage to farms that breed domestic reindeer. Studying setariosis in domestic reindeer in Yakutia is currently very relevant. The results of helminthological studies of the serous covers of the abdominal cavity of 26 wild and 156 domestic reindeer indicate 32.8% invasion by grids. Extensiveness of the setariosis invasion according to the data of helminthological studies of the abdominal cavity was 4.4% higher than according to the data of the blood test in domestic reindeer. The intensity of the setariosis invasion was predominantly average — 3.3 ± 0.5 spec/head and ranged in*

certain areas from 3.4 to 7.2 spec/head. It is noted that with increasing extensiveness of invasion, the density of the setaria population in the body of deer increases.

Keywords: deer; wild, domestic, *Setaria cervi*, eggs, larvae, Yakutia.

Introduction

Setarioses are helminthiasis of many mammalian species from the group of filariasis, caused by nematodes of the genus *Setaria* of the family Setariidae, parasitic (mature individuals), liver in the abdominal and thoracic cavities, liver, in the pericardial bag), in the blood (microsetaria). Helminthiasis of many mammalian species, caused by nematodes of the genus *Setaria* of the family Setariidae, parasitic in the abdominal cavity (sexually mature individuals), in the brain and spinal cord, in the eyes (juvenile forms), in the blood (microsetaria). In reindeer, helminthiasis is caused by nematodes of the genus *Setaria* fam. Setariidae, parasitic in the abdominal cavity (sexually mature individuals), in the eyes (juvenile forms), in the blood (microsetaria). In northern deer, these are common in the Far East, in the Altai Mountains and Yakutia [1].

An analysis of the literature indicates that, according to the morphological features, the setarians are not so numerous, and also that mosquitoes of the genus *Aedes*, *Culex*, *Anopheles* and blood-sucking flies — *Haematobia*, *Stomoxys* — play the role of intermediate hosts, and it should also be noted that some authors have met difficulties in defining and differentiating species of the genus *Setaria* in various animals [2, 3].

Materials and research methods

Setarii larvae are detected in the study of smears prepared from peripheral blood. Smears are painted according to Romanovsky-Giemsa. It is desirable to prepare smears in the evening, when the number of microsection in the peripheral blood increases.

Yu.V. Kozlov, A.G. Derevyankina (2011) suggested taking blood from the jugular vein into a glass test tube. Next, add 2–3.5 ml of 0.1% acetic acid to 1 ml of taken blood, keep for 10–15 minutes and microscopically examine the sedimentary liquid.

In addition, a 0.1% solution of acetic acid is not a toxic reagent, and the optimal dose of acetic acid is 3 ml, since with a smaller amount of it does not complete hemolysis of red blood cells, and with more, the larvae of the setaria die.

Purpose of the study – study of nematodes of the genus *Setaria*, peculiarities of their distribution in the reindeer of Yakutia.

Results and discussion

Further development of reindeer herding, increasing the productivity and profitability of reindeer herding is not possible without reliable organization and effective protection of domestic reindeer against various diseases, including helminth

infections and breeder invasions, which cause significant damage to farms that breed domestic reindeer. Studying setariosis in domestic reindeer in Yakutia is currently very relevant.

The organs and tissues of reindeer - the liver, heart, intestines, lungs, eyes, brain are investigated. Incomplete helminthological dissection of organs and tissues of deer according to the Scriabin method [4]. Counting, identification, sex determination and the average intensity of invasion per head (spec./head.). Fixation of sexually mature *Setaria* nematodes found in the organs and abdominal cavity in the Barbagallo solution.

Setariums are distributed with the participation of intermediate mosquito hosts, and blood-sucking flies. The setaries species found in the reindeer - *Setaria cervi*. Mature nematodes of *Setaria cervi* are localized in the abdominal cavity. In the definitive host, the parasites become sexually mature in 224-235 days. Their lifespan is 1.5 years. The pathway of infection is the inoculation of invasive larvae with blood-sucking insects of deer pastures. The maximum intensity of invasion is recorded during the period of flight of the blood-sucking insects. Symptoms in deer are also eye affection; it is possible to carry out an *in vivo* diagnosis of reindeer through blood tests for the detection of micro-satellites.

In the study of the organs and tissues of wild reindeer in Yakutia, *Setaria* - filamentary nematodes, a male with a length of 30–66 mm, and a female of 25–190 mm were found. Anterior end of the body with cuticularized lip-like ornamentation above the head end. Spicules are different, both in shape and size. The tail of the female ends with a cone or spines. Vulva is located in the esophagus. *Setaria* - viviparous nematodes. The microssetaries are covered with a cap.

The results of helminthological studies of serous covers of the abdominal cavity on the serous membrane of the internal organs - the liver of 26 wild and 156 domestic northern ones indicate a 32.8% invasion by the *Setaria*. Extensiveness of the setariosis invasion according to the data of helminthological studies of the abdominal cavity was 4.4% higher than according to the data of the blood test in domestic reindeer. The intensity of the setariosis invasion was predominantly moderate — 3.3 ± 0.5 ind. goal and ranged in some areas from 3.4 to 7.2 spec./head. It was noted that with increasing extensiveness in deer liver, signs of the occurrence of chronically occurring inflammatory processes were observed on the parenchyma of the organ and surface. A connective tissue seal is observed in the liver and overgrowth with the omentum and the serous membrane of the intestine, corneal opacities are also observed, which cause eye lesions and inflammatory processes when eye glands are damaged, causing corneal opacities.

All marked pathological changes are the result of parasitization in the abdominal cavity and eyes by the *Setaria*, the clinical signs of setiosis of domestic reindeer have not been sufficiently studied.

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考虑到地区寒冷气候的马驹和治疗的寄生虫

**PARASITOGENIC ILLNESSES OF FOALS AND TREATMENT
TAKING INTO ACCOUNT THE COLD CLIMATE OF REGION**

Kokolova Luidmila Michailovna

Doctor of Veterinary Sciences, Head of Helminthology Laboratory

Gavriliyeva Lubov Yurievna

Candidate of Veterinary Sciences, Senior Researcher

Stepanova Svetlana Maksimovna

Candidate of Veterinary Sciences, Researcher

Dulova Sargylana Vitalievna

Researcher

Yakovleva Svetlana Stepanovna

Postgraduate

Yakutsk Scientific Research Institute of Agriculture after M. G. Safronov,

Yakutsk, Russia

注解 考虑到地区寒冷气候的寄生虫病预防和治疗痢疾

总结;在雅库特牧业马育种是畜牧业的传统和重要的分支。 马的牛群保养和这种技术在雅库特的发展有助于马的当地雅库特品种的繁殖,以及适应全年牧场和维护美元和北方的恶劣气候。 目前,一个限制因素为提高畜群马育种的生产力是由肠道绞杀引起的疾病,这是广泛在雅库特境内,并造成损害,由于降低生产力和年轻的损失。 文章的作者研究了幼马的感染与strongylats。 为了确定侵袭的季节性动态,每月进行coproovoscopic和幼虫检查研究。 本文还提出了新的方法,用于在远北条件下的驱虫后期,幼马的菌群对蠕虫-细菌病原学的依赖。

关键词: 马驹, 入侵, 季节性动态, Strongylus equinus, Alfortia edentates, Delafondia vulgaris, Strongylidae, dehelminization, dysbacteriosis, 益生菌, 枯草芽孢杆菌。

Annotation. *Prophylaxis and treatment of dysbacteriosis of foals at parasitogenic illnesses taking into account cold climate of region*

Summary; *herd horse breeding in Yakutia is a traditional and important branch of animal husbandry. The herd upkeep of horses and the development of this technology in Yakutia contributes to the breeding of the local Yakut breed of horses, well adapted to year-round pasture and greenback upkeep and to the harsh climate of the north. Currently, one of the limiting factors for increasing the productivity of herd horse breeding are diseases caused by intestinal strangulation, which are widespread in the territory of Yakutia and cause damage due to reduced productivity*

and loss of young. The authors of the article studied the infection of young horses with strongyls. To determine the seasonal dynamics of invasiveness, monthly coproscopic and larvoscopic studies were performed. The article also presents new methods for the dependence of dysbacteriosis of young horses on helminth-bacteriological etiology in the post-worming period in the conditions of the Far North.

Keywords: foals of horse, invasion, seasonal dynamics, *Strongylus equinus*, *Alfortia edentates*, *Delafondia vulgaris*, Strongylidae, dehelminthization, dysbacteriosis, probiotic, *Bacillus subtilis*.

Antigelminthny drug Ekvisekt paste, once at the rate of 0,2 mg/kg of body weight. The experimental group I was treated with Ekvisekt paste, once at a ratio of 0.2 mg/kg body weight. And 6 days after the treatment, the probiotic "Sahabaktisubtil" was administered orally at a dose of 10 ml ($50 \cdot 10^9$ CFU / Bac. Subtilis). The second experimental group was treated with Ekvisekt paste, once at the ratio of 0.2 mg/kg body weight, supplemented for 6 days: oats 0.250 g 1 ml ($50 \cdot 10^9$ CFU / Bac. Subtilis). Experimental group III was treated only with Ekvisekt paste, once at a ratio of 0.2 mg/kg body weight. IV group - 15 heads control. Seasonal dynamics was studied by monthly coproscopic and larvoscopic studies of 209 foals at the age of one year. Freshly isolated horse feces samples were investigated by the flotation method with a saturated solution of sodium chloride according to Fülleborn (1923), a total of 590 samples were studied. To count the number of eggs and larvae in 1 g of faeces, a counting chamber (VIGIS) developed by L.D. Migacheva, G.A. Kotelnikov (1987) was used. For the purpose of differential diagnosis of strongest, larvae were cultivated according to the method of P.A. Velichkina (1967). The species composition was determined using the literature (K.I. Scriabin, N.P. Shikhobalova, R. S. Schulz, 1952). To normalize the intestinal microbiocenosis in the post-de-worming period, the probiotic "Sahabaktisubtil" developed on the basis of *Bacillus subtilis* strains "TNP-3" and "TNP-5", isolated from the frozen soils of Yakutia, and developed in the Yakutsk Scientific Research Institute of Agriculture, was used. The anthelmintic efficacy of the drug was taken into account on the basis of the results of quantitative coproscopic studies using the Fülleborn flotation method and the Barkman method of larvoscopic studies before and after 6, 14 and 20 days after deworming. The number of microorganisms was determined in colony-forming units (CFU) in 1 year, conducted a generic and species identification of selected cultures of microorganisms

Results and Discussion

The research results show that in horses herd keeping in the Republic of Sakha (Yakutia) parasitize 42 strongyles species. The most common strongyles species are *Strongylus equinus*, *Alfortia edentates*, *Delafondia vulgaris*, and numerous species of Trichonematidae. A coprological study of horses revealed *Strongylus equinus* - 44.4%, *Alfortia edentates* - 44.4%, *Delafondia* - 75.0% and Trichonematidae - 100%.

Introduction. Currently, an important scientific and practical interest is the assessment of the use of effective anthelmintic drugs with a wide spectrum of action, and the establishment of optimal terms for their use in basic helminth infections of horses, as well as the study of the effects of their action on the organism of animals. It is also known that the use of anthelmintic drugs for animals does not pass without a trace; along with active helminthocidic actions, they cause functional changes in the organism of animals, as established by research in the field of veterinary medicine. The use of anthelmintic drugs has a negative effect on the normal microflora of the gastrointestinal tract of animals, causes side effects such as endotoxemia, slowing weight gain, increasing pre-implantation mortality, the development of neuroses, it is also established that more than one helminth often parasitizes in an animal, but rather several pathogens that are in complex relationships with each other and with the host organism (Yu.F. Petrov, 1984; I.A. Arkhipov, 2000; O.V. Byakova, S.N. Beloze s, O.O. Skornekova, 2007; S.N. Maksimenko, 2007). To date, the infection of the horses of Yakutia with helminths is 100%, and the species composition is represented by 49 species of helminths (Isakov, S.I., Kokolova, L.M., Grigoriev, V.P., 2000, 2006, 2007). Currently, there is a worldwide interest in the use of natural remedies for animal and human health protection. One of the most widely used drugs in both medical and veterinary practice is biologics, which are based on living microorganisms. Biopreparations based on bacteria-probiotics are ecologically safe, harmless, they are mainly used for the treatment and prevention of gastrointestinal diseases, correction of the intestinal microbial landscape after antibiotic and chemotherapy drugs, are used to stimulate growth and increase the body's natural resistance. In this regard, the development of scientifically based, environmentally safe and effective methods of correction from helminth-bacterial etiology and post-worming dysbacteriosis is an important task of veterinary medicine in the conditions of the Far North.

Purpose of research: to study the peculiarities of the spread of the main stragulation of horses with herd in Yakutia, and based on the results obtained, develop and justify the technology of integrated and environmentally friendly methods of treatment and prevention in Yakutia.

For the research, 60 heads of foals aged up to a year, with a living weight of 35-40 kg, belonging to «Khorobut» Ltd of the Megino-Kangalassky district of the Sakha Republic (Yakutia) were selected. Three experimental groups of 15 animals each and a control group of 15 animals were formed from the examined animals. *Alfortia edentates*, *Delafondia vulgaris* and *Trichonematidae* were used for treatment, and it was showed that the extensiveness of invasion (EI) of the main horse stallation in the Namsky district - 95.0%, Megino-Kangalassky district - 93.1%, Amginsky district - 95.5%, Suntarsky district - 100% and Nyurbinsky district - 100%. The average number of strongyles eggs per 1 g of horse feces varied and

ranged from 21.0 ± 1.24 to 77.6 ± 6.4 spec. The greatest extensiveness (100%) of the strongyles invasion was noted in Amginsky - 77.6 ± 6.4 , Suntarsky 34.4 ± 2.1 and Nyurba 24.7 ± 2.1 copies. in 1 g of faeces. Seasonal dynamics was studied by monthly coproscopic and lavascopic studies of foals at the age of one year. The maximum invasion of *S. equinus* in young animals under the age of one year was observed in November - 80.0%, the minimum in August - 35.7%. The maximum invasion of *A. edentatus* in January is 78.6%, the minimum in November is 46.6%. The invasion of *D. vulgaris*, its peak of extensiveness — reached 86.6% in November and December, and the minimum infection rate was noted in March - up to 66.6%. The extensiveness of horse invasion was 93.8% at the age of one year, with an invasion intensity of 36.7 ± 2.9 ; - up to 2 years - 100% is equal to 40.4 ± 2.8 ; - over 4 years old - 97.2% to 28.3 ± 2.5 spec. in 1 g of faeces. Helminthological autopsy of the digestive tract of 35 foals up to a year showed 100% invasion by strongyles. The strongyles population density in young animals was 1036.8 ± 20.1 ind. and ranged from 772.8 ± 37.5 to 1067.5 ± 108.5 spec/head. As a result of microbiological studies of faeces of foals before experiments and treatment, the indicators of MAFANM are $1.5 \pm 0.1 \cdot 10^5$ CFU/g; low growth of bifidobacteria, lactobacilli - $1.4 \pm 0.1 \cdot 10^4$ CFU/g; non-pathogenic staphylococci - $5.7 \pm 0.2 \cdot 10^4$ CFU/g; lactose-negative *Escherichia* - $4.7 \pm 0.1 \cdot 10^3$ CFU/g; lactose-negative *Escherichia* - $4.7 \pm 0.1 \cdot 10^5$ CFU/g, the absence of lactose-positive *Escherichia*, an intensive growth of mold fungi of the genus *Mucor ramosissimus*. As a result of the experiment performed with the use of the probiotic "Sahabaktisubtil" per os with deworming with the drug Ekvisekt paste microbiocenosis of foals in foals showed that the number of MAFANM CFU/g is $2.4 \pm 0.1 \cdot 10^5$; lactobacilli - $4.3 \pm 0.2 \cdot 10^4$ CFU/g; lactose-positive *Escherichia* - $3.6 \pm 0.2 \cdot 10^4$ CFU / g; lactose-negative - $2.03 \pm 0.1 \cdot 10^5$ CFU / g; non-pathogenic staphylococci - $1.04 \pm 0.1 \cdot 10^6$ CFU/g; pathogenic staphylococci - $3.4 \pm 0.2 \cdot 10^2$ CFU/g; moderate growth of bifidobacteria is observed. Mold and toxigenic fungi were not sown. In the study of intestinal microbiocenosis after carrying out deworming with Ekvisekt and feeding oats with the "Sahabaktisubtil" probiotic, it was established that the number of MAFANM was $3.7 \pm 0.2 \cdot 10^5$ CFU/g; lactobacilli increased to $3.1 \pm 0.2 \cdot 10^4$ CFU/g; lactose positive *Escherichia* - $1.02 \pm 0.1 \cdot 10^6$ CFU/g; non-pathogenic staphylococci - $3.5 \pm 0.2 \cdot 10^5$ CFU/g; marked intensive growth of bifidobacteria; however, the number of lactose-negative *Escherichia* has decreased to $2.9 \pm 0.2 \cdot 10^4$ CFU/g; pathogenic staphylococci became - $3.2 \pm 0.2 \cdot 10^2$ CFU/g; mold and toxigenic fungi were not sown. In the study of intestinal microbiocenosis after carrying out deworming with Equisect without the use of probiotics and feeding with oats with probiotics, they showed: the growth of MAFANM to $3.5 \pm 0.2 \cdot 10^5$ CFU/g; intensive growth of bifidobacteria; at the same time, the number of lactose-negative *Escherichia* decreased to $5.4 \pm 0.1 \cdot 10^4$ CFU/g; pathogenic

staphylococci - $5.1 \pm 0.1 \cdot 10^5$ CFU/g; mold and toxigenic fungi were partially sown. In the control group of foals, dysbacteriosis was observed: in the study of intestinal microbiocenosis MAFANM - $1.7 \pm 0.1 \cdot 10^4$ CFU/g; low growth of bifidobacteria; lactobacteria - $1.04 \pm 0.1 \cdot 10^2$ CFU/g; non-pathogenic staphylococci - $3.7 \pm 0.2 \cdot 10^3$ CFU / g; lactose-negative Escherichia - $6.7 \pm 0.1 \cdot 10^4$ CFU / g; high levels of pathogenic staphylococci were noted - $2.2 \pm 0.1 \cdot 10^5$ CFU / g; the absence of lactose-positive Escherichia and the intensive growth of mold fungi of the genus *Mucor ramosissimus*. The anthelmintic efficacy of the drug Ekvisekt after treatment with strongylosis was 100%.

After deworming with the use of the anthelmintic drug Equisekt Paste, the ratio of previously established microbial equilibrium in the body of the foal changes to a significant decrease in beneficial microflora, while simultaneously increasing the number of conditionally pathogenic bacteria and fungi. The use of the probiotic preparation in the post-de-worming period in foals, in our opinion, will allow in the shortest possible time to normalize enterobiocenosis and eliminate the symptoms of dysbacteriosis.

Conclusion

In the course of our research, it was found that horse strongylosis is widespread in the horse farms of Yakutia. The species composition is represented by 42 species of strangulate, of which *S. equinus*, *A. edentates*, *D. vulgaris*, Trichonematiidae are dominant. The incidence of herd horses with strongyloses is 100%, with an invasion intensity of 939.8 ± 60.7 spec. The use of Equicect Paste in horses at a dose of 0.23 mg/kg of the active ingredient without prior starvation diets, once, individually, showed high anthelmintic efficacy against strongylosis (100%). For the first time, the technology of complex treatment of strongaglyatosis of horses of herd keeping with the use of the probiotic preparation “Sahabaktisubtil” was developed and introduced into practice. The use of probiotics based on the bacterial strains *Bacillus subtilis* “TNP-3” and “TNP-5”, adsorbed on oats, in a dose of 10 ml ($50 \cdot 10^9$ CFU / Bac. Subtilis) to the foals once a day for 6 days in the post-de-worming period contributes to the rapid, within 7 days, the restoration of normal microflora of the digestive tract.

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地热采暖在大型工业城市地区应用的现代方法
**MODERN METHODS OF GEOTHERMAL HEATING APPLICATION
IN LARGE INDUSTRIAL-URBANIZED CITY AREAS**

Kadtcyn Ivan Ilyich, A.P. Starikov

Omsk State Transport University

Omsk, Russian Federation

注解 本文讨论了在高约束、密集建筑的大型工业城市地区使用自主地热供暖的相关性。分析了低温热源和非传统可再生能源的种类。最常见的地面收集器概述和显示,并显示了在承重建筑结构中使用地热加热的方法。

关键词: 低势能, 热探针, 地热收集器, 热能。

Annotation. *The article discusses the relevance of the use of autonomous geothermal heating in areas of high constraint, dense buildings in large industrial-urban areas. The types of low-temperature heat sources and non-traditional renewable energy sources are analyzed. The most common ground collectors are outlined and shown, and the methods of using geothermal heating in load-bearing building structures are shown.*

Keywords: *low potential energy, thermal probe, geothermal collector, thermal energy.*

Thermal energetics is one of the alternative sources of thermal energy in the electric power industry.

Currently, one of the priority areas of energy development in Russia is energy saving and efficient use of fuel and energy resources. The need for high sectoral productivity is caused by the need to reduce operating costs for heating buildings and structures, reducing depletion of natural resources of ecosystems (natural capital), exacerbation of environmental problems in large industrial-urbanized areas [3].

High competition, rivalry in the business environment makes business owners look for options to reduce various costs affecting the price of manufactured products. Operating costs (heating, electricity, water supply and sewerage) of buildings and structures are one of the main expenses of entrepreneurs. The introduction of modern materials and technologies can significantly reduce the maintenance

(operation) of capital construction projects, which ultimately increases the competitive advantages not only in the location of the business, but also far beyond the region.

The industrial and environmental policy is currently one of the main strategic directions in the state policy of our country. Thus, such solutions are needed for the development of industry, which will contribute to the reduction of environmental harm, as well as contribute to environmental measures in the development (modernization) of enterprises [4].

The introduction of low potential thermal energy of soil, air, water, domestic wastewater, mine water, industrial wastes and other resources is one of the most relevant underutilized sources of thermal energy, the conversion of which allows, without changing (reconstructing) the existing engineering infrastructure, to heat new industrial, administrative, residential facilities, without using additional fuel and energy resources.

As low-temperature heat sources, can be used [1]:

a) repeated (side) energy resources:

- heat vent emissions;
- sewage heat;
- process heat (steam, water), etc.

b) unconventional renewable energy sources:

- heat of the surrounding air;
- groundwater and geothermal heat;
- warmth of water bodies and natural water flows;
- heat of solar energy, etc.;
- warmth of surface and deeper soil layers.

In particular, the heat pump increases the temperature of the heated coolant to the required comfortable level. A significant advantage of using geothermal energy is the possibility of using the system as a heating system, the air conditioning system of all types of buildings.

The high growth in popularity of heat pumps was largely due to the fact that heat energy is obtained directly at the installation site of the equipment, as well as being autonomous. With a high environmental friendliness has a high degree of fire and explosion safety, because there are no fuel combustion processes and emissions of combustion products. The equipment does not require laying of fuel (gas) lines and smoke removal systems.

In comparison with centralized heat supply systems, extensive heat networks to the consumer are not required, the heat supply source is located directly on the site or close to the consumer.

Currently, more than 30 million heat pumps of various capacities operate in the world. In the US, more than 30% of residential buildings are equipped with

heat pumps (combined heating and air conditioning systems). In Sweden in recent years, more than 100 heat pumps (power from 5 to 80 MW) have been commissioned. Geothermal power engineering has developed and spread to a greater degree in countries where there are a high number of hot springs, as well as the absence or deficiency of combustible minerals. Based on the available statistics for 2015, the largest distribution, experience in the use and operation of the systems under consideration, was gained by the import companies of the USA, the Philippines, Indonesia, Italy, New Zealand, Iceland. In the above countries, hot springs are used not only for heating, but also for generating electricity using geothermal stations. Moreover, methods of using soils with hot rocks that lack inter-layer underground waters have been developed and introduced. In the present embodiment, the technology provides for the injection of water in interlayer cavities of soil with the subsequent extraction of the heated media.

In our country, the first significant technical progress of the large-scale development of heat pumps was in the years 50-60, the time of the development of Soviet engineering, refrigeration technology and the construction of powerful hydroelectric power plants. The collapse of the USSR significantly influenced the massive decline in the production of almost all types of heat pumps, leading to the lack of demand, physical and moral obsolescence of the existing technology and equipment developed.

In recent years, in our country, interest in heat pump technologies has grown significantly, but the number of implemented projects is small, which is explained by a number of climatic, socio-economic and technological features of their use.

When implementing projects using geothermal heating, the prevailing spread was gained by:

1. horizontal ground collectors.

This technical solution is applied in the European part of Russia, where the depth of soil freezing is minimal. Constructive solution is the cheapest and fastest way to perform construction and installation works.



Figure 1. General look of a horizontal soil collector

2. Vertical soil collectors.

This solution is a relatively expensive way to use the thermal energy of the soil, due to the need to perform geological exploration of the territory, the use of drilling equipment, as well as the construction of casing on sandy, subsurface soils. Vertical soil collectors, in order to save space, occupy a relatively small area of the territory. The use of vertical collectors is possible, perhaps, in almost all types of soils. A significant advantage in comparison with the vertical solution is the presence of local areas with the existence of thermal water sources in the soil (for the Omsk region ~ 24-65 °C), which can significantly improve the efficiency of the use of soil collectors.

Types of vertical soil collectors:

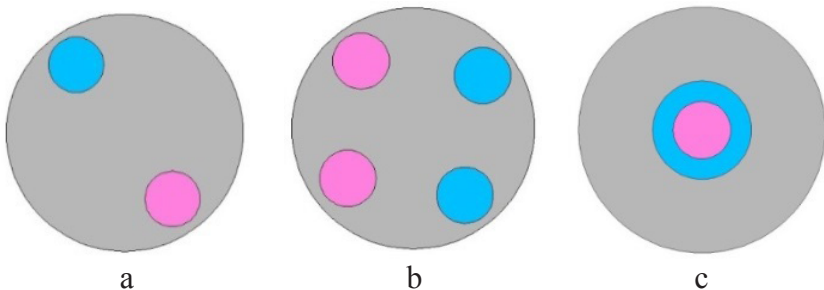


Figure 2 - Examples of vertical collectors in cross section: a - single U - shaped collector; b - dual U - shaped collector; c - coaxial collector.

High constraint, building density in large industrial-urbanized areas, lack of connection resources to existing utility networks provide for a search for fundamentally new modern ways of autonomous maintenance of engineering networks for designed buildings and structures.

Types of innovative methods of using geothermal heating in bearing frameworks of buildings and structures:

1. Energy drilled piles.

The design of the device is carried out according to the method of pouring the concrete mixture into the installed metal frame with fixed thermal probes, into the prepared borehole.



Figure 3. General look of the pile frame with thermal probes

2. Foundation walls and basement walls.

Thermal probes, in the present construction, are fixed in the central part of the metal frame, with the subsequent pouring of the concrete mix. The application of the current solution is carried out in deep-buried buildings and structures (at least 6 m).



Figure 4. General look of the foundation wall with thermal probes

3. Reinforced concrete sewage pumping stations.

The current version is used in industrial enterprises that have an SPS in operation. Due to the high temperature of untreated wastewater (16-24 °C), the presented solution is highly relevant in the implementation of projects for reconstruction or new construction.

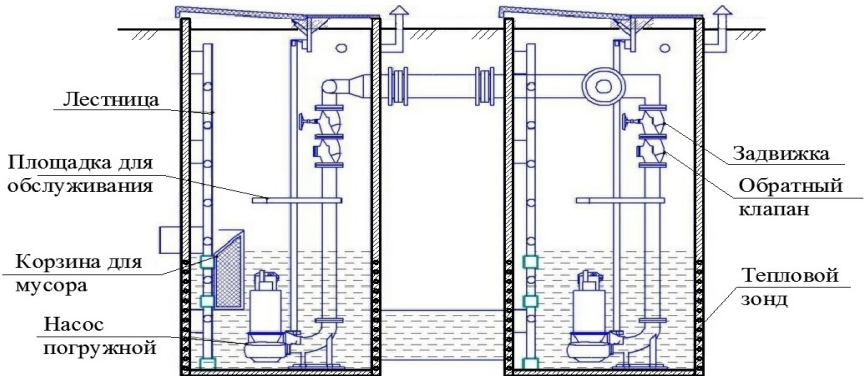


Figure 5. Typical reinforced concrete sewage pumping station with the device of thermal probes

Conclusions: Currently, due to the depletion of natural resources, the existing increase in prices for energy resources, as well as the same expensive connections to existing heating networks, the need to build networks is proof of the relevance of modern non-traditional heating systems for capital construction projects.

The use of autonomous geothermal heating, in areas of high constraint, dense construction in large industrial-urbanized areas, can significantly reduce the costs required for new (reconstructed) construction sites, directly reducing construction costs, through the use of thermal probes in supporting structures.

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评估煤矿井下网络中电力质量的重要方面
**TOPICAL ASPECTS OF ASSESSING THE QUALITY OF
ELECTRICITY IN UNDERGROUND COAL MINE NETWORKS**

Plashchansky Leonid Aleksandrovich

*Candidate of Technical Sciences, Professor at the Department of
"Energy and energy efficiency of the mining industry"
National University of Science and Technology "MISIS"*

Reshetnyak Maria Yurievna

*Postgraduate
National University of Science and Technology "MISIS"*

注解 目前,地下电力网络的电能质量问题对矿业企业没有给予足够的重视,但是,地下消费者的容量显着增加,伴随着大量的转换设备用于控制各种机制的电为了增加电能质量指标的水平,专门的FCD器件(滤波器-补偿器件)、BD(平衡器件)被使用,以及它们的各种组合。应该指出的是,在具体的地下开采条件,包括煤矿,危险的气体和粉尘的突然排放,这些设备都没有安装。电能质量的参数是动态值,取决于许多外部因素,如电力系统的容量变化,网络中的紧急情况的发生,采矿和野外地质条件的变化等。降低电能质量可导致电力消费者的操作模式的变化,因此,工作机器的生产率下降,这将严重影响矿山的生产水平,特别是高效率的,因为它们清洁配合

关键词:供电系统;煤矿;电能质量,谐波成分,地下电网,电能质量指标

Annotation. *Currently, the problem of quality of electrical energy in underground electrical networks of mining enterprises is not given sufficient attention, however, a significant increase in the capacity of underground consumers, along with a significant number of converting devices used to control the speed of rotation of electric drives of various mechanisms, make it necessary to improve the quality of electrical energy in these networks. To increase the level of electrical energy quality indicators, special FCD devices (filter-compensating devices), BD (balancing devices) are used, as well as various combinations thereof. It should be noted that in the specific conditions of underground mining, including for coal mines, dangerous by sudden emissions of gas and dust, these devices are not installed. The parameters of the quality of electrical energy are dynamic values and depend on many external factors, such as changes in the capacity of the power system, the occurrence of emergency conditions in the network, changes in the mining*

and geological conditions of the field, etc. Reducing the quality of electrical energy can lead to changes in the operation modes of power consumers, therefore, to a decrease in the productivity of working machines, which will seriously affect the level of production of mines, especially high-efficiency ones, since their cleaning complexes are equipped with converting devices that create negative interference in underground electrical networks.

Keywords: *Power supply system; coal mine; quality of electrical energy, harmonic composition, underground electrical networks, indicators of quality of electrical energy*

Modern mining enterprises should focus on the production of competitive products, due to the instability of coal prices in the global energy market. This statement makes prerequisites for the development of technological solutions to improve the energy efficiency of coal mines by reducing the cost of coal production. These issues are solved by optimizing the operating modes of the main equipment of the coal mines [1], or by energy-efficient operational management of technological operations [2]. The main energy resource used in underground mining, and often the only one, is electrical energy. Currently, the problem of quality of electrical energy in underground electrical networks of mining enterprises is not given sufficient attention, however, a significant increase in the capacity of underground consumers, along with a significant number of converting devices used to control the speed of rotation of electric drives of various mechanisms, make it necessary to improve the quality of electrical energy in these networks [3].

The quality of electrical energy is understood as a component of electromagnetic compatibility, which characterizes the parameters of the electromagnetic environment. Electromagnetic compatibility implies the ability of electrical equipment to function in an electromagnetic environment under nominal operating conditions, without creating unacceptable electromagnetic interference for other equipment operating in the same environment [4, 5].

- Increased electromagnetic interference, i.e. reduction of the quality of electrical energy leads to negative consequences of electrical and technological nature, which include the following:

- Increased active and reactive power losses;
- Increase in capital investments in the development of the power supply system (i.e., when designing the power supply system, it is necessary to overestimate the power, to compensate for the loss of active and reactive power);
- Reduced service life of electrical equipment;
- Changes in the nominal operating modes of electrical equipment, as a consequence of a violation of the technological parameters of mineral extraction (equipment failure, accidents, defective products, false alarms of protection systems, etc.) [5, 6].

Studies of the parameters of electromagnetic compatibility proposed a number of

methods to optimize the negative impact of reducing the quality of electrical energy due to passive and active filters of higher harmonics, as well as hybrid filters [7, 8, 9].

It should be noted that measures related to the quality of electric energy are the result of the strategy of development of the mining industry in Russia, and coal mining companies are directly interested in the implementation of these activities. Information-measuring system of technical accounting of electric energy in underground networks of coal mines [10, 11], only records the volumes of consumed electricity and takes into account a number of parameters of electric energy without technical possibility of influencing the quality of electric energy, therefore, improving the quality of electric energy in underground electric networks in highly productive coal mines is highly relevant.

When solving the problem of determining the quality indicators of electrical energy in electrical networks, it is possible to use several methods. The first is a calculated method for determining indicators, the second is using technical measuring tools. The combination of these methods of solving the problem allows to obtain the most reliable result. The analysis of the obtained results of solving this problem allows us to proceed to the solution of a new task associated with the development of measures and means of increasing the level of electromagnetic compatibility of the network and the electrical energy consumers connected to it. It should be noted that the reduction in the level of electromagnetic interference to zero or close to zero values, i.e. Improving the parameters of electromagnetic compatibility to almost perfect - technically and economically unprofitable.

The quality indicators of electric energy regulated by GOST 32144–2013 [12] can be classified into three groups: the first (frequency deviation Δf , slow voltage variations $\delta U_{(+)}$, $\delta U_{(-)}$). A distinctive feature which is the maintenance of indicators by system-wide means of regulating the level of frequency and voltage; the second group (total harmonic component K_U , distortion factor of the n th harmonic component $K_{U(n)}$, negative sequence factor K_{2U} , zero sequence factor K_{0U} , voltage swing δU_{τ} , dose of the flicker $P_{5\tau}$, $P_{L\tau}$) are sources of distortion and are users electric energy, and for their subsequent adjustment, it is necessary to carry out technical measures both at the design stage of the power supply system of the mining enterprise and at the operation stage.

Indicators of the quality of electrical energy related to the harmonic components of the voltage are: the value of the total harmonic component of the voltage (the ratio of the rms value of the sum of all harmonic components up to the 40th order to the rms value of the main component) K_U , % at the point of transmission of electric energy in foreign literature denoted as total harmonic distortion; the values of the harmonic components of the voltage up to the 40th order $K_{U(n)}$ as a percentage of the voltage of the main harmonic component U_1 at the point of transmission of electrical energy.

The use of certain methods and special tools that improve the quality of electri-

cal energy, is possible only with a detailed analysis of the power supply system, wiring diagrams, power and operating modes of consumers of electrical energy, the type and level created by this consumer of interference, as well as the technical and economic the effectiveness of the decision.. If there are several types of electromagnetic interference from the consumer, the compensation level of one of them affects the level of the other, as a rule, negatively.

It should be noted that all measures to improve the quality of electrical energy in networks can be classified as:

- Organizational and design measures to improve the levels of quality of electrical energy at the stage of approval of the project of the power supply system of a particular enterprise;
- Technical measures that allow to increase the level of quality of electric energy through special devices that can actively adjust the quality indicators in the existing power supply schemes of a particular enterprise.

To increase the level of electrical energy quality indicators, special FCD devices (filter compensating devices), BD (balancing devices) are used, as well as various combinations thereof [13]. It should be noted that in the specific conditions of underground mining, including for coal mines, dangerous by sudden emissions of gas and dust, these devices are not installed. Special devices that increase the level of quality of electrical energy, are not unified and their choice should be guided by the following subjective factors:

- representation of the causes of electromagnetic interference (higher voltage and current harmonics), as well as spectral analysis of this interference;
 - location of sources of electromagnetic interference in the power supply circuit, as well as system power at the points of connection of sources of electromagnetic interference;
 - the presence in the power supply system of other, previously installed, specialized means of improving the quality of electrical energy;
 - the influence of sources of electromagnetic interference on a number of other consumers of electrical energy located in the immediate vicinity of the source and powered by a single feeder;
 - frequency characteristics of the power supply system in order to prevent the occurrence of resonance phenomena at frequencies generated by sources of electromagnetic interference
- Filter compensating devices can be classified:
 - by type of elements used: passive filters, active filters, combined filters;
 - by the number of phases: single-phase, three-phase (three-wire), three-phase (four-wire);
 - by connection scheme: sequential filters, parallel filters, combined filters (including both parallel connection of elements and sequential).

Assessment of the quality of electrical energy should be made by determining

the degree of compliance of the parameters of electrical energy (voltage, frequency, shape of the electric current curve, etc.) to the established values. The quality of electrical energy is a component of electromagnetic compatibility, which characterizes the electromagnetic environment. The parameters of the quality of electrical energy are dynamic values and depend on many external factors, such as changes in the load of the power system, the occurrence of emergency conditions in the network, changes in the mining and geological conditions of the field, etc.

It should be noted that the level of interharmonic components of the power supply voltage increases due to the use of frequency converters and other control equipment in electrical installations. Permissible levels of interharmonic components of the power supply voltage, currently GOST 32144–2013 is not regulated.

Reducing the quality of electrical energy can lead to changes in the operation modes of power consumers, therefore, to a decrease in the productivity of working machines, which will seriously affect the level of production of mines, especially high-efficiency ones, since their cleaning complexes are equipped with converting devices that create negative interference in underground electrical networks.

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开发PPG最优过滤方法
DEVELOPMENT OF PPG OPTIMAL FILTERING METHODS

Tsibriyi Irina Konstantinovna

*Candidate of Technical Sciences, Head at the Department of
«Instrument Engineering and Biomedical Engineering».*

Zhilina Larisa Anatol'evna, Batura Pavel Petrovich

Graduate students

Don State Technical University

注解。在医疗信号中存在已知的硬件和数字降噪算法。然而，尚未提出最佳PPG过滤方法。本文致力于开发最佳降噪算法，特别是当噪声幅度大于信号时。在这项工作中，我们使用了使用多通道生物信号记录器获得的短PPG记录。对于数据配准，将光电容积描记图传感器放置在左手手指的指骨上

关键词。光电容积描记图，PPG，滤波，数字滤波器。

Annotation. *There are known hardware and digital noise reduction algorithms in medical signals. However, the optimal PPG filtering method has not been proposed yet. The article is devoted to the development of an optimal noise reduction algorithm, especially when the amplitude of the noise is greater than the signal. In this work, we used short PPG records obtained using a multichannel bio-signal recorder. For data registration, a photoplethysmogram sensor is placed on the phalanx of the left hand finger*

Keywords. *Photoplethysmogram, PPG, filtering, digital filters.*

Introduction. Currently, there is an increased interest in monitoring vital body functions in real time using the photo plethysmography method. The advantages of the method lie in the non-invasiveness of the measurement technique, cheapness and convenience of the diagnostic tool. The structured nature and specific parameters of the photoplethysmogram waveform (PPG) allows the inclusion of PPG parameters in methods for analyzing heart rate variability (HRV). Sensitive sensors are necessary for registration of a low-frequency dynamic PPG signal, since various kinds of artifacts distorting the shape of the useful signal are a serious obstacle to the interpretation of signals and reliable diagnostics [1-2]. There is a need to study the optimal methods of analyzing physiological data and assess the degree of influence of filtering on the quality and information content

of the signal. Determining the optimal noise reduction algorithm is useful for minimizing cases where the level of random noise is significantly higher than the level of the biosignal itself.

Materials and methods. The method of recording the volume pulse of the blood flow at each heart beat is based on the absorption and reflection of the light flux by the blood components. Optical transmittance and absorption coefficient characterizes proximal and distal blood volumes. The PPG signal characterizes the pulsations caused by the absorption of light by the components of the blood flow (hemoglobin and oxyhemoglobin), while the other part of the signal is formed by non-pulsating blood.

The nature of the reflection and passage of different wavelengths of the light flux allows you to select the necessary sensor parameters. The placement of the sensors at the fingertip is due to the best signal-to-noise ratio. Using the PPG curve, one can estimate the heart rate and heart rate variability, and using monochromatic radiation sources one can determine the oxygen saturation of the blood. By the PPG waveform, the amplitude of the systolic pulse wave, the amplitude of the diastolic pulse wave, the time interval between heart cycles, points 2.3 and the interval t1 are assessed, which are shown in Figure 1. [3]

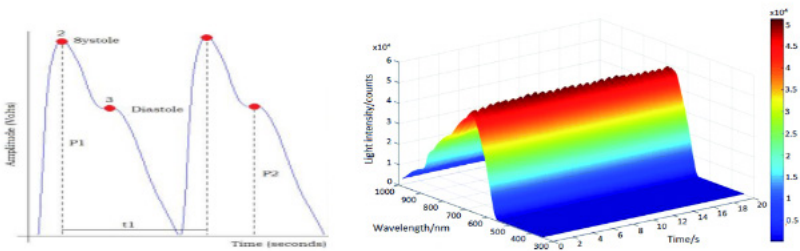


Figure 1 - Local points and morphological shape of the PPG signal.

So, using the PPG parameters, the instantaneous heart rate (HR) is determined using formula 1 and the average heart rate using formula 2, where Q_{nn} – is the number of samples of normal R-R intervals in the interval $[T_i, T_f]$.

$$HR_{instantaneous} = \frac{60}{t1} \tag{1}$$

$$HR_{average} = \frac{1}{Q_{nn}} \sum_{[T_i, T_f]} NN [T_i, T_f] \tag{2}$$

It is known from literature [4] that the filters of Butterworth and Chebyshev

I are the most common among all types of filtration, despite the high level of sensitivity at low orders, these filters are not without drawbacks. The authors report that the optimal filter for processing a PPG signal is a Chebyshev type II filter. In comparison with the Butterworth filter, the filter characteristics allow as little as possible to distort the useful signal component in the passband.

Result.

The morphological form of the recorded PPG wave is clearly shown in Figure 2, in the original PPG signal, random signal components are clearly observed.

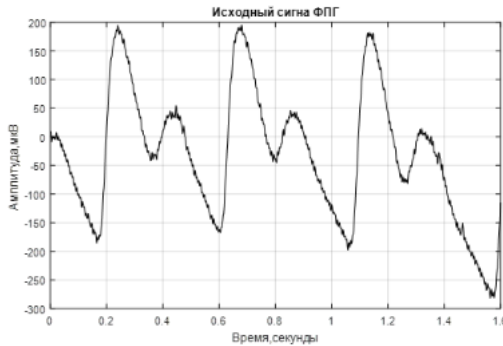


Figure 2 - PPG waveform before filtering.

The main statistical characteristics of the recorded PPG signal are shown in Table 1.

Table 1 - Statistical characteristics of the original signal

Parameter	Value
Average	9.2787
Standard deviation	122.9
Variation coefficient	0.1325
Asymmetry coefficient	0.1606
Coefficient of kurtosis	2.5337
Maximum values of signal count	9.3083
Minimum values of signal count	9.2521

The nature of the distribution of the PPG signal relative to the normal distribution can be estimated using the histogram shown in Figure 3a and the scatterogram in Figure 3b.

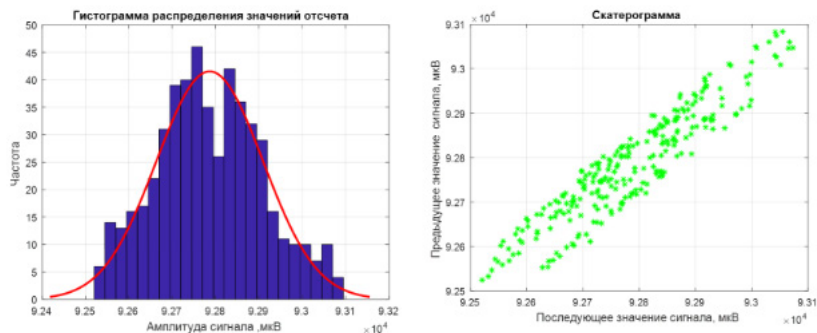


Figure 3a - Histogram of the distribution of PPG signal values.

3b-Scaterogram of the distribution of PPG values relative to the normal distribution.

The main types of artifacts that affect the quality of the PPG signal include high-frequency pickup of transmission lines, which introduces a sinusoidal component into the recording. Background illumination, the movement of the patient during signal recording also significantly reduces the information content of the recording [5]. A graphical depiction of non-informative recordings of PPG signals is shown in Figure 4.

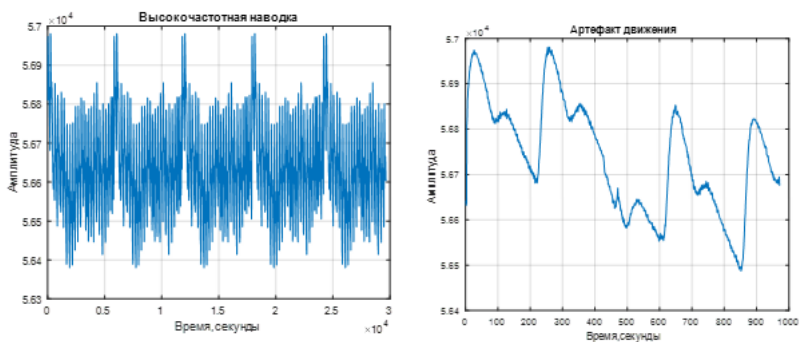


Figure 4 - The nature of the distortion of the useful PPG signal by noise pickups

After recording the signal, digital processing and comparison of the signals before and after filtering with Chebyshev type 2 filters and Butterworth filters was performed in the MathLab environment [6]. The block diagram of the digital noise reduction algorithm is shown in Figure 5.

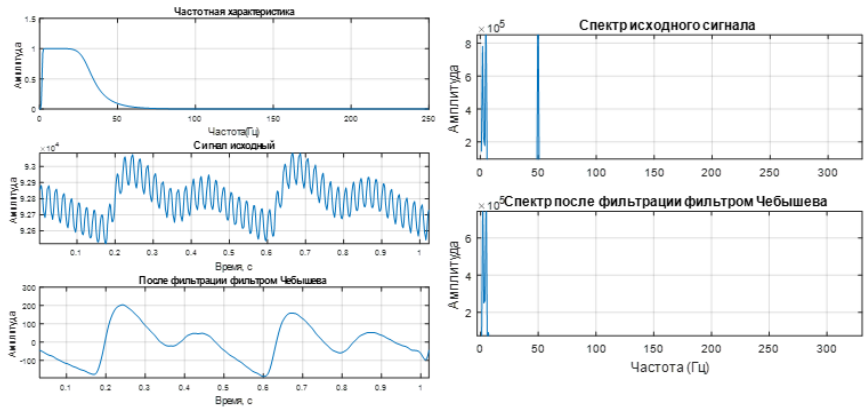


Figure 5 - Schematic representation of the process of filtering the signal with Butterworth and Chebyshev filters.

To compare and select the optimal filtering method for the PPG signal, we used a fourth-order discrete Chebyshev filter of the second kind. In the MathLab environment, the function $[b, a] = \text{cheby2}(n, R_s, W_n)$ sets the parameters of the second-kind Chebyshev digital filter. For the original PPG signal, the fourth order of the filter is used, chosen to obtain the optimal slope of the transient process and the minimum distortion of the original waveform, the normalized cut-off frequency of which lies within $W_n = 0.002 \div 0.36$ and pulsation in the passband $R_s = 60$ dB below the peak value of the bandwidth. The relationship between the values of the parameter ε (the magnitude of the fluctuations of the frequency response in the passband) and the level of the pulsations R_s in dB is determined by formula 3.

$$R_s = 20 \lg(\sqrt{1 + \varepsilon^2}) \text{ dB} \quad (3)$$

The frequency response of the filter of the 2nd kind does not have pulsations in the passband, and in the damping band the pulsations are uniform. The Chebyshev digital filter is characterized by a steeper decrease in the frequency response in the transition region, which is reflected in Figure 6. Figure 6b shows the spectral component of the PPG signal before and after filtering.



**Figure 6a - PPG waveform after filtering by Chebyshev filter.
6b - Spectrum of the original signal and the PPG signal after filtering.**

Fast Fourier transform reflects the frequency components of the input signal. In the original PPG signal, high-frequency network pickup prevails at a frequency of 50 Hz. Comparison of the original signal and the signal after filtering shows that the Chebyshev filter with the specified values of the transfer function allows subtracting high-frequency pickups from the useful signal and compensating for the baseline drift. On the spectrum graph after filtering there is no 50 Hz spectrum.

We synthesize a second-order digital Butterworth filter with coefficients \hat{c} the normalized cut-off frequency W_n $0.0039 \div 0.1563$, the cut-off frequency $w_0 = 40\text{Hz}$.

The expression for the frequency response of the Butterworth filter is determined by the formula 4.

$$K(w) = \frac{1}{\sqrt{1+(\frac{w}{w_0})^{2n}}} \tag{4}$$

where w_0 - cut frequency, n- filter order.

Figure 7 shows the frequency response of the filter, which has no ripples in either the passband or the delay band, but as can be seen in the graph of the frequency response of the Butterworth filter, the frequency response of the filter has a long transient process. At a cutoff frequency of 40 Hz, the quality factor of the filter does not allow to completely suppress the 50 Hz component of the signal, but only reduces its amplitude.

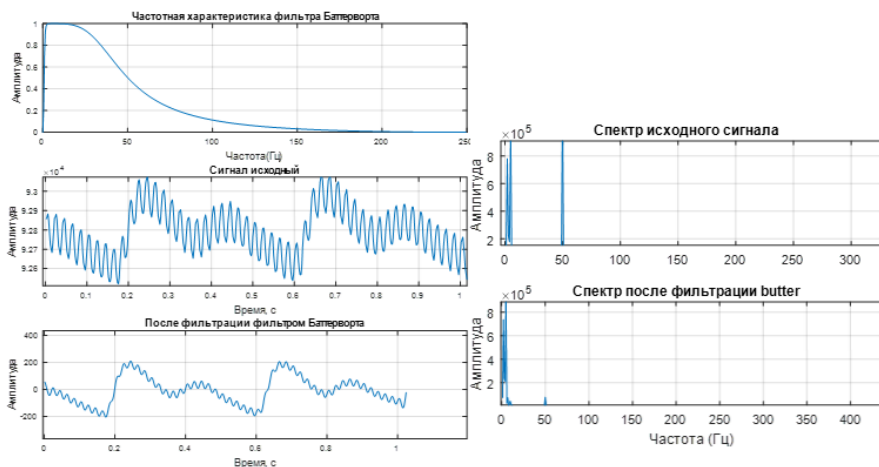


Figure 7 - PPG waveform after filtering by Butterworth filter.

Conclusion

For reliable diagnosis and monitoring of the body's parameters using PPG wave parameters, high-quality signal pre-processing is necessary. Inaccuracy in readings, which can be caused by a low amplitude of the pulsating blood component, a saturated noise component (bright light, electromagnetic interference or movement) or a combination of them, leads to data loss, inaccurate readings and false positives.

The paper simulates discrete filters with infinite impulse response and selects the optimal values of the transfer function coefficients of the filters for processing short PPG records. Comparison of the frequency response of the Butterworth and Chebyshev filters of the fourth kind of the fourth order with the same frequency parameters revealed that the morphological form of the PPG wave after filtration by the Chebyshev filter had a more uniform shape. An increase in the order and the ripple factor per octave leads to a distortion in the frequency domain of the original signal. Spectral analysis of the PPG signal before and after filtering shows that the Chebyshev filter effectively removes the high-frequency components of the signal and compensates for the baseline drift.

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关于线性算子在径向薛定谔方程中的位置
**ON POSITIVENESS OF A LINEAR OPERATOR
IN THE RADIAL SCHRÖDINGER EQUATION**

Abdullayev Abdula Ramazanovich

Doctor of Physico-mathematical Sciences, Full Professor

Loyko Natalia Aleksandrovna

Senior Lecturer

Savochkina Anna Alexandrovna

Senior Lecturer

Krokhaleva Yana Nikolaevna

Master Student

Perm National Research Polytechnic University (Perm Perm)

注解 考虑了与Schrödinger方程相关的线性算子。为该算子获得有效的下界估计。得到的结果可以应用在径向薛定谔方程的光谱特性研究中。

关键词: 薛定谔方程, 正算子, 下界, Cesaro算子。

Annotation. *The linear operator associated with the Schrödinger equation is considered. Effective lower bound estimates are obtained for this operator. The results obtained can be applied in the study of the spectral characteristics of the radial Schrödinger equation.*

Keywords: *Schrödinger equation, positive operators, lower bound, Cesaro operator.*

The linear operator is considered

$$Sx(t) = \frac{d^2 x}{dt^2} - \left[\frac{\mu(\mu-1)}{t^2} + q(t) \right] x(t), \quad (x = x(t), 0 \leq t \leq T),$$

associated with the radial Schrödinger equation [1].

As is known, the Schrödinger equation arises in many mathematical models of physics. Depending on the specific type of function $q(t)$ in the expression of the potential $\left[\frac{\mu(\mu-1)}{t^2} + q(t) \right]$ the Schrödinger equation models certain processes in quantum mechanics. In particular, when $q(t) \equiv 0$ we speak of a singular potential, which corresponds to the radial Schrödinger equation with a centrifugal potential [2, p. 116].

In the proposed paper, for a special case, the lower bound for the operator S is found. This result can be used to analyze the location of the spectrum of the corresponding operator.

We define the functional Banach spaces used in the paper. Let $L_2 = L_2[0, T]$ – be the Lebesgue summable space with square functions $y : [0, T] \rightarrow R$, with the norm $\|y\|_2$, enerated by the scalar product $(y, z) = \int_0^T y(t)z(t)dt$.

Let $W_2^0 = W_2[0, 1]$ denote the space of absolutely continuous together with the first derivative of the functions $x : [0, T] \rightarrow R$ as such, that $x'' \in L_2, x(0) = 0, x'(0) = 0$. Norm for W_2^0 define by equality $\|x\|_W = \|x''\|_L$. Thus, the spaces W_2 and L_2 are isometric, moreover, $W_2^0 \in x \leftrightarrow x'' \in L_2$.

The operator S will be considered as a bounded operator $S : W_2^0 \rightarrow L_2$. Together with the operator S we consider the operator $B : L_2 \rightarrow L_2$, which is metrically equal to it, and is defined by the equality

$$(By)(t) = y(t) - \left[\frac{\mu(\mu - 1)}{t^2} + q(t) \right] \int_0^t (t - s)y(s)ds$$

We will be interested in value estimates

$$m(B) = \inf_{\|y\|=1} (By, y),$$

that is called the lower bound of the operator B .

Define operators $C, C_0, C_1, R : L_2 \rightarrow L_2$ by equalities

$$(Cy)(t) = \frac{1}{t^2} \int_0^t (t - s)y(s), (C_0y)(t) = \frac{1}{t} \int_0^t y(s)ds,$$

$$(C_1y)(t) = \frac{1}{t^2} \int_0^t sy(s)ds, C = C_0 - C_1, B = -I + \varphi C_0 - \varphi C_1 + R.$$

Assuming, that

$$B = B_0 + R, (B_0y)(t) = y(t) - \frac{\varphi}{t^2} \int_0^t (t - s)y(s)ds,$$

$$(Ry)(t) = q(t) \int_0^t (t - s)y(s)ds,$$

where $\varphi = \varphi(\mu) = \mu(\mu - 1)$.

The operator C_0 is known in the literature as the Cesaro operator [3] (or the Hardy-Littlewood operator), and the operator C_1 is called the generalized Cesaro operator.

Let's formulate auxiliary statements about operators C, C_0, C_1 in a convenient for us forms, proved in [3,4].

Lemma 1. Valid statements:

$$1) \|C\| = \frac{4}{3}, \|C_0\| = 2, \|C_1\| = \frac{2}{3},$$

$$2) (C_0 y, y) = \frac{1}{2} \|C_0^* y\|^2, (C_1 y, y) = \frac{3}{2} \|C_1^* y\|^2,$$

$$3) (C_0^* y, C_1^* y) = \frac{1}{4}, \|C_0^*\| (C_0^* y, C_1^* y) = \frac{1}{4}, \|C_0^*\|^2 + \frac{3}{4} \|C_1^* y\|^2,$$

$$4) \|C_1^* y\| \leq \|C_0^* y\|.$$

The assertions of Lemma 1 are proved using representations of the operators conjugate with C_0 and C_1 , $C_0^*, C_1^* : L_2 \rightarrow L_2$, namely

$$(C_0^* y)(t) = \int_t^T \frac{y(s)}{s} ds, (C_1^* y)(t) = t \int_t^T \frac{y(s)}{s^2} ds.$$

Using the assertions of Lemma 1, we prove the following assertion, which we state in terms of the parameter φ .

Assuming, that $B_0 = I - \varphi C_0 + \varphi C_1$. It's obvious that

$$(B_0 y, y) = \|y\|^2 - \varphi (C_0 y, y) = \|y\|^2 - \frac{\varphi}{2} \|C_0^* y\|^2 + \frac{3}{2} \varphi \|C_1^* y\|^2.$$

Lemma 2. Valid inequality

$$m(B_0) \geq m(\mu) \begin{cases} 1 - \frac{4}{9} |\mu(\mu - 1)|, \text{ если } \mu \in (0; 1), \\ 1 - \frac{4}{9} |\mu(\mu - 1)|, \text{ если } \mu \in [-\frac{1}{2}; 0] \cup [1; \frac{3}{2}]. \end{cases}$$

Evidence. First we obtain the estimate for the interval $\mu \in (0; 1)$. Since, in this case $\varphi < 0$, then applying statement 4) of Lemma 1, we obtain

$$(B_0 y, y) \geq \|y\|^2 - \frac{\varphi}{2} \|C_1^* y\|^2 + \frac{3}{2} \varphi \|C_1^* y\|^2 = \|y\|^2 + \varphi \|C_1^* y\|^2$$

We use the assessment $\|C_1^* y\|^2 \leq \frac{4}{9} \|y\|^2$. Then $(B_0 y, y) \geq (1 - \frac{4}{9} |\varphi|) \|y\|^2$.

Hence, we obtain the estimate for $m(B)$ with $\mu \in (0; 1)$. Now, assume that

$$\mu \in [-\frac{1}{2}; 0] \cup [1; \frac{3}{2}].$$

We have $(B_0 y, y) \geq (1 - |\varphi| \|C\|) \|y\|^2 = (1 - \frac{4}{3} |\varphi|) \|y\|^2$. It remains to be noted, that in this case $\frac{4}{3} |\varphi| \leq 1$.

Lemmas is now proved.

Remark 1. On the interval we can use the following convenient estimate: if $\mu \in (0; 1)$, then $m(B_0) \geq \frac{8}{9}$.

Remark 2. Since $(B_0, y) \leq \|B_0^* y\| \|y\|$, the estimates obtained in the lemma can also be applied to the lower estimate of the quantity $q(B_0) = \inf_{\|y\|=1} \|B_0^* y\|$, which is the coefficient of surjectivity of the operator B_0 . This means that under the conditions of Lemma 2, i.e. with $\mu \in (-\frac{1}{2}; \frac{3}{2})$, the operator B_0 is surjective.

The statement of Lemma 2 allows us to obtain sufficient conditions for a positive operator B for various cases of the operator T . Here we consider the case when the function $q(t)$ has a representation $q(t) = \frac{1}{t} \alpha(t)$, where $\alpha(t)$ is a continuous function of $t \geq 0$.

Theorem. Let the following conditions be fulfilled:

- 1) $\mu \in (-\frac{1}{2}; \frac{3}{2})$,
- 2) $|\alpha(t)| \leq \alpha_0 < +\infty, t \geq 0$.

Then the operator $B : L_2 \rightarrow L_2$ is positive, and $(By, y) \geq (m(\gamma) - \alpha_0 T)$.

Evidence. We have $|(Ry)(t)| \leq \alpha_0 \int_0^t (1 - \frac{s}{t}) |y(s)| ds$.

Since $1 - \frac{s}{t} \leq 1$, then, applying the Hölder inequality, we obtain

$$|(Ry)(t)| \leq \alpha_0 \sqrt{T} \|y\|_2, \text{ i.e. } \|Ry\|_2 \leq \alpha_0 T \|y\|_2.$$

Thence, we get $(By, y) \geq (B_0 y, y) - \alpha_0 T \|y\|^2$.

Taking into account the assertion of Lemma 2, we obtain the corresponding inequality.

The theorem is proved.

Note, that the case $q(t) = \frac{A}{t}$, where $A > 0, A = const$, corresponds to the equation of the radial part of the wave function of the hydrogen atom [5].

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