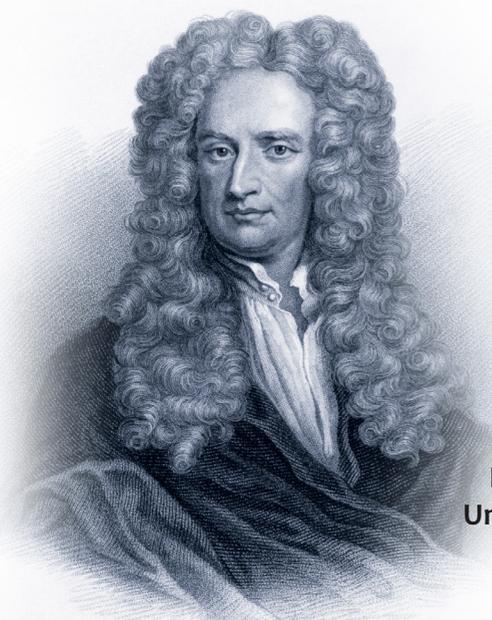




INTERNATIONAL CONFERENCE

**PROCESS
MANAGEMENT AND
SCIENTIFIC
DEVELOPMENTS**



Birmingham
United Kingdom

International Conference “Process Management and Scientific Developments”

Birmingham, United Kingdom
(Novotel Birmingham Centre, January 16, 2020)



Materials of the International Conference
"Process Management and Scientific Developments"
(Birmingham, United Kingdom, January 16, 2020)

M67

ISBN 978-5-905695-79-7

These Conference Proceedings combine materials of the conference – research papers and thesis reports of scientific workers. They examines technical 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.

UDC 330

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UDC 338.2; 330.3; 502/504

THE ROLE OF ENVIRONMENTAL FACTORS IN THE FORMATION OF THE REGION'S ECONOMY: TRENDS, PROBLEMS AND PROSPECTS OF DEVELOPMENT ON THE EXAMPLE OF THE ROSTOV OBLAST

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Abstract. As the nature management practice used today shows, it can be a deterrent in the development of the regional economy. Indeed, the development and condition of the economic sphere directly depends on the state of the environment, since, as before, a person receives most of the resources due to nature. Here, the environmental factor in the region comes to the fore. It is necessary to consider this aspect on the example of the Rostov Oblast.

Keywords: ecology, economic development, nature management, economy, environment, factors of influence, green technologies.

The main goal of scientific research is to determine environmental factors that have a significant impact on the formation and development of the Rostov Oblast economic agenda. The implementation of socio-economic policy is directly related to the integrated solution of a number of critical tasks, which are determined by the territorial features of the organization of the economy of the region. The identification and subsequent analysis of the main characteristics that are inherent in the observed trends, problems and prospects largely determine the state regulation of the development of the region (and the Russian Federation as a whole). It is public administration that forms the most important concept aimed at the environmental component as a priority for sustainable development of society. When assessing the natural resource potential, economic and geographical location and territorial and economic structure, the main indicators of the region for recent years were taken into account.

The chosen research topic is currently becoming particularly relevant in connection with the exhaustion of resources, the growing social needs of people, human intervention in nature, the rapid development of technology and production. Most of the funds necessary for the development of the region's economy are taken from nature. Rostov Oblast provides with technical means and food products not only the Southern Federal District (hereinafter SFD), but the whole country. Infrastructure and economic indicators have always been developed on the Don land, but nowadays one can observe a decline in the region's economy due to the unfavorable environmental situation, as well as the unwillingness of some enterprises to use rational methods of nature management. Not everything is so bad: small enterprises and farmers try to be economical owners and apply "green technologies" (separate waste collection, recycling of raw materials, use of alternative energy sources, tree planting days, environmental campaigns and community work days), but this happens at large and medium enterprises less often. Therefore, it is necessary to conduct a detailed study of this topic for further research and application of the results.

The objects of research are: the environment of Rostov Oblast, the economy of the region and the mutual influence of ecology on the development of the economy and industry in the Don.

When conducting the study, we used the following scientific methods: analysis of scientific literature on a selected topic, including work with electronic library networks.

We turn to the presentation of the information we received.

Physico-geographical characteristic. Rostov Oblast is located in the southern part of the East European Plain and partly in the North Caucasus region, occupying a vast territory in the Lower Don river basin. By the nature of the surface, the Oblast territory is a plain dissected by river valleys and beams. The maximum height above sea level is 253 m. The Central Russian Upland enters Oblast territory from the north, the eastern part of the Donetsk Ridge wedges in the west, and the Salsko-Manych Ridge and Ergeni rise in the south-eastern part of Oblast. [8]

Oblast covers an area of 100.8 thousand sq. Km, which is 0.6% of the territory of Russia, has a length of 470 km from north to south, 455 km from west to east. Rostov Oblast has land and water borders with the following regions: in the west and north-west - with Donetsk and Lugansk Oblasts of Ukraine, the total length of the border is 660 km, in the north and northeast - with Voronezh and Volgograd Oblasts, in the east and southeast - with Kalmykia, in the south - with the Stavropol and Krasnodar territories, in the south-west it is washed by the Taganrog Bay of the Sea of Azov, having a sea state border with Ukraine.

On the territory of Oblast, one of the largest rivers in Europe flows - the Don (2 thousand km), the Tsimlyansk reservoir (volume 24 billion cubic meters) is located. The main tributaries of the Don are navigable - the Sevversky Donets and Manych rivers. Lakes occupy only 0.4% of the territory of Oblast. [5]

Oblast has a favorable temperate continental climate. The average air temperature in January is (-7C), in July - (+ 23C). The duration of sunshine is 2050-2150 hours per year. From June to September, the average monthly indicators of the duration of sunshine in Rostov-on-Don and Sochi differ little from each other. The average annual rainfall is 424 mm. High summer temperatures and a long growing season provide increased yields of wheat, melons, horticultural crops and grapes. [8]

The nature of Rostov Oblast is very diverse. Steppe open spaces, forest oases, the floodplain of the Don River, the coast of the Sea of Azov, is a haven for more than a hundred species of animals and valuable commercial fish species. The Oblast territory lies within the steppe zone, only the extreme southeast is a transitional region from steppes to semi-deserts. 5.6 percent of the land fund is covered by forests and shrubs, while most of Oblast is occupied by farmland, mainly on high-fertile chernozems.

Population. The population of Oblast is 4260.6 thousand people. Of these, 2874.2 thousand people live in cities, 1386.4 thousand people in rural areas. The region ranks 6th in Russia in terms of resident population after Moscow, Moscow Oblast, Krasnodar Krai, St. Petersburg and Sverdlovsk Oblasts. Among the subjects included in the Southern Federal District, Oblast is in 2nd place after the Krasnodar Krai. [2]

The population density is 42.2 people per 1 sq km. By ethnic composition, 90.3% of the population of Oblast are Russians, 2.6% are Armenians, 1.9% are Ukrainians, 0.9% are Turks, and 0.4% are Azerbaijanis. In general, representatives of more than 150 nationalities and ethnoses live in Oblast. The able-bodied population is about 60% of the total population. The average annual number of people employed in the economy is 1.9 million people, including 1.4 million people at enterprises of the private sector.

Demographic situation: the number of births per 1000 population is 10.9 people, and the number of deaths is 14.3. Natural population decline decreased from 3.8 ppm to 3.4 ppm. Life expectancy at birth is 70.3 years (according to 2011 data). [2]

Economy. The geographical position of the region has a decisive role in shaping the economy of the region. First of all, due to the soil and climate, the development of agriculture is possible, the availability of minerals and their active extraction allow the development of industry, and the beauty of

nature and the preservation of cultural traditions contribute to the influx of tourists and the development of recreation in the region. More and more are showing interest in the economy of Oblast, including foreign manufacturers. Over the past year, the number of investments has increased and many joint ventures have opened. [6]

The closest Oblast environment is represented by economically highly developed regions: the Donbass in the west, Central Russia in the north, the Volga region in the east and the Caucasus in the south. Within the radius of 1.0-1.5 thousand km from the borders of Rostov Oblast, the country's largest coal, oil, gas, metallurgical, engineering, chemical, agricultural areas and centers are located, the exchange of finished products of which is carried out, to a large extent, through the territory of Rostov Oblast.

Mineral raw materials include a group of fuel and energy resources. Among them are the coals of the East Donbass, in particular anthracite, the best in the world in calorie content. Deposits of non-metallic raw materials for metallurgy and the production of building materials are being developed. Explored gas reserves are estimated at 56.2 billion cubic meters.

Oblast Forest Fund is insignificant, represented in 2.8% of the territory, mostly by forests that perform both water protection and protective functions. Recreational resources are represented by resorts of local importance for summer holidays with reserves of high-quality mineral waters, as well as ample opportunities for the development of international tourism. [7]

The leading place in the economy of Oblast belongs to industrial production, which remains the main sector of the economy for the creation of material wealth, commodity and money supply, new jobs and investment sources. Oblast enterprises produce a quarter of the industrial products of the Southern Federal District. By the level of development and the diversity of industries, Rostov Oblast is one of the leading in the Russian Federation.

The largest share is occupied by manufacturing (95%): metallurgy, production of machinery and equipment. The industry share in the gross regional product of Oblast is about 25%.

Engineering and metalworking maintain a strong position - their share in the total industrial turnover is about 1/3. The largest Oblast enterprise is "Rostselmash". Today it is one of the main agricultural equipment manufacturers in the CIS, controls 63% of the Russian grain harvesting market and 17% of the world market. Oblast enterprises produce 80% of the country's main electric locomotives and steam boilers, three quarters of combine harvesters, the leading place in Russia belongs to heavy helicopter building and the manufacture of navigation systems for ships.

Oblast metallurgical enterprises are located in Taganrog, Novocherkassk, Belaya Kalitva, Krasnyy Sulin. They are engaged in the production of steel, rolled steel and wire, drill, water and gas pipes, electrodes for the aluminum industry. The metallurgical sector of the Don economy is developing thanks to the investments of large Russian financial and industrial groups, such as the Pipe Metallurgical Company, "Russian Aluminum" Holding, and "MAIR" Industrial Group. The largest enterprise in Russia for the production of graphite electrodes is OJSC "Energoprom-NEZ". The main consumers of the enterprise are the largest metallurgical plants in Russia and neighboring countries. RVPK OJSC "Rostvertol" specializes in the production of heavy helicopters Mi-26 and Mi-26T. These models are exported (parts, components) to 20 countries. [3]

Rostov Oblast has a whole range of high-tech industries. The most developed areas of the chemical industry are: petrochemical products, paints and decorative coatings, chemical and synthetic fibers. The leading enterprises in the industry are "Novoshakhtinsky Oil Products Plant" OJSC with an oil refining capacity of up to 2.5 million tons per year, "Empils" CJSC and "Kamenskvokno" OJSC.

The share of light industry in the total volume of industrial production is consistently 4%, which is significantly higher than in the whole country. The leading enterprises of the industry determining the level of development of light industry of the Oblast are: CJSC "Gloria Jeans" Corporation, "Donetsk Manufactory M" OJSC, "Don-Tex" CJSC, "Donobuv" CJSC, PKF "Elegant" CJSC. The sales of goods to the countries of near and far abroad have noticeably expanded.

Agricultural land occupies 8.2 million hectares, arable land - 5.8 million hectares, including irrigated 228 thousand hectares. The share of Rostov Oblast in the total agricultural land of Russia is 3.9%. By the area of farmland and the area under grain crops Oblast takes the 2nd place in the Russian Federation, by the fertility of arable land - 10th place among other subjects of the Russian Federation.

Over 65% of Oblast's gross agricultural output is produced in the crop sector. Its development is based on improving the culture of agriculture, introducing energy-saving technologies, new varieties and hybrids of cereals, oilseeds, and increasing the efficiency of agricultural land use. The grain direction in crop production is of paramount importance. Rostov Oblast ranks third in Russia in grain production. About 67% of the sown area is occupied under grain crops. The main grain crop is winter wheat. Crops of spring barley, corn, millet, rice, buckwheat, peas, and soy are widespread. The leading technical crop is sunflower. Harvesting of grain

crops annually amounts to an average of 6-7 million tons, sunflower - up to 1.5 million tons. [6]

Livestock breeding is traditionally developed in the Don. In this industry, farms specialize in dairy and meat production, pig breeding, sheep breeding, horse breeding and poultry farming.

Glory to the Don region was also made by the fishing industry. The Sea of Azov, large reservoirs (Tsimlyanskoe and Manychskoe), rivers, lakes, man-made ponds - everywhere there is fish.

Food and processing industry occupies the first place among manufacturing industries, its contribution to the total industrial volume is more than 28%. More than 200 large and medium-sized enterprises work in this industry, more than a thousand small business organizations operate. Oblast produces products from almost all sectors of the food and processing industry, with the exception of sugar.

Also in the structure of the region's economy are represented: construction, electric power, transport, high technology and science-intensive production. [2]

It is worth noting that large enterprises extract resources for their production or make emissions into the air, water and soil. The development of the coal industry led to the growth of heaps and the appearance of abandoned coal mines and quarries in Mines, Novoshakhtinsk, Gukovo. The Azov poultry farm releases water into the Taganrog Bay of the Sea of Azov, the sea is desalinated and shallow. The electrode plant in Novocherkassk and state district power plants do not always use air filters and pollute the atmosphere, making emissions of graphite and coal dust. This situation developed in the 20th century and has passed on today.

It should be noted that due to its favorable geographical position and developed infrastructure, the region's economy is developing, the following trends are observed: 1) growth in production rates; 2) increase in sown area; 3) the introduction of innovative technologies; 4) inflow of investments; revival of the agro-industrial complex. The environmental factor in the development of the region's economy is manifested in: 1) the wealth of resources; 2) favorable geographical position; 3) infrastructure development.

Industrial enterprises use Oblast's natural resources, but pollute the environment. This is due to the desire of business owners to maximize profits at minimal cost, soft laws (fines, reprimands and regulations), as well as an insufficiently developed system of rational environmental management in Russia. [4]

But in the region there are enterprises among representatives of large businesses that use green technology in their production, and quite successfully. Reducing the negative impact of economic activity on the environment is one of the most serious environmental areas.

Thus, the “Rosvertol” enterprise implements the “Environmental Policy” project. Some sources of pollutant emissions into the atmosphere are already equipped with gas purification plants. The introduction of new purification systems has reduced the emissions of hydrogen chloride, sulfuric acid, chromium, sodium hydroxide and other substances. The company has wastewater treatment plants and waste solutions of galvanic production. Centralized and local circulating water supply systems operate. In each division of the enterprise, selective collection and temporary accumulation of waste by type in specially equipped places in marked containers is organized.

As part of the investment project for the reconstruction of the “Severn” airdrome, it is planned to build local treatment facilities on the storm sewer pipeline passing through the airfield of the flight test station. The construction of structures will allow to eliminate the pollution of storm sewage by substances formed as a result of the operation of the airfield. Last year alone, the company invested more than 22 million rubles in environmental technologies.

In the end, we can draw the following conclusions.

Favorable economic and geographical location of Rostov Oblast, well-developed transport infrastructure, high labor supply, lack of social tension have historically determined the position of Oblast as one of the largest centers of diversified industry, developed agriculture, science, culture in the south of the country. In terms of GRP, Oblast is among the first 15 regions of Russia. High rates of economic development of the region are possible due to a mild climate, a favorable position, and the availability of natural resources. Consequently, the environmental factor plays a key role in the development of the Don Krai economy.

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**THE DEVELOPMENT OF DIGITAL COMPETENCIES IN THE
CREATION OF THE MES-SYSTEM FOR THE PRODUCTION OF
SPARE PARTS FOR CHINESE AUTOMOBILES BRILLIANCE AUTO
BY A RUSSIAN ENTERPRISE**

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Annotation. With regard to the activities of the Russian company engaged in the production of spare parts for Chinese premium-class cars Brilliance Auto, the prerequisites were identified and the need to create an MES system was substantiated. The spectrum of tasks arising during the creation of the MES-system and its integration into the activities of the Russian enterprise is determined. The analysis of the functions implemented by the MES system is given. Competencies are established that are formed among the participants in the project to create an MES system.

Keywords: production process. Managerial decision. Informatization of business processes. MES system. Functions of the MES system. ERP system. Information competencies of staff.

Introduction

In the context of globalization, programs implemented in the framework of international cooperation play an important role in the development of regional economic systems. One of such programs is the Program "Russian-Chinese Economic Cooperation as a Strategic Direction of the Development of the Economy of the Border Territories". The scientific part of the program is carried out by the scientific and educational structures of Russia and China, including the Pacific Center for Strategic Research

(Vladivostok) and Heilongjiang University (Harbin). The results of scientific developments are implemented both at Russian enterprises and at the enterprises of the Daqing and Harbin zones for the development of new and high-tech industries, the Harbin economic zone for development, and the zones of cross-border economic cooperation of Suifenhe and Heihe of China.

As part of the program, a project was implemented to create and implement the MES system (Manufacturing Execution System) at the Daldizel enterprise, which manufactures spare parts for Brilliance Auto vehicles manufactured in the Chinese province of Heilongjiang. The project aims to improve the quality of spare parts manufactured by Daldizel for Chinese-made Brilliance Auto vehicles and involves a radical modernization of production.

The aim of the project is to increase the competitiveness of Brilliance Auto cars manufactured in China by timely supply of spare parts to authorized services located in China, Russia, Southeast and Central Asia, as well as Europe. The creation of promising production structures based on deep modernization of existing production and the use of innovative technologies was chosen as a tool to achieve the goal. The project was implemented under project financing, in which capital was raised from banks in the Chinese province of Heilongjiang and the Russian Primorsky Territory. These are China Construction and Industrial Banks (Heihe), Longjiang Bank (Harbin), Russian Sberbank, Asia Pacific Bank and Orient Express Bank.

1. Prerequisites for creating a MES system for Daldizel

The prerequisites for the creation of the MES system were due to a number of circumstances [1]. Firstly, it was taken into account that a significant share of economic added value is created in the organizational and production structures of workshops and sections. Therefore, investments in the production process, in particular through the use of the MES system, will provide Daldizel with a real return. In the conditions of digital transformation, focusing on the creation and use of the MES system, the Daldizel enterprise is able to quickly change equipment of production facilities when changing consumer preferences. In addition, it was taken into account that reliable information necessary for making managerial decisions is generated directly in production structures [3].

Secondly, it was taken into account that the optimization of process control based on the integration of the MES system in the activities of the Daldiesel company can significantly improve the economic results of the enterprise. Considering that efficiency in the digital economy is largely

determined by information and intellectual resources, the use of the MES system will become a significant source for the formation of information competencies of Daldiesel personnel. In the event of disturbing influences on the spare parts production control system, for example, when production volumes fall to critical values approaching the breakeven point, the MES system enables the on-line analysis of information. This will allow us to offer managerial solutions that compensate for the disturbing effects, for example, by changing the order structure of the production subsystem at Daldizel.

The use of the MES system in the IT architecture will allow the company to maintain a balance between its uniqueness and the best world practices in informatization of business processes. Otherwise, this balance will have to be created in the process of customization using the resources of the ERP system, which is much more expensive [6]. In literary sources (for example, in [2, 3]), as an alternative to MES-systems, the introduction of systems oriented to the Lean Manufacturing concept is sometimes considered. However, these concepts do not contradict, but complement each other. Lean manufacturing is, first of all, a change in the philosophy of the enterprise, and the implementation of the MES system is associated with a change in the methods of working with information.

MES-system, contributing to improving the quality of production of spare parts by the Russian company Daldiesel, is a tool to achieve a high level of competitiveness of Brilliance Auto cars manufactured in China. A competitive factor, in addition to improving the quality of spare parts manufactured at the Daldizel enterprise, will be a reduction in the time for their delivery to authorized services.

2. Setting a goal and determining the range of tasks for creating an MES system at the Daldizel enterprise

The project implementation provided for the informatization of spare parts production processes. This was due to the need to improve the quality of manufactured spare parts, which are delivered to automobile factories in China that manufacture Brilliance Auto premium cars. The production of spare parts at the Daldizel enterprise is multinomenclature and is characterized by large amounts of data, not always well-structured, but necessary for making managerial decisions. Handling such data manually has become virtually impossible.

The task of increasing the level of computerization of production processes at the Daldiesel enterprise was accomplished by using automation systems such as BI (Business Intelligence), ERP (Enterprise Resource Planning) [6], MES (Manufacturing Execution System) [1] and automated

process control systems. The combined use of such systems has allowed us to create a vertical structure for managing the enterprise's activities, starting from the automatic collection of information and downloading by receiving summary analytical reports. When solving the problem, it was taken into account that the Daldizel enterprise management system, being hierarchical, has three levels: strategic, tactical and operational. Each of these levels is designed to solve various types of tasks, which differ primarily in the frequency of data processing.

Class BI and ERP systems determine the strategic level of management, MES systems are oriented to the tactical level, and the automated process control system is operational. MES-level involves the use of an automated production management system of the enterprise Daldizel. Such a system allows you to plan production processes in real time, from the formation of the order to the release of finished spare parts. The MES system provided the Daldizel enterprise with effective management of current production activities, having formed a number of competitive advantages of the enterprise. In particular, such properties of the MES system as increasing the speed of response to events and the use of mathematical methods incorporated in the system to minimize deviations from the created schedule made it possible to optimize the production process of manufacturing spare parts, increasing its level of profitability.

Within the framework of the project "Creation at the Daldizel enterprise", an MES system for managing the production of spare parts for Chinese automobiles Brilliance Auto a range of tasks was formed. The first task is related to the distribution and control of resources used by Daldiesel in the production of spare parts. The solution to this problem involved the construction of a model for the production of spare parts, the organization of a centralized storage of raw materials, semi-finished products, finished products, a quick and convenient search for data on their specifications.

The solution to another problem involved dispatching the production processes of manufacturing spare parts by managing production orders, resources (raw materials and semi-finished products), monitoring the implementation of the plan, work in progress and resource balances [2]. The next task covered the collection of evidence on the production process of spare parts, quality management. These data come from an automated process control system for the production of spare parts. Then the quality and reliability of the data are checked, their archiving and long-term storage.

The solution of one more problem was connected with the organization of management of equipment maintenance processes at the Daldizel

enterprise, which is closely related to the assessment of its performance. For this, methods of statistical and mathematical analysis were used. An electronic document management system was created to organize time and equipment downtime accounting. In addition, based on the attraction of toolkits of oriented graphs, the task of compiling production schedules and calendar work schedules for the production of spare parts was solved. As a result of solving this problem, the Daldizel enterprise was able, firstly, to coordinate the implemented technological processes, and secondly, to monitor the readiness of order fulfillment [5].

3. Functions of the MES system at Daldiesel

With regard to the activities of the enterprise Daldizel, the functions of the MES system were identified. These functions are operational in nature, and their implementation ensures the achievement of appropriate quality indicators. The implementation of the resource control function provides management of the processes of resource support for the production of spare parts. This applies to equipment, materials, personnel, documentation, tools and equipment. The operational planning function involves the calculation of production schedules based on the use of pre-formed heuristic preference rules, taking into account the characteristics of the Brilliance Auto model range and the specifics of spare parts.

The production dispatching function is associated with the control of the flow of manufactured spare parts. The implementation of the document management function involves controlling the content and passage of documents accompanying the manufacture of spare parts for Brilliance Auto vehicles. The function of collecting and storing data ensures the interaction of information subsystems in order to obtain, accumulate and transmit data circulating in the production environment of the Daldiesel enterprise. The personnel management function provides in the monitoring mode a range of control actions on the personnel of the Daldizel enterprise. First of all, this applies to those structural divisions that directly produce spare parts for Brilliance Auto vehicles.

The product quality management function allows you to analyze data characterizing the measurement of quality indicators of manufactured spare parts for Brilliance Auto vehicles. This happens in real time based on information from the production level [4]. This function provides the Daldiesel enterprise with effective quality control of spare parts, which is implemented by identifying problem areas. The implementation of the management function of production processes involves monitoring them, the results of which are either automatic adjustment or dialogue support for the decisions of the operator performing the process control.

The maintenance and repair management function enables the Daldiesel company to maintain a high level of operational readiness of elements of organizational and production structures, within which spare parts for Brilliance Auto vehicles are carried out. The function of tracking retrospective information on manufactured spare parts involves the visualization of information about the place and time of work for each product. This information is materialized at the Daldiesel enterprise in the form of a set of electronic reports that are compiled in various sections (executors, technological routes, components and materials). The performance analysis function is to report on the results of operations and involves a comparison of planned and actual performance indicators, production volumes of spare parts.

4. Choosing a way to solve the problems of creating an MES-system for controlling the release of spare parts for Brilliance Auto cars

To achieve the goal, the appropriate toolkit for solving the tasks set in the framework of creating the MES-system and its integration into the information system of the Daldiesel company was chosen. This is, firstly, the decomposition and analysis of the enterprise management system. Secondly, the structuring of goals necessary to highlight the range of tasks solved by the MES system. Thirdly, a functional analysis that allows to identify the functions of the MES-system in relation to the activities of the enterprise Daldiesel.

5. Evaluation of the results of the creation of the MES-system for the management of the production of spare parts for Brilliance Auto cars

The created MES-system, collecting and summarizing the data received from various subsystems, ensured the level of organization of production activities of the Daldiesel enterprise that meets the requirements of international quality standards. The improvement affected all stages of the production of spare parts, from the formation of a production order to the delivery of manufactured spare parts to the warehouse.

By integrating the MES-system into the structure of the information system of the Daldiesel enterprise, real-time effective communication of the production processes of structural divisions with the business processes of the Daldiesel enterprise as a whole is realized. This has improved the economic performance of the enterprise, including return on assets, cash flow, cost of production of spare parts, ensuring increased productivity and profit due to timely deliveries.

The use of the MES system at the Daldiesel enterprise increased the reliability of the data on the current production performance of the structural

units of the enterprise, including data on the real cost of manufactured spare parts, which is necessary for the organization of the effective functioning of the enterprise's ERP system. Thus, at the Daldizel enterprise, the MES system was the link between the ERP system and the systems of operational production activities of workshops, sections and production lines.

For Daldizel, the MES system has become the core of the integration of various business processes, including information processes. At the same time, the functions performed by the MES system were synchronized with the functions of other enterprise systems. This primarily relates to systems that provide supply chain planning (SCM-systems), sales and service management (SSM-systems), resource planning (ERP-systems). The synchronization of the functioning processes of the MES system and the automated process control system allowed at the Daldiesel enterprise level to monitor those processes that are key to ensuring the quality of the manufactured spare parts.

6. Developing the competencies of the participants in the project of creating an MES system for the Daldizel enterprise

Developing the MES system for managing the production of spare parts at the Russian Daldizel enterprise for Chinese Brilliance Auto Premium cars, the project participants acquired skills in defining functions and shaping the structure of such systems. The acquired competencies are necessary for the qualified development of hypotheses and conceptual provisions for the use of information systems and technologies, including MES systems, in various projects.

The MES system has fundamentally changed the organizational culture of the production of spare parts at Daldizel. The result of this process was an increase in the level of general cultural competencies of the enterprise personnel. This applies, firstly, to the development of the ability to find rational managerial decisions in the field of integrating information technology into project management strategies. Secondly, competencies associated with the use of regulatory documents relating to the use of information technology in project management. The perceptions of the staff on the importance of information technology in project management have expanded significantly.

The professional competencies of the staff improved. This refers to the ability of personnel to develop procedures and methods for monitoring business processes in the field of information technology, analyze the relationships between these business processes, apply the results to prepare balanced management decisions. The competencies of the personnel of

the Daldizel enterprise have increased in the implementation of integration solutions in such areas as information management and project management. The ability of the staff to assess the impact of external and internal environment on the efficiency and effectiveness of projects implemented in the field of information technology, as well as to develop a set of measures to minimize disturbing factors, has increased.

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«GREEN» VECTOR FOR SUSTAINABLE TERRITORIAL DEVELOPMENT IN BORDERING REGIONS

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Annotation. This article considers the directions of sustainable development of territories and populations of Russian bordering regions with the People's Republic of China, with the special focus on the «greening» of cooperation. Identified special features of Asian type cross-border cooperation to develop territories with the common history, territorial-geographical location, old traditions. In the context of sustainable and safe development, has been underlined the influence of natural and anthropogenic threats on the livelihoods of bordering regions, relevant and needed areas of cooperation are formulated.

Keywords: border areas, sustainable development, green economy, security, international cooperation.

Two modern processes determine the vital activity of nowadays society which connected with globalization and upholding the states sovereignty of their economies. They appear at the level of international relations between countries, characterized by international treaties and agreements.

At the same time, there are problems affecting the whole World, and humankind tries to solve global problems together, in particular, ecological issues and climate change. And if the first problem – ecology, caused the activation of «green» strategies for the national economies development, the second problem, - the climate change is still waiting for scientific conclusions and special solutions. These factors of influence on the national economies competitiveness are taken into consideration for the research issues on sustainable development of population and territories.

The aim of the research is to estimate the prospects for sustainable development of territories and population in the bordering regions related to a specific type of interaction. The purpose of this research to determine peculiarity of the regions development with the established type of bordering interaction.

Paying special emphasis to the impact of natural hazards and threats on life in the context of sustainable development, indicate promising areas of cross-bordering cooperation for the dynamic development and economic growth of bordering territories and their population. Objects of the research - the adjacent territories of the Russian Federation and the People's Republic of China. These territories of Russian regions represent one type of cross-border cooperation - Asian, interaction due to the history, established old traditions and geographical location.

The aim of the research is to estimate the prospects for sustainable development of territories and population in the bordering regions related to a specific type of interaction. The purpose of this research to determine the peculiarity of the regions development with the established type of bordering interaction.

Trade and economic cooperation between Russian and Chinese regions has developed unevenly, starting with the period when the Russian Federation entered the market economy [1]. Thus in 2015, the trade turnover decreased by more than 19.6 billion US dollars compared to 2011, the decline in exports of Russian goods to China reached 2.5 billion US dollars. But after signing in 2015 the Joint Agreement between the Russian Federation and the Republic of China on cooperation in conjunction with the construction of the Eurasian Economic Union and the Silk Road Economic Belt [2], trade and economic cooperation between our countries demonstrates sustainable progressive development. Official data on turnover in the period between 2015 - 2018 demonstrate that it consistently grew from 63.5 billion US dollars in 2015 to 86.9 billion US dollars in 2017 (Table 1).

Table 1 - The Dynamics of foreign trade of Russia and China in 2011 - 2017 (million US dollars)

Period/ indicator	2011	2012	2013	2014	2015	2016	2017
Turnover	83 232	87 394	88 799	88 389	63 556	66 108	86 964
Export	35 030	35 766	35 625	37 505	28 605	28 021	38 922
Import	48 202	51 628	53 173	50 884	34 950	38 087	48 042
Balance	-13 172	-15 862	-17 548	-13 380	-6 345	-10 066	-9 12

The trade turnover between Russia and China in 2018 reached 110 billion US dollars. China's main trading partner is Germany, followed by Switzerland. Russia ranks only on the tenth position in this indicator.

Russian company «Rosneft» and «Chem China» have agreed to build a petrochemical complex of the Eastern petrochemical company (VNHK) in the far East of Russia with a capacity up to 30 million tons per year. Commissioning of the first and second stages is scheduled for 2022. «Gazprom» signed a Memorandum of cooperation in the field of gas generation in China in the form of joint ventures. Indeed, China's electric power industry includes a significant share of coal plants (more than 25%). As the environmental costs of producing coal-fired electricity grows, China has planned to use in the near future natural gas as the most efficient and environmentally friendly raw material by the end of 2020. Currently, the largest volume of export from the Russian Federation to China are energy resources.

The first official document on the supply of oil, natural gas and electricity to China, cooperation in the field of nuclear energy, was the Agreement between the Government of the Russian Federation and the Government of the people's Republic of China on cooperation in the peaceful use of nuclear energy, signed in 1996. Strict criteria for sustainable development, which are directly related to environmental standards of nature management, have not yet been achieved by both countries, and economic entities of the real economy do not meet these standards to the necessary extent (although almost all enterprises of the Russian Federation have developed environmental production standards and are included in the production development strategy). However, in Russian regions bordering China, the environmental policy of the neighboring state has a significant impact on the environment.

The «Strategy for Ecological Safety of the Russian Federation for the Period until 2025» [3] lists the main threats for environmental safety: internal threats due to general changes in the global economy; planetary threats, global threats; regional threats caused by the activities of neighboring countries having common borders with the Russian Federation.

The researched threats include: mining in the bordering territories; fires that occur in adjacent territories; pollution of trans boundary watercourses and lakes; redistribution of the flow of trans boundary watercourses. Indeed, environmental problems are becoming increasingly urgent in the implementation of cross-border and cross-border cooperation with China. This concerns the problems of the Amur River - the largest water body

in the world is formed by the water flow from the territories of the Russian Federation, the People's Republic of China, the Republic of Mongolia and North Korea. Thus, 820 thousand square meters km of Amur river are located in China. In the territory of China there is also the headwaters of another great Russian river, the Irtysh, the Black Irtysh.

The negative anthropogenic impact on the Amur river basin appeared to another natural object in China - the Sungari river, a major tributary of the Amur river, with the number of environmental problems. As an example, the accident in November 2005, with a chemical plant in Jilin province, outflow of 100 tons of benzene. Another disaster in July 2010, in the same province Jilin, the flood in Sungari river, as a result about 7 thousand containers were washed into the river, 3 thousand of them contained dangerous chemicals. Despite the commitment to the agreements on informing the parties about emergency situations, the consequences of anthropogenic and natural influence on the ecology of the Russian border territories cannot be considered satisfactory. On the territory of the Khabarovsk territory of the Russian Federation, systematic pollution of the Amur river has observed, which leads to a reduction in fish stocks, the appearance of previously unknown diseases for the river fauna.

Another river Irtysh flows through the territory of three countries - China, the Republic of Kazakhstan, the Russian Federation, where it flows into the river Ob. There is occurred a complex problem of the Irtysh watercourse. China, in order to solve the problems of drought in agricultural areas, carried out irrigation works, actively affecting the fresh water reserves of the Omsk region, through which the Irtysh flows. These and other activities on water disposal, expansion of riverbeds, etc., lead to the destruction of ecosystems that affect the socio-economic development of the bordering with China Baikal region. These problems have led to joint environmental protection programs of the Russian Federation and China, for example, from the pollution of river basins in Heilongjiang province and the signing of an Agreement between Russia and China on the rational use and protection of transboundary waters.

The main point in cooperation with China in the field of environmental safety was the efforts to develop common standards and targets for the quality of transboundary waters. This also includes innovations and high tech technologies for the efficient use and protection of transboundary waters. An important part of the agreements is to inform the second party about the activities that can lead to a negative transboundary impact in the future, as well as joint efforts to prevent floods in transboundary waters, informing immediately transboundary environmental disasters, etc.

Environmental sustainability, as a component of the integrated sustainable development of cross-border territories and settlements of the Russian Federation and China, contradicted to the desire for a sharp, at any cost, increase in the regional product. At the same time, China is implementing several forest programs to minimize the anthropogenic impact on the coastal territories of the Chinese section of the Amur river and creates a huge area of ecological sustainability of flora and fauna. For comparison, protected areas of this type in China are 16%, and in Russia-only 9% [4].

The achievement of environmental sustainability in the bordering territories of the Russian Federation can be given with the practical example of the Khabarovsk territory. An important direction of cross-border cooperation – «Green vector» is connected with the implementation of measures for environmental cooperation and is based on the strategy of development of the territory, implemented in modern conditions [5]. Table 2 summarizes the indicators, threats, measures and results of cross-border environmental cooperation between the Russian Federation and China «Green vector».

Table 2 - Characteristics of the cross-border environmental direction of cooperation between Russia and China «Green vector»

	Indicators of environmental quality and environmental safety	The main threats to water bodies in the region	Measures of cross-border environmental cooperation between the Russian Federation and China	Results / Prospects for the Implementation of Environmental Cooperation Measures
Region Khabarovsk region	1. Situation in Amur River and its tributaries	Powerful anthropogenic load	Modernization of treatment facilities in Khabarovsk and Komсомolsk-on-Amur. Water quality monitoring	Positive changes in water quality of Amur and Ussuri rivers
	2. Air quality in the cities of bordering regions	High level of microbiological contamination	Increase in the volume of eco-friendly fuels, transfer to centralized energy and gas supply in the settlements	So far, the situation of atmospheric air in the settlements of bordering regions are evaluated as unfavorable.
	3. Provision of settlements with stable systems of waste collection and disposal	Intermittent chemical contamination due to lack of waste management and disposal infrastructure	Arrangement of places of placement of solid municipal waste. Development of the sphere of waste management of production and consumption	Elimination of objects of accumulated harm to the environment

The sustainable development goals of the region provide the growth and development of social communications. To the greatest extent, tourism contributes to this task, and in connection with the increase of tourists flow from China to the Russian bordering regions, some activities have been implemented in order to developed sustainable tourism and improve the security of border areas and the population (Table 3).

Table 3 - Measures to develop sustainable tourism and improvements in the security in bordering territories

N	Activity name	Results
1	Opening of a permanent customs on the Russian-Chinese border on Bolshoy Ussuriysky island	Integration into international and national tourist routes of the Chinese regions
2	Development of a premium segment of tourist services	Business, cultural and extreme tourism in the bordering regions
3	Building an international airport with waiting area for transit passengers with a capacity around the clock.	Availability of a world-class hotel, currency exchange points, restaurants and duty-free shops.
4	Extension of the practice of visa-free regime (eight-day, in accordance with the regime of the Free Port)	Tourist visits from the bordering states from cities like Khabarovsk and Komsomolsk-on-Amur
5	Tourism infrastructure development	Availability of hotels with conference facilities. Hotels with different price category in the territory of Khabarovsk with a total design capacity of at least 2.5 - 3 thousand guests; the construction of shopping and entertainment complexes on the territory of the Bolshoi Ussuriysky island and the city of Khabarovsk
6	Cooperation with international tourism associations	Entering the international tourism world market

The creation of international tourist cruises with access to China - the Shantar Islands will serve to promote the development of the transit corridor Fuyuan - Nikolaevsk-on-Amur. For the growth of attractiveness and the formation of a comfortable environment for consumers of a tourism product, the development of appropriate infrastructure is required. Including river stations Khabarovsk and Komsomolsky, marinas Troitskoye, Bogorodskoye, Amursk.

Similar environmental problems of China and the Russian Federation entail the formation of similar environmental policies of states. It includes environmental aspects of cross-border cooperation. A single informational

cross-border platform serves to attract the regions of the PRC and the Russian Federation, promoting cooperation in the field of ecology. Understanding of common problems and mutual support in solving them is also the basis for the sustainable development of the «green vector» of bilateral relations, the security of border areas and the population. Russia and China have created the Russian-Chinese Coordination Council for inter-regional and cross-border trade and economic cooperation.

As a conclusion we point out the transboundary aspect of the common environmental problems in bordering regions of Russia and China. The territorial development programs of bordering China are associated with increased water consumption, which affect the sustainability of Russian territories bordering with China. Ecological catastrophes of an anthropogenic nature on the adjacent Chinese side caused ecological and economic damage to Russian regions. The intensification of economic activity within the undeveloped border territories of the Amur river without proper control in the field of environmental protection can also lead to the destruction of the existing ecosystem. The listed problems, as well as global trends in environmental sustainability, approved standards in this area necessitated priority measures initiated at the state level - in the form of national projects, and at the regional level - in the form of strategies for the socio-economic development of territories. The national environmental project of the Russian Federation among 11 federal projects includes the projects like «Conservation of biological diversity and the development of ecological tourism», «Conservation of forests», «Implementation of the best available technologies». The project for the conservation of biological diversity and the development of eco-tourism requires creation of 24 new special protected natural areas.

In the field of environmental protection, cooperation between Russia and China led to the development of a Strategy for creating a transboundary network for specially protected natural areas of the Amur River Basin (2011). As a result of the Agreement on the formation of the Russian-Chinese network of border environmental reserves in the Amur river basin (2016), the Amur Green Belt was formed from 28 reserves of China and Russia [6]. Along with the creation of joint protected areas, the exchange of environmentally friendly production technologies (including the best available technologies), cross-border cooperation parties monitor air quality, surface water and biological resources, and exchange experts in the field of environmental protection [7]. Thus, both domestic policy and the policy of cross-border cooperation are changing the direction to the green vector of the development of socio-economic relations, which is reflected in the relevant national laws, interstate agreements and programs.

The scientific novelty of the research are following. Out of the field of a number deep scientific studies on the «greening of economic growth», cross-border cooperation and environmental issues in the field of economic cooperation between Russia and China [8]. As a example, specific projects and programs of the «green vector» of cooperation between our countries, remained the fundamental issues of culture formation are not so much adherence to the standards of a green economy, but safety, environmentally friendly behavior of the population.

Also alignment of a common understanding of the content of «green» to cultures, «green» upbringing, education, collaboration and the implementation of this type of program. In the first place, this should be promoted, in the authors' opinion, by joint educational and research-and-introduction university international programs aimed at border regions and including sections on sustainable and safe territorial development. The implementation of such international programs will contribute to the "green" growth of bordering territories.

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NEW MANAGEMENT TECHNOLOGIES: ENGINEERING AND RE-ENGINEERING

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Abstract. *The article provides an overview of theoretical data on the nature and features of the implementation of business process reengineering, both in world practice and in the CIS countries, in particular in Kazakhstan.*

Keywords: *reengineering, business processes, implementation, features, economy, technological progress, information technology, business hierarchy, improving business processes, stages of reengineering.*

The economy in the world does not stand still. Any change in the economic situation in the world is reflected in business structures in particular. And, as a result, any company operating in any industry needs to make adjustments to business processes, change them, improve them. Here, the phenomenon of business process reengineering comes to the rescue - a radical rethinking and redesigning of business processes to achieve sharp, spasmodic improvements in the main modern indicators of the company's activities - such as cost, quality, service and pace [1].

Business process reengineering is necessary for companies not only when they are in crisis situations, but also for healthy competition in the market. Its practical application is examined in detail by M. Robson and F. Ullah in his book "A Practical Guide to Business Process Reengineering". In addition, in this book, the authors highlight such an initiating factor in which business process reengineering is necessary - this is a management that clearly represents the prospects arising from radical changes. The authors emphasize the factor of competent management and the right team and put it at the head of reengineering [2].

J. Harrington, C.S. Esseling and H.V. Nimwegen and Ernst & Young LLP in "Business Process Optimization. Documentation, analysis, management, optimization" talk about the importance of analyzing business

processes, also focusing on competent management and a properly selected team that implements updates. Despite the fact that this publication was published in 2002, the authors also touch upon the importance of technological progress and its mandatory application in the reengineering of business processes. Along with the technological aspect of reengineering, the authors highlight such a feature as market monitoring for the relevance of reengineering tools and note that effective improvement of business processes occurs when they are constantly updated, taking into account information technology, market trends and constantly developing employees [3].

The rapid development of information technology has made significant changes to the organization of business processes, some of them have been radically changed, others are completely excluded. However, the management of business processes still remains with the person, and more precisely, with competent management, which also needs regular updating of knowledge. At different stages of the formation of the economy, the human factor in the organization of business processes played a different role, today most companies give their employees more freedom in action, as well as the opportunity to participate in the discussion of key issues of the company, which differs significantly from the bureaucratic method of management. To date, there is no universal approach to personnel management when introducing new processes or improving them, however, the above method is optimal for the implementation of reengineering, as it motivates and directs the team to achieve a qualitative result [4].

Considering the Kazakhstan market from the point of view of implementing reengineering projects, one can make an unambiguous conclusion - the entrepreneur of the Kazakhstan market does not know the concept of "reengineering business processes", but they have not heard about it in the sector of small and medium-sized businesses. The Russian market is ahead of Kazakhstan, the latter has only a few consulting companies that have sufficient experience and provide services for the implementation of reengineering, starting from the analysis stage to project control. It is the lack of sufficient practical knowledge and the difficulty of implementing reengineering, as well as the presence of a bureaucratic factor in some market segments that are affected by R. Novikov and D. Sikhimbaeva in their article "Conditions for the application of technology for reengineering business processes for domestic enterprises". [5].

Considering the above opinions of the authors, one can highlight the main feature of reengineering - the decision to conduct it is made only by the top management of the company, those by competent management.

Because

Firstly: only the management of the company has the breadth of view and authority that is required in order to see the problems of the company in full.

Secondly: reengineering provides for radical changes, which in turn should simplify and / or exclude any process, and possibly a number of processes, which will most likely entail a reduction in the staff of the company, which is the responsibility of the management.

Thirdly: the procedure for implementing reengineering is a rather costly and risky undertaking, therefore, the budget and the entire algorithm of actions are subject to mandatory collegiate discussion and coordination at a higher level.

Back in the middle of the 20th century, the German - American psychologist and sociologist Kurt Levin developed a model for powerful change management in situations where middle and lower level employees of the company resist it. Most Western companies successfully implement all changes in business processes using this model. The first stage of the model is "DEFROST" - company employees are reporting that significant changes are coming in the management structure, and as a result, they experience emotions and resistance to these changes. The second stage - "MOVEMENT" - with the right approach from the leadership, motivation and involvement of employees in the team, the latter in a short time realize the importance of changes and take the leadership side. The third, most important, stage - "FREEZING" - consolidation of the achieved reengineering result, which is achieved by correctly made decisions. At this stage, it is also important to remember that for the complete completion of reengineering, constant monitoring and control of the changed processes is necessary. [6]

Kazakhstan companies do not use the above model of K. Levin, as they prefer to seek help from foreign specialists or consulting companies with foreign experience, which negatively affects the development of this business line. In addition, adopting foreign experience, domestic companies do not take into account that the specifics of the business and regulatory documents are fundamentally different. For example, normative legal acts on obtaining any permits in the field of trade and public catering are completely outdated, since they have not been adjusted since the Soviet Union and they do not correspond to today's realities. All this is a kind of barrier to the introduction of such a tool as reengineering in Kazakhstani companies. It will be important to note that the lack of government support also impedes the development of these technologies in enterprises and

therefore all attempts to improve and apply reengineering in the Kazakhstani market tend to zero.

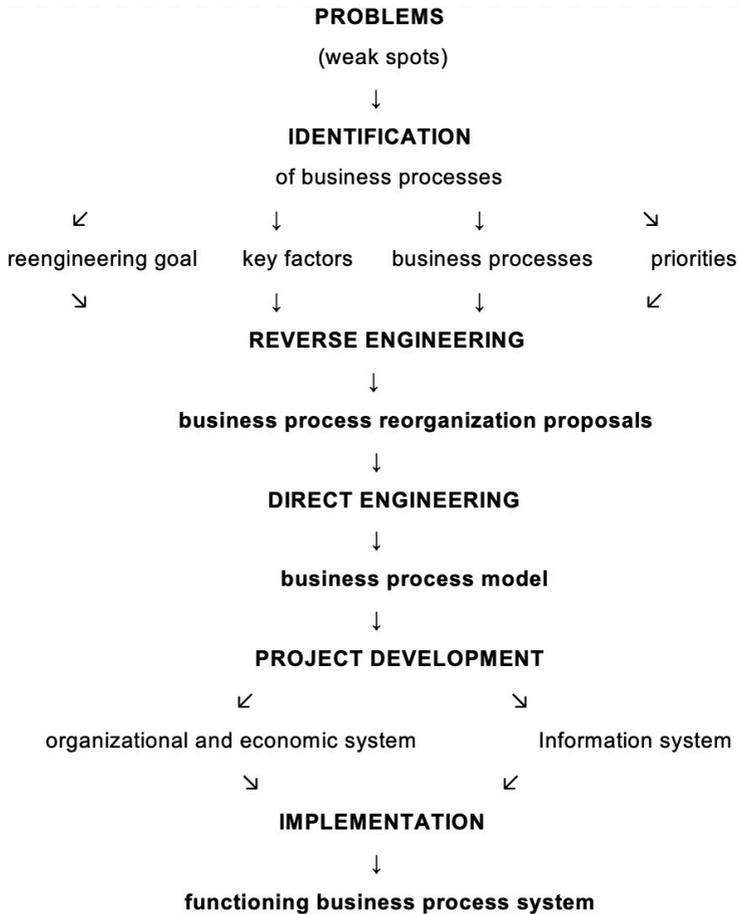
Reengineering is not the only system for transforming a company's business processes; it has its advantages and disadvantages. When identifying this model of changes for Kazakhstani companies, it is necessary to take into account the fact that most domestic companies have a bureaucratic management structure in which reengineering does not work in its classical sense. Since the hierarchical structure of Kazakhstani companies does not allow an objective assessment of the effectiveness of all business processes. And as noted above, without such an analysis, reengineering will not bring the necessary result. Therefore, most often, for a slight improvement, they resort to the internal integration of business processes without a significant change in the functioning of the organization. The choice in favor of this method is clear. This is a less costly and less painful method of improving some performance indicators of a company, and it also does not require intervention from the supervising state body, which will save time.

When introducing a reengineering in a revolutionary sense, some difficulties may arise in the market of Kazakhstan for some reasons:

1. Bureaucratic red tape at every stage of implementation, starting with the hierarchical structure of companies, ending with state bodies;
2. The presence of high risk, based on the lack of positive experience in the local market, taking into account the specifics of Kazakhstan;
3. The lack of qualified specialists in the field of improving business processes and the introduction of reengineering, as well as the lack of tools that must be used for successful implementation;
4. Lack of development of modern information technologies, which are an important factor in the implementation of reengineering;
5. The lack of understanding among the company's management why this improvement method is necessary and, as a result, the lack of a budget for promotion.

In this connection, a clear understanding on the part of company management is needed, where to start reengineering and what is its ultimate goal. Indeed, even with minor changes in the key processes of the company, you can achieve tremendous results in increasing profits and the importance of the company in the market.

D.K. Meirbekov in his article "Reengineering of enterprise business processes" provides a standard algorithm of actions applicable to the implementation of reengineering. [7]



Scheme 1. Stages of reengineering

It can be clearly seen from the above diagram that business process reengineering begins with the preparatory phase - a comprehensive analysis of the company's business processes and problem determination. In addition, the preparatory phase will include the selection of methodology and tools, the definition of the main goals and priority areas of reengineering procedures, as well as the assessment of the amount of work, the creation of a governing body and the formation of a team, the deadlines for each stage are set.

The final stage will be redesigning - reengineering itself, where a new

model of business processes will be created, which will be spelled out in the form of regulatory documents of the company, which are an integral part of office work, and recommendations will be developed for implementation and further control and monitoring. [8]

As a rule, external consultants — marketers and auditors — are involved in the above stages of implementation; they are the ones who can objectively evaluate all the shortcomings and probable prospects. On the basis of the prescribed tasks and recommendations, the completion of the reengineering implementation involves employees of the company - managers of structural divisions and specialists in the field of information technology. [9]

Western practice already has qualified specialists in reengineering in various areas of business, while providing a full range of services that does not require the intervention of either auditors or marketers. For this, consulting companies are being created whose specialists are broadly oriented and can replace the large staff of consultants involved, which simplifies and speeds up the process of implementing reengineering. [10]

Summing up the topics discussed, I would like to note that, reengineering with its main features, such as:

- fundamental nature;
- radicalism;
- spasmodicity,

must firmly take its position in the Kazakhstan market as the main tool to improve the quality of services and / or production. Why is it necessary at the state level to make decisions on supporting this tool and creating the necessary conditions to simplify the procedure. Given that companies all over the world have a positive practice in introducing reengineering in any industry where they actively use modern information technologies, it is necessary to integrate the achievements of modern information capabilities into the Kazakhstani economy. As a result of a minimal set of actions, having gone through mistakes and failures, business process reengineering will firmly consolidate its position among Kazakhstan companies, which will allow them to be competitive players in the international arena.

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HISTORICAL AND REGULATORY ASPECTS OF THE FIGHT AGAINST CORRUPTION IN THE GRAND DUCHY OF FINLAND, THE RUSSIAN EMPIRE AND THE REPUBLIC OF FINLAND

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Abstract. Corruption is a widespread phenomenon, and therefore corruption-related research in Finland is very fragmented and requires research. The article examines the nature of corruption, its causes and consequences, the formation of criminal legislation for bribery and extortion and the need to eradicate this phenomenon in the Russian Empire and in the Grand Duchy of Finland, starting from the XIV century, and also after the Republic of Finland gained independence on December 6, 1917. The presented studies of Finnish, Swedish and Russian historians and legal scholars from the mid- XIX to early XXI centuries indicate the emergence of corruption long before the formation of the Grand Duchy of Finland. Corruption in Finland has been studied from both theoretical and empirical points of view. Corruption studies were conducted using various studies that were conducted in many scientific disciplines and related to various areas of society. According to researchers of the police high school, insufficient research has been conducted in the field of corruption, which combined information on unsolved crimes and hidden corruption, as well as observations on various articles of the Criminal Code in various areas of society.

With the transformation of Finland into an independent and sovereign state, it was recognized that it was necessary to develop and strengthen its political system with new statutes that have the character of new laws, which provide the necessary authority of the executive branch, at the same time expand the powers of national representation and guarantee the rights and constitutional freedoms of citizens.

But, despite the existence of laws regulating the activities of political parties and the holding of election campaigns, political corruption is becoming an increasingly urgent problem. It is necessary to strengthen financial control measures and ensure transparency in the activities of parties, as well as freedom of the press is an important condition in the fight against political corruption in compliance with basic international standards and the requirements of EU Directives.

Keywords: corruption, the Grand Duchy of Finland, extortion, bribery, criminal punishment.

The prerequisites for the development of such a phenomenon as corruption originated in ancient times. The classical concept of corruption as a general disease of the state was present before the new era and was central to the political thinking of the ancient Greek philosophers Plato and Aristotle.

So, Aristotle defined corruption as a factor that can lead the state to degeneration and even death. "The most important thing in any state system is to arrange things through laws and the rest of the routine so that officials cannot profit"¹.

Studying the history of corruption as a phenomenon in the Grand Duchy of Finland will help understanding the trend and level of corruption in Finland in the XXI century, as well as assessing the effectiveness of anti-corruption measures to create their own specialized institutions for preventing and combating corruption and reducing its level.

The international legalization of the inclusion of Finland in the Russian Empire began with the first military campaigns of the Swedes on the borders of the Novgorod principality in the middle of the XII century, which culminated in signing the definition of borders between Novgorod land and the Kingdom of Sweden in the Oreshek fortress of 1323, confirmed in Derpt in 1351 and Vyborg in 1468. The Russian-Swedish war of 1700-1721 ended with the signing of the Nishtat Peace Treaty and the annexation of Livonia, Estonia, Ingermanland, part of Karelia and other territories to Russia.

The first mention of the oldest existing land law in Finland probably refers to the laws issued in 1347 - Maunu Eerikinpojan maanlaki. The law was widely used throughout the country and applied legal proceedings in obscure situations.

Professor of Law and Judge of the Supreme Court of Finland from 1925-1935 Carl Allan Serlachius, refers to the first written law of Kristoferin maalaki of 1442 in Swedish, which was valid for almost 300 years and was a general law of Sweden and Finland until 1734². The General Code of Finland and the supplementary code in three volumes were the result of legal reform and included the Criminal Code. Chapter XVI "On crimes against public authority and public order" and chapter "On official crimes of officials" provided for punishment for giving a bribe.

¹Aristotle. Works: in 4 v. V.4./M. Thought. 1983.

²Kristofer kuninkaan maanlaki, Tietosanakirja, 5. osa (Kaivo-Kulttuurikieli), s. 435-436. Tietosanakirja-Oy, 1913.

In the Russian Empire, the criminal liability for bribery was determined earlier. So, in the era of the reign of Ivan III, bribery among judges in the exercise of their powers acquired such a massive character. In the Judicial Code of 1497 - the first regulatory legal act of the Russian state - the criminal liability for receiving bribes by judges was first established. The judge legalized torture as a means of reaching the truth.

In the Codex of 1550, punishment in the form of placement in prison was widespread, including for bribery and official duties that violate private interest and violate state interest³.

In the XVIII century, as a result of the reforms of Peter the Great, a bureaucratic apparatus developed and corruption became widespread, Peter the Great tried to combat bribery with repressive measures, including the death penalty, according to the Tsar's Decrees of August 23, 1713 and February 5, 1724. In 1721, for official abuse, the Siberian governor M.P. Gagarin was hanged, and the vice-governor of Petersburg after torture was publicly carved by a whip.

Empress Elizaveta Petrovna, by one of her first decrees of May 7, 1744, abolished the death penalty in the territory of the Russian Empire, including for malfeasance. During the reign of Elizaveta Petrovna, local officials, whose powers included legislative, judicial and administrative functions, did not receive a salary and used their posts as sources of income.

In 1779, for the first time, royal clauses were added to Finnish-Swedish legislation by a royal decree, which significantly softened the sentences for many crimes, including service ones.

The Criminal and Correctional Penalties Code of 1845 (as amended in 1864 and 1885) provided for the responsibility of an official or other person in the state or public service for receiving a bribe, extortion, bribery and extortion, as well as for assistance or for concealing of these crimes⁴.

If an official or other person accepts a gift consisting of money, things or whatever, the amount of no more than double the price of the gift should be recovered. For a repeated act in addition to a monetary penalty, removal from office (Art. 372). So, for receiving a gift of money, a thing or another, it was foreseen the deprivation of all rights and advantages and to be sent to a correctional detention center for a term of 2.5 to 3 years (Article 373).

³Judicial Code of the Sovereign Tsar and Grand Duke John Vasilyevich and some of this Sovereign and his close successors Decrees. Second Edition. Moscow. Printing house of N. Novikov, 1786.

⁴The Code of Criminal and Correctional Sentences of 1845. 1885 edition // Code of Laws of the Russian Empire. In 16 volumes. Volume 15. St. Petersburg. Activist. 1912, P. 1-202.

According to the Code, extortion was considered the highest degree of shakedown. The perpetrator of extortion was deprived of all rights and advantages and transferred to a correctional detention unit for a term of 5 to 6 years. If the extortion was accompanied by torture or other obvious violence, deprivation of all rights of the state and reference to hard labor for a period of 6 to 8 years (Art. 378).

The officials of the rural municipality and rural administrations, as well as their clerks and their assistants, guilty of illegally collecting money or other gifts and treating officials or other people, were sentenced to imprisonment for 4 to 8 months. If it is proved that all the money collected in this way or part of it was appropriated by them, then they are deprived of all the special and assigned rights and advantages and transferred to a correctional detention center for a period of 4 to 5 years. (Art. 379).

Contributed to bribery or extortion by accepting gifts or bribes, or participating in the demand, transfer or receipt of bribes or gifts, or through participation in harassment or threats used for extortion, as well as superiors, and finally judges who are exposed to bribery or extortion try to justify contrary to the laws and circumstances of the case, sentenced to transfer to a correctional detention center from 4 to 5 years, 1.5 to 2.5 years (Art. 380).

In the years 1863-1864, the Zemsky estates were presented with a package of new criminal laws. The first bill concerned the general principles on which the future criminal law should be built, the second concerned the provisional criminal system, which was in force until the adoption of the new criminal law, as well as partial amendments to the criminal law. The bill actually contained an outline of the basic principles of the Criminal Code. The new bills of the Code of Laws in 1866 dealt with significant amendments to the history of the criminal law of the Grand Duchy of Finland, including the first sentence of "imprisonment"⁵.

In 1889, the Finnish Seimas approved the Criminal Code of the Grand Duchy of Finland 19.12.1889 ⁶. The Criminal Code entered into force by Decree of Alexander III, signed on April 2/14, 1894 ⁷.

In 1902 a collection of Finnish decrees was published. Legislation promulgated in Russian "in three volumes, and in 1907 an" Alphabetical Index to Decisions Relating to the Grand Duchy of Finland "was published⁸.

⁵Allan Serlachius. Suomen rikosoikeuden oppikirja. Ensimmäinen osa. Kustannusosakeyhtiö Otava, Helsingissä. 1919.

⁶Suomen Suuriruhtinaanmaan Rikoslaki. Annettu Helsingissä, 19 p:nä Joulukuuta 1889.

⁷Suomen Suuriruhtinaanmaan asetus-kokoelma. 1894. n:o 17. Hatsinassa 2/14 p:nä Huhtikuuta 1894.

⁸Alphabetical Index to Decisions Relating to the Grand Duchy of Finland. Compiled by N. N. Korevo. SPb., 1907. V. 1-3.

The comprehensive reform of the Finnish Criminal Law was amended in 1991. In 2003, the so-called general doctrine of criminal law was supplemented.

At the same time, each modern edition of the Finnish Criminal Law of 1889, with subsequent amendments to the present, begins with the words:

We, Alexander the Third, by the Grace of God, the Emperor and Autocrat of All Russia, the Tsar of Poland, the Grand Duke of Finland, and so on, and so forth, and so forth. We hereby command: Guided by the presentation of the Commissioner of the Finnish State, we hereby approve the following criminal law for the Grand Duchy of Finland, for entry into force and the enforcement of which a special decree is given.”

Immediately, we note that the structure of the 1889 Criminal Law has not changed much in the current edition. And in the second decade of the 21st century, the titles of the chapters of the Criminal Law on Crimes against the Government, providing for penalties for giving and accepting a bribe, remain unchanged: chapter 16 “Crimes against state power and public order” and article 40 “Service crimes of officials”. Thus, article 16, §13 of the Criminal Law of 1889 provided for a state official or other person to give, promise or offer to give a bribe, a fine of up to 500 Finnish marks or imprisonment for up to 3 months with the loss of the bribe or its value.

According to article 40 §1, a government official was punished with imprisonment of up to two years and the deprivation of the right to occupy certain positions or engage in certain activities.

It is also important to pay attention to the right of a defendant to a fair trial or administration of justice, stipulated by the Law of 1889, depending on the severity of the crime or the consequences that may arise as a result of violations in the course of deciding on criminal prosecution, investigation and conviction based on objective assessment of authentic and reliable evidence.

For example, according to Art. 40 §2, if a judge or other official intentionally pronounces an unfair sentence, must be removed from office and declared unsuitable for holding public office.

So, in case of imposing too severe a punishment on the innocent, imprisonment is provided for a term of 4 to 12 years or life imprisonment with removal from office and proclamation as a person who has lost civilian confidence.

According to article 40 §7 for misappropriation of money or other property by public servants, a penalty of loss of office and imprisonment of up to two years is prescribed. If the value of the misappropriation is more than 1,000 Finnish marks or if there are too severe aggravating circumstances, the punishment is imprisonment of up to four years. In case of concealment

of documents appropriated or falsified, accounts and other documents, imprisonment for a term of two to ten years with deprivation of office and the proclamation as a person who has lost civil confidence is provided.

It must be recalled that the Code of Law approved by the State Council of 1845 included other additional criminal penalties, including those not at the discretion of the court, but *ipso jure*, that is, by virtue of the law.

So, the Code of 1845 and article 961 of the Charter of Criminal Procedure additionally determined the deprivation of letters, diplomas, patents and certificates from convicted persons. The Editorial Commission intended to deprive only the nobles, church and clergymen and honorary citizens of their rights when serving their sentences in a correctional house, and when imprisoned, by the nobles and church and clergymen. Deprivation of state rights for all classes was supposed only during hard labor.

The State Council also included the loss of the right to retirement on the grounds that persons who have lost their rights and benefits in the service cannot retain the right to care and material support from the state. When determining a court for hard labor or a reference to a settlement, all personal obligations of the convict were terminated; but “his obligations on property passed to his heirs in proportion to the inheritance received, if they did not refuse it at all”⁹.

In 1903, Nicholas II approved a new Criminal Code, in which chapters on state crimes were added in 1904, but no additions were made regarding corruption offenses.

According to the laws of the Russian Empire, in the 1906 edition, the Grand Duchy of Finland was part of the Russian Empire and was in the power of the Russian Emperor and Grand Duke of Finland and the jurisdiction of the Russian Empire¹⁰.

With the transformation of Finland into an independent and sovereign state, it was recognized that it was necessary to develop and strengthen its political system with new statutes that have the character of new laws, which provide the necessary authority of the executive branch, at the same time expand the powers of national representation and guarantee the rights and constitutional freedoms of citizens.

The first Constitution of independent Finland came into force on July 17, 1919 after the signed Decree on the Declaration of Independence of the Republic of Finland ¹¹ in full accordance with the principles of the right of nations to self-determination.

⁹Code of Civil Laws of the Russian Empire. Volume I.1832. Article 1553.

¹⁰Code of basic state laws on April 23, 1906 Chapter Two, paragraph 26).

¹¹Resolution of the Council of People’s Commissars of December 18, 1917 on the recognition of state independence of the Republic of Finland.

According to § 93, each official is responsible for the measures that he has taken or in which he participated as a member of a collegially organized administrative department.

Hidden crime in Finland in 1973 was studied by professor at the University of Tampere Pertti Hemanus. "Latent crime is a problem in the fight against bribery and corruption in general. The information obtained from statistics does not provide a complete picture of the reality of corruption."¹². Corruption in power was a topic of study for many Finnish political scientists and lawyers in 1970-1980.

Professor of Sociology and Law, Paavo Uusitalo, referred to the complexity of the investigation of corruption in Finland: "Since corruption is a phenomenon completely foreign to the ideal of legal state and the rule of law, by definition it cannot exist in a right state, so it is difficult to obtain accurate information about actual corruption. Part of the discussion is about the problem of defining corruption, and partly about the high share of hidden or latent crime."¹³.

Changes to the criminal law and the Constitution in force since 1919 were required. New amendments to the Finnish Criminal Law regarding corruption offenses came into force in 1998, but they did not provide for the strengthening of criminal liability for the most serious crimes against state power, in comparison with the revision of the law of 1889, just as clarifications and the very term "corruption" was not introduced in the Finnish legislation to date.

According to the amendments to the Criminal Code of Finland dated 07.24.1998, a fine or imprisonment of up to two years is prescribed for a promise, offer or giving bribe to a public servant (13 § (12.7.2002/604).

For giving a bribe, receiving other benefits in significant amounts or causing harm to another, the punishment is imprisonment from four months to four years.

In 2011, article 14 a § 16 of the head of the Criminal Code (10.6.2011/637) came into force on giving a bribe to a deputy with a fine or imprisonment of up to two years. Bribery of a deputy of the Parliament as a whole is a gross act, the offender must be sentenced to imprisonment for a term of four months to four years (14 b § (10.6.2011/637).

In 2002, additions were made to Chapter 40, Article 1 § (12.7.2002/604) for receiving a bribe, for receiving a large bribe and corruption offenses §§ 1-3.

¹²Hemanus Pertti. Joukkotiedotus piilovaikuttajana. Delfiinikirjat. Helsinki: Otava, 1973. P. 109.

¹³Paavo Uusitalo. Yleinen etu, esitysintressit ja suomalainen vallankäyttö". Jyväskylä. Gummerus.1990. Ps.13.

The latest additions on 29.3.2019 to Article 40 8 a § (29.3.2019 / 368) concerned the misuse of funds of the European Union by a Member of Parliament and the conflicting financial interests referred to in Art. 2, p, 1 of Directive (EU) 2017/1371 and are punishable by a fine or imprisonment for up to two years.

If the crime as a whole is assessed as serious, the deputy shall be punished by imprisonment from four months to four years (Article 40 8 b §).

Despite the fight against corruption in all directions, according to the Gallup Kanava poll conducted from December 1 to 5, 2019 on Finnish attitudes towards corruption, 21% of respondents consider it acceptable to give bribes to a government official in Finland or abroad and 29% consider it unacceptable. 37% of Finns between the ages of 18 and 30 find it acceptable to offer money to a government agency¹⁴.

Finland's accumulated historical experience, international experience and coordination of international cooperation will help provide additional guidance on the implementation of the criteria for the effectiveness of anti-corruption institutions in the fight against corruption.

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¹⁴The results of a survey of corruption relations commissioned by the Municipal Development Fund of Finland. HS. 11.1.2020, P. A31.

ABOUT THE PROGRESSIVE DEVELOPMENT OF MODERN MAN

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Abstract. The article substantiates the possibilities of organizing the progressive development of modern man. Using a constructive approach, the authors were able to identify absolute human values (constructive freedom, health and happiness) and formulate their concepts. These values interact and form the human evolutionary cycle. The ability and opportunity to progressively develop - constructive freedom is the basis of such development. In human society, constructive freedom is opposed to arbitrary freedom - the ability to do what one wants. Constructive freedom leads to progress, arbitrary freedom to degradation. The conclusion is made that the upbringing of constructive freedom should be a necessary component of modern education.

Keywords: constructive approach, absolute human values, human evolutionary cycle.

Introduction

The natural mechanisms of evolution (progressive development) are the struggle for existence and natural selection [11]. In modern human society, these mechanisms are limited by the achievements of civilization and the social framework. There are two possibilities - either humanity is doomed to degradation, or it finds an adequate way to ensure its evolution.

Due to biological characteristics, the survival of a nascent person became possible due to his conscious self-improvement. Modern man should be directed towards his progressive development in individual life, and humanity should be directed towards the evolution of man in the historical process. This is the mechanism of evolution (progressive development) of modern man, it is social.

At present, science is dominated by an analytical (descriptive) approach to the study of the universe, the purpose of which is to realize what is happening [1, 4].

Based on mathematical logic, J. Von Neumann showed [9]:

1. The description of the functions of a simple automaton is simpler than the automaton itself, but with high complexity, a real object is simpler than its description.
2. It is possible to build an organ capable of doing everything possible, but it is impossible to build an organ that gives an answer to the question whether this can be done.
3. You can work inside a logical type that includes everything that is implemented, but the question of whether something is realizable in some type belongs to a higher logical type.

Thus, not everything is realized, but everything possible is created. So there is a constructive approach to the study of the universe, the purpose of which is to develop an algorithm for creating complex objects. The use of concepts that contain indications of the rules for creating the necessary is the basis of a constructive approach [1, 2, 4, 5].

Man is one of the most complex natural objects and, apparently, therefore, the dominance of the analytical approach does not allow existing science to give concrete recommendations for ensuring the progressive development of modern man. Using a constructive approach has given us the opportunity to obtain scientific and methodological material that brings clarity to this problem.

Purpose of the study –familiarize the scientific community with some provisions that help modern people to organize their progressive development.

The results of the study

Man (original individuality) is a combination of three components: essence, mental principles and physical body. The *essence* is the personality basis [2, 6]. A real person is any creature that is aware of the absolute values and rules of their achievement, which is guided by this in their behavior [8]. *Mental principles* - the ability to adequately and fully perceive reality, to think and act productively and successfully with benefit for nature and society. The *physical body* - is an instrument of action [2, 6].

Human needs are divided into three types [1, 2, 6, 10]:

1. Material and biological conservation needs (food, clothing and safety).
2. Ideal growth needs (self-improvement).
3. Social needs (communication, affection and friendship).

Real needs may relate to a particular species or represent a combination of several species.

Thinking is an active process of forming and satisfying needs. It includes the perception of information from the outside world and the internal environment, its processing taking into account past experience and future prospects, setting goals, developing the necessary program for achieving it, implementing this program, evaluating effectiveness and restructuring behavior. Human thinking includes three areas or levels [1, 2, 3, 5, 6]:

1. Subconscious mind - uses well-known programs, is connected with the past, serves material and biological needs, consciously.

2. Superconsciousness - develops new action programs, is associated with the future, serves ideal needs, is not consciously, absolute knowledge is formed at its level.

3. Consciousness - organizes thinking: sets goals, evaluates the effectiveness of their achievement, using speech, unites people and generations, is associated with the present (current moment), serves social and dominant needs, relative knowledge is formed at its level.

Information- is any data about objects and their phenomena, allowing the system (person) to coordinate its activities with them. The information involved in thinking can be divided into conscious (verbal) and unconscious (spiritual). Moreover, unconscious information is much more. Understanding consists of awareness and feeling. There are real circumstances, fundamentally unconscious, to take them into account, an adequate feeling is necessary [3, 4, 5, 6].

A neural resource of thinking is distributed depending on the nature of the dominant needs. The dominance of conservation needs expands the subconscious, growth - the superconscious. Consciousness is the most mobile sphere: it narrows when you focus on an object or action, or it expands tremendously when you try to become aware of everything that happens. Excessive "thinking" makes thinking ineffective - a person breaks away from reality and "leaves" the world of imagination. New programs lead to progressive development, so the work of superconsciousness determines the success of thinking. Thus, a conscious expansion of superconsciousness helps to increase the effectiveness of thinking.

Focused action ensures that needs are met. This activity is reinforced by a pleasure center. The reinforcement mechanism works as follows: when the demand is not satisfied, the pleasure center generates unpleasant sensations that protect the long-term memory from remembering an ineffective program, signal individuals about the need for changes, acti-

vate executive systems to satisfy the need and force them to look for a way out; when meeting a need - generates pleasant sensations that contribute to the memorization of the implemented program and stop the activity to satisfy the need [1].

Depending on the dominant needs and the development of thinking, three types of individuals are formed among people [1, 2, 6]:

1. Ordinary people (extreme type) - the needs of conservation dominate, the subconscious is expanded. These are looking back, living for themselves, unlimited consumers.

2. Whole people (extreme type) - growth needs dominate, superconsciousness is expanded. These are the aspirants to the future, serving people and society, who have come to absolute knowledge, creators.

Whole people formed in the process of overcoming difficulties, have developed mental principles and the gift of foresight, and therefore are *spiritually perfect*.

3. Exalted people (intermediate type) - dominant needs are not formed, consciousness is actively developing. A person is not satisfied with his life, he begins to control his actions and seeks a way out.

Unjustified hopes, deception and self-deception make a person distrust their feelings, which leads to an inadequate perception of reality. Information exchange is disrupted. This leads to a distortion of the essence of man. Subtypes are observed: *frozen* - frozen perception and dullness of sensations; *depressed* - general depression, dependence on circumstances, feelings of a dead end in life and hopelessness; *angry* - anger, resentment, heightened sensuality, dependence on feelings, annoyance; *fruitlessly worried* - fruitless worries and obsessive "little thoughts" [1, 2, 6]. With a distortion of the essence observed: health disorders, a tendency to somatic diseases, decreased performance and the effectiveness of targeted activities. This leads to frequent failures.

Man manifests himself through actions controlled by consciousness (conscious behavior) and uncontrolled (emotional behavior).

Emotions are a psychophysiological mechanism that facilitates targeted activity by including the capabilities of the whole organism. In a state of interest, a person learns easier, in a state of fear - runs away faster, etc.

Emotion is a reflection by the brain (the result of thinking) of any actual need (its quality and magnitude) and the probability (possibility) of its satisfaction, which the brain evaluates on the basis of genetic and previously acquired individual experience. Emotions are experienced as positive (acceptance of the situation) and negative (unacceptable situations). A low probability of satisfying a need leads to negative emotions. An increase

in the likelihood of satisfaction compared to the previous forecast gives rise to positive emotions. The set of emotional reactions of a person is indicated by the term - emotional behavior [1].

Correct (effective) thinking gives rise to (constructive) emotions that help to live, and wrong - creates disruptive (destructive) emotions. Thus, a person's emotional behavior can be constructive and destructive.

Many artificial ways of getting pleasure without satisfying a need have been developed. At the same time, ineffective programs are remembered, progressive development is disrupted - a person is degrading.

The formation in a person of an entity not subject to distortions (essential upbringing) and the upbringing of constructive emotional behavior (emotional upbringing) in him are the basis for the success of his life. Essential and emotional upbringing are closely related, have many common components and therefore are considered by us as essential emotional upbringing [1, 2].

The algorithm of essential emotional education consists of the following actions [1, 2, 6]: taking responsibility for one's development and success in life, focusing on meeting the needs of growth, developing a passive will, abandoning the pursuit of pleasures, accepting the constructive role of suffering, increasing sensitivity, activation of memory, learning to think effectively, life practice.

Passive will - patient and persistent overcoming of obstacles to the satisfaction of needs. Passive will consists of a steady skill to overcome difficulties and emotions of composure [7].

The basis of most pathological conditions is a vicious vegetative-behavioral stereotype (pathological dominant). A way to prevent and eliminate the pathological dominant is the formation of a physiological (useful) dominant, in which previously pathological impulses will contribute to a useful result for the body.

The most important physiological dominants are: sensitive, motor, energy-saving, food and heat-producing [2, 6].

Relaxation methods (autogenic training, meditation, neuro-muscle relaxation) form a sensitive dominant; purposeful increase in range of motion - motor; breathing restriction (breathing exercises) - energy-saving; dosed fasting and a balanced diet - food; cold training - heat producing [2, 6].

Physiological dominants increase the functionality of the basic life support systems and contribute to the progressive development of the body. Therefore, the formation of physiological dominants is a common homeostatic training [2, 6].

Absolute - unconditional, in itself existing, eternal, universal; relative - conditional, coming, temporary [6, 12]. Absolute for the universe (nature and man) is progressive development - evolution. Adequate perception, body resources, productive and successful thinking (**constructive freedom**) are a condition for progressive development. Progressive self-renewal (**health**) is a development process. The general reaction, which is manifested by sensations of the fullness and meaningfulness of life with a pronounced shade of pleasure (**happiness**), is the result of development. At the same time, the programs leading to progress are remembered, biological structures become more complicated, resources increase, the level of freedom increases.

Thus, the absolute values for a person are: constructive freedom, health and happiness. **Progressive development links absolute human values into the human evolutionary cycle.** [2, 6].

The methodological principles of the organization of human evolution are: essential emotional education and general homeostatic training.

Conclusion. Using a constructive approach, we were able to identify absolute human values and formulate their constructive concepts. Constructive freedom, health and happiness are interconnected and form the human evolutionary cycle. The ability and opportunity to progressively develop - constructive freedom is the basis of such development. In human society, constructive freedom is opposed to arbitrary freedom - the ability to do what one wants. Constructive freedom leads to progress, arbitrary freedom to degradation. The education of constructive freedom should be a necessary component of modern education.

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FEATURES OF MOTOR ACTIVITY AND HEALTHY LIFESTYLE OF MIDDLE SCHOOL STUDENTS

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Introduction

The relevance of the research topic is determined by the following reasons. At the present stage, intensive development is observed in all spheres of the life of society. In secondary schools of the Republic of Kazakhstan, a program of updated educational content has been introduced. It makes high demands on the intellectual activity of students, their self-training. This in turn leads to the fact that they must spend a lot of time at the computer, lead a sedentary, sedentary lifestyle. This is due to the great psychological, physical effects on the growing body of children. Because of this, students get sick with various diseases. Under these conditions, one of the ways to solve this problem is the organization and implementation of optimal motor activity of schoolchildren. As you know, it is accompanied by an effective healthy lifestyle.

The research problem lies in the contradiction between, on the one hand, in connection with the increasing demands on the mental performance of students by the need for optimal physical activity and a healthy lifestyle, and on the other hand, insufficient scientific and methodological support for this process.

The following specialists paid attention to this problem in their research: N.G. Mikhailov, S.M. Chechel'nitskaya [9], A.R. Shakhriev [15], A.V. Zhmulin [6], S.A. Sherstyuk, A.A. Sherstyuk, A.Yu. Aseeva [16], M.M. Lebedeva [7], L.A. Alifanova [2], etc.

The purpose of the study is to determine the characteristics of motor activity and a healthy lifestyle for secondary school students in secondary schools.

The objectives of the study. 1. To determine the scientific and theoretical aspects of motor activity and a healthy lifestyle for middle school students.

2. To identify the specifics of physical activity per day for middle school students of secondary schools and the total pulse cost of the physical exercises they performed per lesson.

3. To study the characteristic features of a healthy lifestyle of secondary school students in secondary schools.

Research methods and organization. To solve the tasks, the following research methods were used. The analysis of scientific and methodological literature was used to solve the first problem. Theses, scientific articles and constituent research problems were studied.

To identify the characteristics of motor activity of schoolchildren, the number of steps was calculated using the Mi Band 3 bracelet [10], which was put on the hand of the subject. It allows you to automatically determine the total number of steps taken per day.

Using this bracelet, the total pulse cost of the physical exercises performed by students per lesson was determined.

To study the specifics of a healthy lifestyle of schoolchildren, a questionnaire survey method was used. The first questionnaire was devoted to identifying students' knowledge of the terms on the proper conduct of the body's life. This was done by clarifying their knowledge of the structure and content of the organs of the body; semantic explanation of the implementation of the activity of a specific element of the body; terminological apparatus of the correct way of life (health status, daily routine, personal hygiene, compliance with the correct conduct of life).

Using the second questionnaire, such indicators as the possession of skills for the implementation of skills for the development and improvement of their own health were revealed; their motor abilities.

The third questionnaire determined such indicators as: attending academic classes in physical education; execution of all elements of the correct daily routine; preference for interesting elements of free time (hobby for a sport; festivities; working at a computer; watching television programs); one-time smoking attempt; drinking alcohol.

To obtain statistically reliable data, methods of mathematical statistics were used [5].

The study was carried out in three stages. At the first stage (September 2018), an analysis of the scientific and methodological literature was

carried out. Along with this, methods were developed for studying motor activity and a healthy lifestyle for schoolchildren.

At the second stage of the study (October-November 2018), factual material was collected. A study was conducted to study motor activity and a healthy lifestyle for middle school students.

At the third stage (December 2019), work was done on the design of the article.

The study was carried out during 2016-2018 on the basis of school No. 29. In total, 150 eighth grade students took part in the study.

Research results and discussion

An analysis of Russian literature showed that in the studies of scientists on the problems of locomotor activity and a healthy lifestyle of middle school students, the following areas can be distinguished.

The volume of motor activity of children. In this direction, experts recommend the following: a) "...The total amount of physical activity in boys is on average 17 hours a week. Moreover, the boundaries of the values of physical activity are very scattered - from 2 to 66 hours per week. For girls, these values average about 15.5 hours per week, with a range of variation from 0.8 to 47 hours per week..." [9, p.15]; b) Subject to participation in compulsory academic classes in physical education and walking from home to school, students in the Far North do not comply with the standards of physical activity per day recommended by A. G. Sukharev [13, p12]; c) the number of steps performed by the fifth grade student per day is equal to an average of 8000 steps; the fourth grade — about 10,000 steps; and the third grade — about 11,000 steps. A relative decrease in indicators of motor activity from primary school students to middle school students is noted [12, p.17].

Optimization of the motor mode. Experts believe that its elements include: a) independent and extra-curricular activities of physical activity with the implementation of certain motor actions; restriction on the number and pace of physical exercises; performing movements in the form of games and competitions [15]; b) increasing the volume of movements in the lessons; adjustments in the teacher's activities related to his immediate daily work on providing advice to students, their relatives, monitoring the physical activity of their students; control over the process of formation in students of the basic technique of movements for its effective implementation in individual lessons [6]; c) an increase in the pace and rhythm of performing all motor actions in independent studies of the types of physical activity of children during their leisure time; intensification of the specific work of physical education teachers conducting classes with children outside school hours in sections by sports [12, p.18];

Monitoring and evaluation of various body functions during motor activity of schoolchildren. Experts have found that: a) optimal motor activity (conducting academic studies, taking into account the interaction of all body systems with good motor density, leads to an increase in the functional potential of all its elements) [2]; b) one of the indicators for monitoring the optimal level of motor activity of students is a test that determines the level of their physical performance (PWC170). It allows you to identify the lack of power of the body's working capacity, which in turn indicates an unsatisfactory level of motor activity [7].

The relationship of motor activity with physical development, mental, physical performance. Specialists see these types of interconnections in the following: a) the level of physical development, physical, mental working capacity, 13-year-old schoolchildren who are actively involved in sports in specialized classes are higher than those engaged in classes with mathematical and other areas [11, p. 14]; b) additional swimming lessons led to a decrease in the number of children with physical development disorders; increase the activity of independent processes of coordination of the rhythm of the heartbeat and increase the impact of the parasympathetic system in a state of rest and movement [8, p. fifteen].

Problems of forming a healthy lifestyle for schoolchildren. In this direction, experts emphasize the following components: a) value-motivational attitude to a healthy lifestyle (physical education); a conscious attitude to the development of their health; means of creating a healthy lifestyle are theoretical studies, specific types of physical activity, optimally organized work with relatives of students and work in sections on sports. [4, pp. 106-107]; b) preventive measures for the non-use of smoking, alcohol, other bad habits (the introduction of special elective courses on the proper conduct of life, the implementation of extracurricular lessons in valeology, the activities of teachers during the schoolchildren's rest between study periods) [14]; c) advice to parents: making changes to the lives of children during periods of fatigue, overstrain from physical and mental stress; taking into account the individual needs of the child in nutrition, volume of loads; the use of an individual approach to the child with the implementation of their own examples of physical exercises, etc. [16]; d) elements of a healthy lifestyle: the presence of an information environment for the prevention of negative causes that affect the optimal level of health; learning the basics of proper life; protection from negative habits (smoking, alcohol, drugs); work on his physical perfection [1].

Table 1 presents the number of steps taken by students in 8th grade per day

Table 1 - The number of steps taken by students in 8th grade per day (n = 150)

Number	Up to 5000 steps	Up to 8000 steps	Up to 10,000 steps	Over 100,000 steps
n	25	50	45	30
%	16,7	30	33,3	20

As can be seen from table 1, 16.7% of students complete up to 5000 steps, 30% up to 8000 steps, 33.3% up to 10,000 steps and 20% over 10,000 steps. Almost all students, except the last group (over 10,000 steps), are below the low level (according to A.G. Sukharev, 13). The last group of schoolchildren refers to a low level of motor activity.

Thus, the bulk of the studied schoolchildren (80%) in terms of motor activity belongs to the group below the low level.

Table 2 presents the indicators of the total pulse cost during the physical education lesson of 8th grade students. The study involved 20 students.

Table 2 - Indicators of the total pulse cost of physical exercises performed by students of the 8th grade at a physical education lesson

Indicators	3900-4900 beats per minute	4000-5000 beats per minute	5000-6000 beats per minute	6000-7000 beats per minute
n	4	8	5	3
%	20	40	25	15

As can be seen from table 2, in 20% of schoolchildren per lesson, the total pulse cost during physical exercises is 3900-4900 beats per minute, in 40% - 4000-5000 beats per minute, in 25% - 5000-6000 beats per minute and 15% have 6000-7000 beats per minute. In the second, third, and fourth groups of schoolchildren, the values of the total pulse cost correspond to low, medium, and high loads (according to source 3).

Thus, more than half of the studied students (60%) in terms of the total pulse cost correspond to low and lower low levels.

3 59.6% of schoolchildren do not have knowledge about the structure and content of body organs. 31.2% do not understand and 58.2% cannot quite explain the implementation of the activity of a specific element of the body. 76% of schoolchildren do not speak the term "state of health"; 41.6% - "daily routine"; 47.9% - "personal hygiene"; 47.6% - "observance of the correct conduct of life."

Only 11.2% of schoolchildren possess knowledge on the implementation of skills for developing and improving their own health and 25.9% possess knowledge on the implementation of skills of their motor abilities.

In all respects for proper life, schoolchildren showed results that did not meet its standards.

Conclusions

1. The scientific and theoretical aspects of motor activity and a healthy lifestyle for middle school students are as follows:

- recommendations on the volume of motor activity of schoolchildren (decrease in the number of steps from primary school students to the middle level; reduced parameters of motor activity in schoolchildren of the Far North; scattered range of DA);

- adjustments to optimize motor activity (increasing the volume of movements in the classroom; adjustments in the teacher's activities; increasing the pace and rhythm of movements; monitoring the process of formation in students of the basis of the technique of movements);

- monitoring and evaluation of motor activity (increasing the functional capabilities of the body due to the effective interaction of the elements of the lesson content; application of the PWC170 test);

- the relationship of motor activity with physical, mental, physical performance (for students involved in specialized sports classes, additional swimming lessons, the level of physical development, mental, physical performance is higher);

- problems of the formation of a healthy lifestyle for schoolchildren (activation of motivation for their health, purposeful work to implement types of physical activity, help relatives of students; preventive measures about the dangers of smoking, alcohol, drugs)

2. In the bulk of the studied schoolchildren (80%), a low level of development was revealed by the level of motor activity.

3. More than half of the studied students (60%) in terms of the total pulse cost correspond to low and lower low levels.

4. In all respects, the students showed results that do not meet its standards.

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INCLUSION OF RESEARCH-ORIENTED EDUCATION IN EDUCATIONAL ACTIVITIES OF A UNIVERSITY IN THE TRAINING OF TEACHERS

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Abstract. In the article, the authors consider the features of the inclusion of innovatively-oriented teaching in the process of training teachers. The authors present the conceptual and terminological justification of the scientific approach to innovative learning., Present the results of a study on the unification of efforts in the framework of intersubject interactions of involving students in research activities and the option of implementing innovation-oriented learning at Shukshin Altai State Humanities Pedagogical University (Shukshin ASHPU).

Keywords: research, research work, research training, research orientation, research-oriented training, effectiveness

Currently, around the world, the outlook on the educational process and, in particular, on the training of specialists of any industry has changed significantly [1]. But the greatest importance for creating breakthrough technologies in the development of Russia is given to the preparation and implementation of innovative components in education. To solve a serious range of issues in this direction, the national project "Education" is directed. A serious area in many of this project, such as "Teacher of the Future", "Young Professionals", "Social Lifts for Everyone", pays great attention to the readiness of future teachers and teachers of vocational education for practice-oriented research activities both personally and in guiding student researches [2].

Studying this issue, we found a problem that was formulated as the topic of pedagogical research, indicated in the title of this article.

At the same time, we set the goal of the work to study what research-oriented teaching is and how to include it in teacher training.

At first glance, the topic is quite simple, what teacher doesn't include elements of research and creative activity? However, in professional pedagogical education there is some misunderstanding that there is a study in the educational and self-educational activities of a student, a future teacher, and how to prepare each student to constantly and purposefully engage in this type of activity, both in the process of obtaining a pedagogical profession and subsequent pedagogical activity [3].

At the same time, we see that this is a general problem that does not depend on the profile of teacher education and even on how the future teacher plans to work in general or professional education.

Based on the problem and purpose, we considered it necessary to determine the concept of research-oriented teaching, to determine its place in the process of teacher training and to put into practice the inclusion of such training in the educational process of the university.

To begin with, research is always a personality-oriented action, a kind of "following from the inside." In addition, this is a process and the result of scientific activity aimed at gaining new knowledge about the laws, structure, mechanisms of functioning of the phenomenon under study, about the content, principles, methods and organizational forms of activity. Also, research is one of the types of cognitive activity, which is characterized by objectivity, reproducibility, evidence, accuracy.

At the same time, orientation to scientific activity is a direction of activity in one direction or another, reckoning on someone and (or) something in the process of activity.

Then research-oriented training is nothing more than obtaining knowledge about research in cognition along the paths to achieving new scientific knowledge, obtaining a result in using a scientific approach to solving a particular educational and practice-oriented task, studying an issue or actual problems that go beyond educational activities, as well as achievement-oriented research:

- universal competencies, such as systemic and critical thinking, project development and implementation, self-education and self-development, how to build and implement self-development trajectories based on the principles of education throughout life;

- professional competencies, such as the scientific basis of pedagogical activity, the development of basic and additional educational programs, psychological and pedagogical technologies in professional activities;

- professional competencies, such as developing, mastering and applying modern psychological and pedagogical technologies based on knowledge of the laws of personality development and behavior in a real and virtual environment (in our case, to develop a keyword), designing and implementing educational programs (designing a keyword), development of individual development programs, to develop and implement individual educational routes, individual development programs and individually oriented educational programs taking into account personal and age characteristics of students, etc. [3,4].

Moreover, in a research-oriented educational activity of a student, initiative, independence, and creative search should be most fully manifested.

Our studies have shown that there is no reason to link research-oriented teaching to any specific profile of pedagogical activity.

If the future teacher is to be taught certain universal research activities, to include research in the educational process, to direct the student to research training as a constant search for information in each subject area, to focus on research and research work, and most importantly on effectiveness (cognitive, scientific, practice-oriented, research and other, aimed at the result), then the training will become generally research-oriented [4].

As a result of the research, we found that when a research-oriented education is included in the educational activity of a university during the training of teachers, it is necessary to combine the efforts of the entire pedagogical and scientific-pedagogical staff. We believe that there is not a single subject area, not a single discipline, not a single type of activity that could be excluded from the sphere of orientation of the future teacher to research-oriented teaching. Orientation of the future teacher to research, research knowledge and gaining competencies in creating a research-oriented environment for himself will allow him to successfully implement research-oriented training for those with whom he will be entrusted with conducting educational activities [5].

Here are some experience in the implementation of research-oriented teaching in educational activities in the training of teachers at Shukshin ASHPU:

- 1.1. Work with students begins from the moment they enter the university and until graduation. And in each subject area, universal and general professional competencies are formed that contribute to the development of a research-oriented approach to learning and self-education for each student.

2. We begin to formulate the orientation toward research, the search for truth, and scientific knowledge from the first year, and we develop and improve at every stage of preparation for the future teacher.

3. At all courses and for all disciplines, this is most important and in the experience of the university there is the use of research-oriented training in the following areas:

3.1. In the field of mathematics, physics, computer science

- Practice-oriented educational project “Designing of software systems by student teams” is being implemented as part of student learning practices. It is aimed at expanding students' knowledge in the field of programming, instilling teamwork skills and implementing project activities

- An educational project with elements of research activity “Elements of scientific activity in academic disciplines using modern software and hardware” The project is aimed at attracting students to research projects of teachers of the Department of Mathematics, Physics, Informatics, development of research skills of students and cognitive activity. All students of 2-5 courses are involved.

- Master class "Information technology - opportunities for everyone"

3.2. Russian language, literature, foreign languages

- Educational project “Mentoring and pedagogical support of gifted children”. The project is aimed at preparing future teachers for work with gifted children, designing individual trajectories of personal development of children, psychological and pedagogical support of creative and research activities.

- Innovative projects “Promotion of V.M. Shukshin ”project is aimed at researching students of the literary heritage and summarizing the results in the form of presentations and publications in the framework of the school-conference. In addition, as social research activities, such events as the translation of V.M. Shukshin works to English, German, Chinese, theatricalization of Shukshin's stories (in Russian and foreign languages) and other types of research-oriented activities are conducted in the educational and extracurricular time.

3.3. History, law, social and humanitarian disciplines

- In the work of the Laboratory of a novice researcher, a historical and ethnographic study of the daily life of the Altai Territory is carried out.

- Educational research-oriented project "Study on the formation of ethnocultural competence of students." The project is aimed at conducting research, educational and enlightening events on the ethnocultural education of students: "Quest" Time Machine ", " Folk Festival "Wide Shrovetide", "Folk Theatrical Festival" Kumandinsky Wedding".

- Social research-oriented project “Material culture of the peoples of Altai Projects and exhibitions of reconstruction of objects of material culture of the peoples of Altai in the following areas: the culture of the

Scythians of Altai, the culture of Altai tribes, the culture of the Russian people of Altai, the culture of Kazakhs. Conducting interactive excursions for students and residents of the city of Biysk at the exhibition "Material culture of the peoples of Altai".

3.4. Natural-science disciplines

- The project "Multimedia Technologies in the Formation of Universal Technologies" The project provides for involvement in the scientific activities of the department on the basis of individual work of teachers with students.

- Innovative educational project "Ecological and geographical expeditions as a means of developing students' research activities"

- Educational project "Elements of an adaptive system in the teaching of chemistry in the context of the implementation of the GEF"

- Educational project "Modern technologies in biology education in the context of the implementation of the GEF"

3.5. Physical education, life safety

- Innovative project "Opportunities for everyone"

- Educational project "10,000 steps to a healthy heart"

- Educational project for educational and extracurricular activities "Sport and healthy lifestyle"

- Educational projects "The Holy Gift of Life" and "I Choose Life!"

3.6. Socio-economic disciplines

- Preparing students for financial literacy education for schoolchildren, students of secondary vocational education and conducting educational work with various target groups of the population.

- Innovative educational project "Business design in the educational process"

- Design and research activities of students within the framework of the student scientific circle "Formation of readiness of bachelors of teacher education (Technology profile) to fulfill the teacher's labor functions in various fields of planning (pedagogical, design, engineering, technology)"

3.7. General educational disciplines

- Innovative educational project to prepare students for the development of creative abilities in elementary school

- Project "The use of assessment tools VPR, USE in the preparation of students

- Educational innovative project "University - the center for the development of volunteering in the Biysk science city"

- Testing of the innovative basic vocational educational program in terms of education master's profile training "Head of the educational organization".

- Innovative educational and social project “Teacher of the future”
- Innovative project “Pedagogical class as a model of early career guidance for the profession”

3.8. Disciplines of the formation of universal competencies

- Innovative educational and informational project "Development of electronic informational and educational environment (EIEE) of the Shukshin ASHPU and the introduction of digital learning »

• Innovative social and professional project “Institute of Mentoring” within the framework of the Career Center for scientific and methodological support and accompaniment for future teachers

- Social and professional project "Laboratory of scientific and methodological support and accompaniment for young teachers" as a resource for the development of professional competencies

4. Constant participation of students in the competition "I am a professional", competitions of pedagogical skills "

5. Organization together with students and participation in olympiads, contests of professional and pedagogical skills

5.1. All-Russian competition of research works of teachers, social educators and psychologists in the field of preschool and primary education, preschool children and primary school students "Creative teacher - creative child"

5.2. Socially significant contest “Healthy Family - Healthy Generation”

5.3. Students in the framework of research-oriented training received awards at the 15th annual All-Russian competition of youth authoring and educational projects aimed at the socio-economic development of Russian territories "My country - my Russia":

6. Obligatory generalization by students of the results of activities by writing articles at scientific, scientific and practical conferences and forums. During the period of study, each student should have at least two publications.

7. Obtaining additional professions and advanced training, including in research activities.

8. Obtaining scientific grants both jointly with teachers and personally

9. Continuous participation of students with obtaining grants in the international forum "Altai Development Point".

All this is far from a complete list of research-oriented studies at Shukshin ASHPU.

Conclusions and recommendations:

1. Research-oriented teaching is not a set of forms, methods and tools included in the training of a teacher, but a complex, interconnected and interdependent process in which all teachers, all scientists and the entire training period of future teachers should participate.

2. Only the combined efforts of the entire team of pedagogical and scientific workers can make educational activities research-oriented for each student, and prepare him as a future teacher for the implementation of this type of training in his professional activity.

3. Combining efforts for the preparation and participation of students in olympiads, competitions, forums, scientific and scientific-practical conferences allows you to check the effectiveness of research-oriented activities.

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SELF-CONTROL AS A SUSTAINABLE PROFESSIONAL TEACHER'S SKILL

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Abstract. The relevance of this article is determined by the correct reading of the concept of “soft skills” in the context of bachelor training in the direction 44.03.05 Pedagogical education (with two training profiles) and the author’s point of view regarding the understanding of the formation of self-regulation among bachelors of teacher education as a sustainable professional skill through training sessions.

Keywords: self-regulation, soft skills, hard skills, universal competencies, training sessions, teacher education, baccalaureate.

The field of teacher education has always been and remains an industry that forms sociocultural ideas about the system of interpersonal relationships among different age groups, based on understandable and conscious models of spiritual and moral values, the potential and capabilities of the younger generation.

The pedagogical university today is focused on the formation of “soft” skills among future teachers of educational organizations, as they are an important component for a specialist who successfully carries out his professional activities in educational institutions of the city and regions, as well as for a person who wants to be successful in modern realities. It is important to form these skills (competencies) in the process of university education. However, educational programs implemented at the university

involve the formation of “hard skills” among bachelors, teachers, with rare exceptions, set the goal to create “universal” skills. Thus, it is important to determine what other opportunities for the formation of “soft skills” the university environment provides, and whether student associations, communities are a platform for the formation and development of such skills.

So, for example, educational disciplines that are “critical” in the short term are somehow “responsible” for updating the “hardskills”, they are formed faster, with less effort and a guaranteed result (subject to the basic conditions - the presence of motivation, student learning, etc.), and also practically do not undergo the reverse development, then “softskills” are formed, most often, spontaneously. They are “critical” in the long run, the formation proceeds more slowly, more efforts are required, the acquisition of the required level is not guaranteed (the “limit” of competencies, deep integration in the personality structure), but under specific conditions they undergo reverse development [6].

The importance of the two integrated competency groups cannot be disputed, because “hard” gives an answer to the question “What should I do?”, And “soft” gives an answer to the question “How can this be done best? Accordingly, hard skills and soft skills are inseparable [4].

Studies show that one way or another, academic science in most cases today is based on stable and qualitatively substantiated, proven in its effectiveness models of preparation and readiness of graduates for educational practice, we are talking about the formation of hard skills, for example, the presence of templates and recommendations on their step-by-step development. I am glad that today a new course of the domestic education system on innovation has been taken, which involves the formation of the ability of young specialists to design and create individual educational routes for the younger generation, which means that it is supposed to “nurture” creative people who are able to overcome the limits of their abilities, looking for new functional opportunities and enterprising. Already today, the training bases created and implemented by the teaching staff as part of the educational process of a pedagogical university are built in such a way that contribute to the formation of a critical nature of thinking and activity; openness to everything new and the ability to navigate in it; communication skills; ability to find and process information; desire to constantly improve oneself and others; the ability to self-represent; organize your activities taking into account time management; self-regulation, etc.

Defining the concept of self-regulation, we proceed from the provisions of a holistic concept of mental self-regulation of arbitrary human activity (O.N. Konopkin, N.F. Kruglova, V.I. Morosanova, A.K. Osnitsky, N.O.

Sipachev), in the framework of which conscious self-regulation is understood as a systemically organized mental process of initiation, creation, maintenance and management of all types and forms of external and internal human activity, directly aimed at achieving generally accepted human goals. We consider the process of self-regulation as a holistic, open-structured open information system in which the interaction of functional units is implemented.

The employer today wants to get a universal specialist who can instantly master various types of activities and be effective here and always.

Sociological studies were carried out in 16 European countries, which showed that 93% of employers are interested in observing from the candidate's side the actualization of softskills as a fundamentally important quality of the employee, as well as his stable professional skills ("hard-skills"). This is due to the fact that in the event that working skills eventually become irrelevant, or require stable improvement, then softskills will be useful and needed all the time. At the present moment, a person's recognition largely depends on his communicative capabilities.

Further interesting is another study. BostonConsultingGroup - an international company specializing in administrative consulting, has established that there are popular groups of soft skills for employers, among them:

- communicative skills: 79% say that this is the most necessary property of the applicant;
- energetic life point of view - 78%;
- analytical thinking - 77%;
- resilience - 75%;
- ability to act in a team - 74%;
- zeal to achieve established goals - 70%;
- ability to handle incidents - 54%;
- the ability to be inspired by fresh ideas - 54%;
- innovation - 43%;
- loyalty- 42% [10].

Within the framework of the World Economic Forum, attempts were made to predict the key competencies that will be relevant in 2020.

According to the forecast, the most important skill will be the ability to solve complex problems. The next most important competency is critical thinking, and the third is creativity. The competencies mentioned above are followed by people management competencies, coordination and interaction skills, emotional intelligence, judgment and decision-making, customer orientation, negotiation skills and cognitive flexibility.

Unprocessed soft skills can ruin the career of any professional who has full professional skills. As a rule, technical skills are always appreciated and welcomed, but to upgrade a post you need to have “soft” skills. D. Tataurschikova in her research notes that the higher an individual rises in the career ladder, the greater the proportion of standardized, that is, “soft” skills, he must apply [7].

The expert opinion of F. Lukyanov, in which it is noted that “soft” skills are one of the definitions of emotional competencies (emotional intelligence), without which it is impossible to achieve success neither in life nor in work, is considered quite predictable. “Soft skills” refer mainly to life skills [5].

We come to the conclusion that softskills are important both in the provision of educational or other services, and in life. Most of these skills are used to achieve goals. And the higher a person goes up the career ladder, “universal” skills play the most important role in life [3], and professional skills turn into a secondary plan, therefore, as you know, 70% of trainings and various courses are oriented towards mastering “universal” skills.

The Max Planck Institute in Munich (Germany) identifies the following types of “soft skills”, especially important in modern society:

- personal dynamics (sense of responsibility, desire for achievement; self-confidence; high motivation);
- area of interpersonal relations (contact, objective self-esteem; sympathy and empathy for people);
- desire for success (dedication, motivation to maintain status, a tendency to systematization, initiative);
- endurance (resistance to criticism, resistance to failures, positive emotional attitude, firmness of life position, job satisfaction).

We distinguish four main groups of softskills: “communicative literacy, self-management skills, effective thinking skills and managerial skills (foresight management)” [9].

The effectiveness of demonstrating a professionally held personality is determined by the presence of a process of self-regulation, which is characteristic of: the presence of one's own subjective model, designed on the basis of clear goals; understanding of measurements (criteria) for evaluating the success of actions; monitoring and evaluation of real results; adjustment of activities in accordance with previously obtained results. And today it is a good indicator of the awareness of one's own actions and doings, as well as the correctness in decision-making by a young specialist.

Our study assumed the use of a number of diagnostic methods to assess the level of “soft skills” formation among students of a pedagogical university (sample from different courses) at the ascertaining and control stages of the study: the diagnosis of communicative and organizational skills developed by V.V. Sinyavsky and V.A. Fedoroshin, which allows to identify the level of severity of these properties and personal qualities; Raidas' Confidence in Self Diagnosis, which allows one to study types of behavior in subjects; E. Zharikov and E. Krushelnitsky diagnostics will help to study such “soft skill” among students as leadership qualities, K. Thomas test is designed to study the behavior style in conflict; V.P. Pryadein diagnostics - to study the degree of responsibility as an important “soft skill” of self-regulation. Considering the results of the ascertaining slice, we developed a training program, the effectiveness of which will ensure the formation of “universal competencies” among bachelors of a pedagogical university, and at the same time provide an effective process of self-regulation as a professional skill.

Our training program involves four blocks for the development of soft skills (competencies), focused on actualization of such a process as self-regulation in the amount of 72 hours.

Goal-training program: the formation of the process of self-regulation as a professional skill through the training of observation, sensitivity to verbal, non-verbal and proxemic (spatial temporal) manifestations of a person and a group in an actual communication situation, the development of a sensory channel: vision, hearing, tactility, sensitivity and etc.; training of quick orientation in situations, individual perception, skills of influence and interaction, skills of business and interpersonal communication.

Block 1. Trainings of self-confidence and self-affirmation.

Purpose: the formation, development, training of confident behavior in interpersonal relationships and conflict situations, self-affirmation; coping skills; social competence; introspection; open expression of feelings and desires.

The training includes exercises for openness and frankness, the development of the ability to say no.

Block 2. Team building trainings.

Purpose: the formation of an active life position.

The training includes the work of mobilizing the group for joint problem solving, as well as training in the recognition of their own behavioral models. The training helps to strengthen the skills of the dialogue style of communication in the leader's practice, and to develop the empathic capabilities of an individual.

Block 3. Training readiness to solve problems and ability to resolve conflicts.

Objectives: to help participants to overcome internal barriers and fears of a crisis, the ability to mobilize in a state of conflict; practice using reframing in a state of conflict.

The training provides an opportunity for a real assessment of the use of reframing to obtain a three-dimensional picture of reality and the ability to present an alternative to the problem; stimulate a change in relations to a conflict situation as an example of one of the styles of conflict resolution - avoidance (leaving).

Block 4. Responsibility building training.

Purpose: the integration of the group through awareness of collective responsibility.

The training is carried out using the method of fairy tales and group discussion and analysis.

Having realized the training program, we note that compared with the ascertaining stage of the experiment, the number of respondents in the experimental group with very high organizational abilities was increased by 15% (from 4 to 7 people), the number of students with an average level of organizational abilities was reduced by 15% (from 13 to 10 people).

The growth of subjects was recorded with a high level of confidence of the subjects in the experimental group by 25%, in the control group this indicator is 15%. In both groups, the number of students with a value of "too self-confident" decreased by 5% in the control group and by 10% in the experimental group.

In the analysis of leadership qualities, positive changes were obtained by 20% of the entire group of subjects (40% of the entire group) in the experimental group of this characteristic after the formative stage of the experiment.

Analysis of the behavior in the conflict showed that in the experimental group it has the character of "compromise", "cooperation" with prevailing values from 5 to 9 points, in contrast to the control group, where three styles of behavior in conflict prevail simultaneously - "compromise", "cooperation", "avoidance."

Such a flexible skill as responsibility in an experimental group with pronounced signs is characteristic of 75% of respondents from the experimental group, while in the control group this value (55% of the requested) did not change at the beginning and end of the observation.

Self-regulation becomes a process in which the subject himself is capable of: initiating, building, supporting and managing all types and forms

of his own external and internal activity, directly aimed at achieving the goals accepted by the person. Once again, we were convinced that the correctly set priorities by the teaching staff of the pedagogical university, taking into account modern trends in the development of modern society, bring tangible results in the personal development of the graduate and contribute to his successful professional career.

The authors of the article made an attempt to develop a skills-passport for a graduate of a pedagogical university, which reflects all the graduate's achievements for the entire period of study at a pedagogical university.

Skills passport is a document that demonstrates a unique set of "universal competencies" and "soft skills", which is present and thereby increases the rating of a graduate of a pedagogical university among existing competitors in the labor market. Skills-passport is a kind of professional portfolio that demonstrates what professional skills a graduate of a pedagogical university has and what his level of knowledge of these skills is [1; 8; 9].

The development of soft-skills is "a personal motive of each person and it depends only on him to what extent his personal qualities will help him to make a successful professional career, determine his productivity in a professional competitive environment [2].

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INCLUSIVE EDUCATION: PSYCHOLOGICAL ANALYSIS OF THE FEATURES OF KAZAKH PEOPLE

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Abstract. In this article, the author analyzes one of the conditions of the development of inclusive education—the readiness of society and the culture of society, in particular the Kazakh society. To cover this issue, the author analyzed the historical concepts in the Kazakh society that reflect the psychological constitution and culture of the Kazakhs. It has been argued that with the revival and development of these qualities, it is possible not only to develop inclusive education, but also, in general, a highly-cultured society.

Keywords: inclusive education, Kazakh people, tolerance, mentality, customs, spiritual culture, folk folklore.

In contemporary society, there is a change in approaches to education, established by the switch of society to the development and formation of personal qualities of a person, regardless of physical, mental, social and other opportunities. It has been noted in a number of studies that the understanding the importance of self-realization of the individual as the main goal of social development, has grown, which has caused the emergence of a new paradigm of education, based on approaches and concepts developed by modern practice, which can include inclusive education.

The concept of «inclusive education», which is actively included in the modern professional lexicon of psychological and pedagogical science in the Republic of Kazakhstan, reflects a new insight into the education system and the facts of time, what the evolution of mankind leads naturally. Inclusive education is a key to social and educational policy and a social value. However, rest of us understand that the development of inclusive education will be successful only if the society develops a culture, a sense of tolerance, empathy and respect for the personality of all, regardless of their characteristics.

What is our cultural context? To what extent is our Kazakh society ready to accept and treat all its members with respect? As a matter of fact, acceptance and respect are the foundation of inclusive education. Many members of our society are concerned with these questions... We are no exception.

The search for an answer to these questions prompted us to analyze the work of scientists in the field of philosophy, history, psychological and pedagogical Sciences and research attitudes to persons with special educational needs of the Kazakhs.

The search for an answer to these questions encouraged us to analyze the work of scientists in the field of philosophy, history, psychological and pedagogical sciences and research attitudes to persons with special educational needs among Kazakh people.

In current times, a lot of work is being done in the Republic of Kazakhstan to create favorable conditions for the full development of all citizens, regardless of physical, intellectual, social and other characteristics. But our evolution in relation to persons with special needs is peculiar. As the famous philosopher of Kazakhstan N. Dzhandildin wrote, «every culture is created in a certain national language, it has been developed on a certain national soil and has been fed on its juices. It captures the struggle and labor, manners and customs, natural intelligence and wisdom of the people, who has been its creator» [1]. And rightly so, the essential side of national culture is expressed in the quality and properties of these people, their differentiation can be seen in the special ply of the character, actions and features of their psychology. Following on this idea, we believe when considering the development of the idea of inclusive education, it is impossible not to refer to the historical information and national characteristics of Kazakh people, because it is impossible to talk about possible ways to develop inclusive education in the Republic of Kazakhstan without taking into account certain conditions.

As the First President N.A. Nazarbayev notes in his speeches «We need to peer into the past to understand the present and see the contours of the future» [2]. Therefore, we deem it advisable to analyze information from the history of Kazakhstan, characterizing the attitude to people with special needs.

As it confirmed by the research of domestic and foreign scientists, as well as the experience of practical teachers, the basis for training teachers to work in an inclusive education is the formation of certain spiritual qualities and value orientation. We think the opinion of the philosopher D.K. Kshibekov is relevant in this case, who in his work «the mental nature

of the Kazakhs» puts forward his theoretical assumption about the deep antiquity of the history of nomad culture. The author devotes a whole chapter to the spiritual world of the Kazakhs as a nomad nation, in which he reveals the concept of spirituality as a special inner world of a person, covering the area of faith, morality and beauty. The spiritual culture of a nation is reflected in its humanity, integrity, nobility, generosity and in the ability to admire beauty, reject vulgarity, immorality, baseness. The distinctive features of the character peculiar to the Kazakh people are the ability to reflect the objective world and, as it was noted by D.K. Kshibekov, «the Kazakhs' moral culture at the level of ordinary consciousness raised to an unattainable height» [3].

In return, this gives reason to believe that the people with these moral qualities are characterized by a caring attitude to all vulnerable segments of the population, i.e. the national character of Kazakh people is highly humane and spiritually rich.

As B.E. Kairova notes in her work, there are certain concepts among the Kazakh people, which have absorbed the universal norms of religion and traditional national values, which together represent the system of ethical tradition. Such norms and concepts that play a huge role in regulating the functions of the Kazakh ethical system and personal relationships include: «sin» and «guilt», «offense» and «retribution», «confession», «sacramentality», «work» and «pleasure», «beingsatisfied with little», «mercy», «good» etc. These concepts are not limited only to the spiritual world of Kazakhs and in a particular life they form an important part of human qualities [4].

It should be particularly noted that in the Kazakh traditional culture, these concepts perform their specific functions, depending on where and how they are used, and under what conditions of interaction factors they are. Let's turn to the concept of «Obal», which has become a permanent lexicon of Kazakh people when expressing attitudes to certain people or things. In the dictionary of B. Kaldybayev [5], this word is translated as: «guilt», «sin». But this translation does not reveal its full content, because this concept is complex and does not fit into a single word for translation. Philosophers interpret this concept as follows: Obal is a concept that reveals the meaning of a thing that is not recommended to throw away in order to avoid retribution or bitterness; it also includes the noble actions of a person in relation to weak and infirm people; or actions, in which the essence of human appearance is exposed, making community dislike it. Obal means that you can not harm the environment, spoil the living, harass and offend people with physiological disabilities, do bad things and abuse someone's trust or harm someone.

The next concept often used among the people is *issauap*. This concept explains the motives of a person's good actions. Careful attitude to all the living and non-living, with the purpose of providing charitable assistance, lifesaving intervention, based not on material interests, but on good will. For example, support orphans, disabled people, widows, care for strangers and needy people, restoration of the bird's nest, etc. The Origins of the spread of these concepts among the Kazakhs are associated with the ancient animalistic and totemistic beliefs of the Kazakhs that you can get a reward only by doing good. At present, these concepts have taken root so much that it has become a distinctive feature of the nation.

It should be noted that an important aspect of the moral culture of the Kazakhs is tolerance, which in the Kazakh language means «*tozimdilik*». Tolerance is typical in traditional Kazakh culture right from the beginning, because this quality is developed by the way of nomads life. Moreover, this concept permeates all the spiritual and material wealth of the people. The people were able to preserve their unique culture thanks to such qualities. As M. Orynbekov emphasizes, «The close proximity of the Kazakhs to nature, proximity from an emotional position to observing the surrounding and perceived world was reflected in their understanding of their inner world, the moral principles of existence» [6]. In the Kazakh language, the concept of tolerance is identical to the concept of «*shydamdylyk*» and «*sabyrlyk*», which have the same semantic content.

In the Kazakh mentality, the centuries-old experience of understanding the surrounding world, its structure, properties, the place of man in the world, the relationship between man and nature, between people, was reflected in poetry, proverbs and sayings. The proverbs of any nation form a moral code. They enrich the norms of people's morality, say what is valued in a person initially, and created for him. So, for example, through proverbs and sayings, the Kazakh people called on to take care of people who need it (orphans, elderly and disabled people): «if you meet an orphan, take care of him», «Orphan's tears are bitter than poison». Kazakh fairy tales are filled with stories of heroes who stand up for the protection of the rights of disadvantaged segments of the population, old people, orphans, etc.

But, at the same time, other aspects of the relationship to different layers of society are known from the historical information. For example, in the well-known law of Tauke Khan «*Zheti Zhargy*» there is a clear social division: the size of the «*kun*» depended on the social status of the offender and the victim. So, for the murder of a simple man, the killer could

pay off by giving his relatives 1000 rams, for a woman - 500, while for the murder of the Sultan or Khoja kun was charged as for seven ordinary people. The cost of a slave was equal to the cost of a hunting golden eagle or hunting dog [7]. The given example of differentiation of prices of human lives depending on its social status can testify to different human value and significance.

Negative attitude to people with different characteristics can be traced from some genres of folklore, in particular from fairy tales. Many characters, who are characterized by negative behavior traits are symbolized by external shortcomings. For example, in the fantastic tales of the Kazakh people, the main images of various kinds of monsters were «one-eyed zhalmauyz» (Cyclops), «Kazyk-ayak», «Karga-tumсыk» - an old woman with a leg stake, with a crow's beak. All of them were characterized by hostility towards healthy people. And, if we take into account the fact that one of the means of educating children are works of oral folk art, then children are more likely to have a negative attitude to people with severe physical disabilities.

However, another interpretation of these works is also possible, since the Kazakh people paid special attention to the education of children from an early age, taking into account these features, a negative attitude to people with non-aesthetic appearance was instilled in the people from an early age as negative. Whereby the child could ask the question about the reasons and then found the answer in violation of the main rule of «marriage without keeping the seven tribes law» and it developed «immunity» to violation of this rule.

Although the history of the Kazakh people contains relatively little information about the attitude to people with special needs, the analysis of historical and literary sources shows that the Kazakh people paid special attention to the physical health of their generation and the prevention of congenital and hereditary abnormalities. This is evidenced by «The ban against the marriage up to seven generations», which suggests that if this rule is violated, the future generations would be born with physical ailments.

Taking into account the historical events when our state was part of the Soviet Union, it should be noted that the general trends in the recognition of equal rights of children are identical with many CIS countries. With the obtaining an independence, a new social policy is being built in our country, which is aimed at creating equal conditions for children with special needs, which have been reflected in the country's normative legal documents.

In accordance with the fundamental international human rights instruments, the legislation of the Republic of Kazakhstan provides the principle of equal rights to education for all children. The children's right to education are guaranteed by the Constitution of the Republic of Kazakhstan, the Laws of the Republic of Kazakhstan «On the rights of the child in the Republic of Kazakhstan», «On education», «On social and medical-pedagogical correctional support for children with disabilities», etc. On the basis of these documents, the state guarantees any child, regardless of nationality, religion, health status, the right to receive free general education.

In general, the analysis shows that the Kazakh people have developed tolerance and respect for all historically, especially the socially vulnerable segments of the population. A shining example of tolerance is the fact that more than 130 ethnic groups live in peace and harmony in our country. It is necessary to revive the historical image of the Kazakhs, develop high feelings of tolerance in children and young people native to the Kazakh people, which will become the Foundation not only for inclusive education, but also in general, for the development of a highly cultural society.

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TERMINOLOGICAL PROBLEM IN THE TYPOLOGY OF MUSEUM- CHURCH INSTITUTIONS

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Abstract. The museumification of churches as a process of preserving historical and cultural values in the 21st century undergoes a new phase in the development of museum-church relations. In the interaction of two or more organizations, the path to cooperation and mutual understanding lies through understanding the terminology when introducing clarifying concepts. In this article, the author analyzes and differentiates the main types of museum and church institutions depending on their priority activities.

Keywords: museum-temple, temple-museum, monastery-museum, terminology, museumification.

An integrating factor creating a single information space is terminology. It provides mutual understanding at all levels of interaction. The terminological problem is multidimensional.

In the scientific literature, museumification is defined as “the direction of museum activity, which consists in transforming historical, cultural and natural objects into objects of museum display with the aim of preserving and identifying their historical, cultural, scientific, and artistic value” [1]. A significant number of religious monuments at different times were subject to museumification in the Russian Federation and the Republic of Belarus. The degree of museum transformation of objects influenced their perception. Some churches have acquired obvious features of a museum institution, while others have retained the priority of the cult. Thus, one of the aspects of the terminological problem is the issue of differentiation of the concepts of museum-temple and temple-museum. In dictionaries, reference books, in official use, this division is absent.

It should be noted that aspects of the concept of a museum-temple are partially considered in publications of, for example, Aryutina A.A. [2], Shableeva N.I., Levchuk V.I., monographs Kaulen M.E. [3].

For a deeper understanding of the topic under study, we turn to the definitions of the museum and temple. In the literature they are invariant.

For a long time, the most used wording for the word “museum” was the one that was written in the ICOM Charter in 1989. In this document the museum is called “a permanent, non-profit institution designed to serve the community and contribute to its development, accessible to the general public, engaged in research, acquisition, storage, popularization and exhibiting of material evidence of a person and his environment in order to study, educate and satisfy spiritual needs” [4]. At the same time, Peter van Mensch, considering a comprehensive museum definition, focuses on the specifics of the museum. In his opinion, “a museum is a permanent museological institution, which for the public good preserves collections of corporate documents and creates knowledge about them” [5, P.289]. The museum phenomenon has many similar wordings. Each of them focuses on any significant mandatory aspect of the specifics of the museum. Depending on the needs of the social group, the definition undergoes transformations.

Consider the generally accepted, accessible to a wide audience wording of the word “temple.” “The temple is a building for public worship” [6]. “The temple is about something that inspires a feeling of deep reverence, veneration” [7]. In all definitions of this word, the emphasis is on sacred designation.

At the same time, the museum and the temple have much in common. The museum can be considered as a temple of art. The temple can be evaluated as a place of storage and presentation of objects of worship. Regarding the initial identity of the goals of these two cultural phenomena, the Russian thinker N.F. Fedorov expressed himself in the XIX century [8, P.382]. Thus, the merger of the two definitions is a well-founded process.

Based on the above definitions, on the differences in the activities of museums [9, P.350-449] and temples, on the differences in some functions [10, 11] of these institutions, we differentiate the concepts of museum-temple and temple-museum at the modern historical stage.

“Museum-temple — Museum-monument, created on the basis of the museumification of a single monument of cult (mainly Orthodox) architecture in order to preserve and disclose its cultural and historical value, which the exposition interpretation is aimed at” [12].

In our opinion, the main activities in the museum-temple are museum activities (research, scientific and stock, exposition and exhibition, cultural and educational) and priority is given to museum functions (documentation, organization of free time). First of all, the museum-temple is a cultural

institution. It has a scientific reference apparatus, scientifically processed collections, funds, expositions built in the interiors of such a museum, are equipped with labels, annotations, reference, navigation texts, interactive and multimedia sets. A museum-temple is characterized by a wide range of cultural programs and educational and recreational activities. Museum-temple is most often owned by the state and in its activities is subordinate to the Ministry of Culture. Divine services in it are not held at all or are rarely held on the basis of Presidential Decrees, orders and agreements.

Typical examples of museum-temples are, for example, St. Sophia Cathedral in Polotsk (Republic of Belarus), St. Demetrius Cathedral in Vladimir (Russian Federation), Cathedral of the Protection of the Virgin on the Moat in Moscow (Russian Federation), Cathedral of the Nativity of the Virgin in Bogolyubovo (Russian Federation).

Temple-museum can be defined as a temple-monument with reconstructed decoration of interiors, elements of an exposition or with a full-fledged exposition, which is to some extent connected with the monument itself, used for liturgical purposes. The temple museum combines the functions of a cult object (cult, worldview, integrative, recreational-psychotherapeutic, socially-regulatory) and a museum (mainly education, upbringing, documentation). Priority in this case is given to temple functions and activities. Liturgical services are regularly held in the temple museum. The temple museum has the basics of museum organization, for example, the established visiting regime to maintain the microclimate, the rules for viewing the exposition, regulated excursion services, etc. Cultural activities are strictly limited. The exhibits lack interactive multimedia technology. Most often, he is legally in the use of the church or joint management of the museum and the church.

As a temple museum we consider, for example, the Church of St. Anthony of Rome in Vitebsk (Republic of Belarus), the Dormition Cathedral in Vladimir, the Cathedral of the Nativity of the Virgin of the Snetogorsky Monastery, the Holy Boris and Gleb Kolozha Church in Grodno (Republic of Belarus), the Transfiguration Church in Polotsk (Republic of Belarus), Intercession Church at Fili (Russian Federation). This status implies the need for constructive interaction between museum and church experts in order to preserve cultural heritage.

As a type of church-museum relations, we propose highlighting churches with a museum component. In this case, the monument fully performs all church functions, but contains and retains an element of universally significant cultural value. A temple with a museum component is usually included in sightseeing routes and is used for sightseeing. However, it does

not have a special museum organization. It contains only separately taken museum equipment (a capsule for an ancient icon, a podium, a showcase), exposition probes of architectural details or ancient sections of the mural can be present.

Examples of temples with a museum component are: the Annunciation Church in Vitebsk (Republic of Belarus), the Church of the Archangel Michael in Smolensk (Russian Federation), the Assumption Cathedral in Smolensk (Russian Federation), the Epiphany Cathedral in Moscow (Russian Federation), the Cathedral of Princes Boris and Gleb in Novogrudok (Republic of Belarus), Church of the Nativity of the Virgin in the Grodno region (Republic of Belarus).

Another type of church-museum relationship is a museum space at the temple. As a museum or exhibition space at the temple, sub-bases, church bypass galleries, Sunday school premises adjacent to or located within walking distance from the church, etc. can be used. In this case, the church performs only liturgical functions, and the museum space is museum functions. The quality of the organization of museum and exhibition spaces in this case will depend on the competence of specialists working on the expositions. An example is the Dormition Cathedral in Vitebsk (Republic of Belarus), the Petro-Pavlovsky Cathedral in Gomel (Republic of Belarus), the underground museum in the Cathedral of the Nativity of the Virgin in the Zachatievsky Monastery in Moscow (Russian Federation).

The ability of organizations to communicate contributes to the formation of a respect for cultural heritage and contributes to the cultural enrichment of audiences. The museum visitor is introduced to the special atmosphere of temple art, and the church visitor to the museum aesthetics.

We assume that consolidating this typology with museum and church institutions may partially solve the terminological problem when working with legal documents. The differentiation of museum and temple institutions will make it possible to communicate more clearly the degree of responsibility of each of the parties regarding the preservation of the monument.

Museums and monasteries are more complex conglomerates of institutions with cultural, spiritual and religious-behavioral components.

By analogy with the allocated statuses, the museum-temple, temple-museum, temple with a museum component, museum space at the temple, we suggest considering the possibility of identifying the types of co-existence of a monastery and a museum institution: museum-monastery, monastery-museum, monastery with a museum component, museum at the monastery.

By definition, “a museum-monastery covers a closed architectural ensemble of monastery buildings, which are used, as a rule, for various historical and artistic expositions, to one degree or another connected with this monastery” [13]. At the same time, monastic life is not conducted on the territory. But some joint church and museum activities are allowed. An example of such an institution, in our opinion, is the Center for the Study of the History and Heritage of the Zlatoust Monastery in Moscow (Russian Federation).

The second type is the monastery museum. It can be described as a closed architectural ensemble of monastic buildings and monuments of historical and cultural heritage with the partial adaptation of individual objects to monastic needs, which should not contradict the requirements for the preservation of heritage. In this case, management is carried out by the church administration. Museum premises and structural units of the monastery should be placed in historical premises. At this time, this status can be assigned to the Novodevichy Convent in Moscow (Russian Federation).

The third type is a monastery with a museum component. Its distinctive feature is that a small exposition and exhibition space is created within the monastery territory. At the same time, the cloister fully functions within the framework of its charter, preserving the peculiarity of religious activity and monastic hostel. Most often, the staff of such monasteries has an employee who has competencies in issues of museum, sightseeing, restoration activities. An example of this type of monastery is the Spaso-Evfrosinievsy monastery in Polotsk (Republic of Belarus), the Conception Convent in Moscow (Russian Federation).

The fourth type is the museum at the monastery. This type of relationship arises, for example, when a museum exposition and exhibition center is created within walking distance from the monastery. An important feature is the fact that part of the exposition is dedicated to the history and activities of the nearby monastery.

Thus, the article identifies some types of museum and church institutions in the context of their close cooperation. In the course of historical and cultural transformations, the probability of the transformation of one status into another is not ruled out. Identified statuses can contribute to a clearer delineation of relations between the museum and the church during document management.

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IDENTIFICATION OF BIOFILM-FORMING MICROBES IN ATHEROSCLEROTIC PLAQUES IN PATIENTS WITH CARDIOVASCULAR DISEASES

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Abstract. The presence of live microbes in clinical samples from atherosclerotic plaques suggests that atherosclerosis microbiomes can be an important segment of human microbiome. The development of methods for identifying the main infection and the prevalence of microbial species in vascular lesions can help determine effective individual treatment regimens for cardiovascular diseases (CVD), including antimicrobial agents, for each patient.

Purpose of the study. Isolation and identification of viable microbes in clinical material from atherosclerotic plaques.

Materials and research methods. Cultivation of fragments of atherosclerotic plaques isolated in 12 patients with coronary heart disease during coronary artery bypass grafting was carried out in a fluid system and anaerobic conditions.

Results. Of all clinical samples with areas of atherosclerotic damage after cultivation in a fluid system and anaerobic conditions, biofilms containing viable microbes were isolated. The genetic material of at least one type of microbiota was identified, including DNA of periodontopathogenic bacterial species, some pathogens of nosocomial infections, viruses of the family Herpesviridae and *Candida* spp.

Conclusion. Recognizing infections as a contributing factor to atherogenesis, and elucidating the specific mechanisms involved, can lead to a relatively inexpensive characterization of the human atherosclerotic microbiome.

Keywords: atherosclerotic plaque, biofilm-forming microbes, periodontal pathogens, causative agents of nosocomial infections, fluid technology.

Epidemiological and seroepidemiological data indicate that infections are risk factors for the development of vascular pathology [2, 11]. The notion that the presence of chronic infections, exacerbated by the host's immune response, plays a major role in atherogenesis, has led to the need to determine the "pathogenic load" in cardiovascular diseases (CVD) [9]. Many studies have shown the presence of DNA of periodontopathogenic bacteria in areas of atherosclerotic damage [1, 4, 12]. Metagenomic studies indicate the presence of genetic markers in atherosclerotic plaques not only pathogens of inflammatory diseases of the oral cavity, but also other clinically important infections, including the intestinal and genitourinary systems [7]. However, the presence of DNA does not allow us to judge the clinical significance. Only the cultivation and identification of live bacterial species from the lesion sites in an infectious disease is consistent with Koch's postulates and justifies further studies [5]. Recently, some authors have demonstrated the presence of live microbes in clinical samples, providing evidence that an atherosclerotic microbiome can be an important segment of a human microbiome [8,14]. However, when studying the relationship of infectious agents with atherosclerosis, little attention is paid to the potential of bacteria in the formation of biofilms in arterial plaques. Although in clinical practice, with the pathology of the internal organs of infectious and non-infectious genesis, much attention is paid to the concept of microbial biofilms. It is assumed that mixed biofilms that form on the mucous membrane of the respiratory tract, mouth and intestines, urinary tract, wound surfaces provide synergistic action of pathogens, which is especially important in the development of secondary infection in the postoperative period and with nosocomial infections, which are becoming more widespread [3.13]. Recognition of infections as a significant factor contributing to atherogenesis and elucidation of the specific mechanisms involved can lead to a relatively inexpensive characterization of the genome of members of the atherosclerotic microbiome [5]. Development of methods for identifying the main infection and the prevalence of microbial species in vascular lesions can help determine effective individual treatment regimens, including antimicrobial agents, for each patient.

Purpose of the study

Determination of the composition of anaerobic periodontopathogenic bacterial species and some other causative agents of nosocomial infections, *Candida* fungi, and *Herpesviridae* viruses in the clinical material from atherosclerotic plaques and oral fluid of patients with coronary heart disease (CHD) using cultural bacteriological and molecular genetic research methods.

Material and research methods

Cultivation in the fluid system and anaerobic conditions [3] of fragments of atherosclerotic plaques isolated in 12 patients with CHD aged 54 to 74 years who were undergoing surgical treatment at the Institute of Coronary and Vascular Surgery of the Center for Cardiovascular Surgery named after A.N. Bakulev was performed. Material (vascular fragments) was taken during coronary artery bypass grafting (CABG) associated with an atherosclerotic lesion, and immediately placed in sterile transport systems with AmiesTransport medium. Before the operation, oral fluid washes were obtained. Samples for research were delivered to the MSUMD Laboratory of Molecular Biological Research within 2 hours.

The design of microbiological studies at the 1st stage included seeding on liquid culture media, reseeded on solid culture media and PCR diagnostics. At stage 2, the results of cultivation in a liquid nutrient medium were recorded (optical density assessment, visual and microscopic methods), followed by repeated seeding on solid nutrient media and analysis of the results; secondary PCR diagnostics from samples of a liquid nutrient medium (after cultivation of the studied samples in them). Primary inoculation for isolation of potential microbiota was performed on nutrient media manufactured by HiMedia Laboratories Pvt. Limited (India): M863 - Wilkins-Chalgren anaerobic broth, with the addition of an enrichment additive for the selective isolation of non-spore anaerobes (FD001). Dense nutrient media M521 (staphylococcal agar N110, M832 (Wilkins-Chalgren anaerobic agar, with an enrichment additive for the selective isolation of non-spore anaerobes (FD001) and 5% blood)); M029 (Endo agar); M304 (selective agar for staple) ; M1297A (chromogenic medium for the rapid selective isolation and identification of *Candida* fungi from mixed cultures); M1293 (chromogenic medium for the preliminary identification of *E. coli* and other coliform bacteria). Each test sample was divided into equal parts using a surgical scalpel. One part was placed in a sterile Eppendorf tube for further PCR diagnostics, and the second part was used to obtain an imprint on a dense nutrient medium M832, which was then placed in a liquid nutrient medium M863. Seedings on solid and liquid nutrient media were placed in a HiAnaerobic System Mark VI anaerostat to create anaerobic conditions in an oxygen-free gas mixture GSO PGM 10532-2014: H₂ (10%), CO₂ (10%) N₂ (80%). An anaerostat with the studied samples was installed in the "ES-20" orbital shaker incubator (Biosan, Latvia) and incubated at a temperature of 36.9°C, rotation speed 90 rpm for 2 and 7-14 days. To control the sterility of the sampling of the test material and cultivation conditions, the transport medium was sown on a solid nutrient medium

M832, in which samples were delivered to the laboratory; Petri dish with M832 nutrient medium and a bottle with M863 liquid nutrient medium without culture. Biochemical identification of the isolated bacterial species was performed using the *Biochemical Identification Test Kits* (Himedia Labs Pvt. Limited, India). Isolation and cultivation of the isolated strains was carried out in accordance with the standard protocol [10, 13].

DNA was isolated from samples using the "Universal Sample Preparation" reagent kit ("Genlab" NPF LLC, RF), recommended for DNA extraction from DNA-rich tissue homogenates, in accordance with the manufacturer's instructions or stored at -30°C until use. Amplification of periodontopathogenic bacteria markers *Aggregatibacter actinomycetemcomitans*, *Tannerella forsythia*, *Porphyromonas gingivalis*, *Prevotella intermedia* and *Treponema denticola* was carried out in the "Tertsik" thermal cycler ("DNA-technology", RF) using the Multident-5 multivariate PCR-kit ("Genlab" NPF LLC), RF). The DNA of periodontopathogens (*Parvimonas micra*, *Fusobacterium nucleatum / periodonticum*, *Campylobacter rectus*, *Eubacterium nodatum*, *Eikenella corrodens*, *Capnocytophaga spp.* (*S. gingivalis*, *C. ochraceus*, *C. sputigena*)) was amplified using the Micro-IDent@plus system from HainLifescience (Germany). Amplified samples were identified using the reverse hybridization method in accordance with the manufacturer's protocol. DNA of other pathogens of many clinically significant infections (*Streptococcus spp.*, *Peptostreptococcus anaerobius*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Enterococcus faecalis/faecium*, *Proteus spp.*, *Enterobacter spp.*, *Escherichia coli*, *Mycoplasma pneumoniae*, *Mycoplasma hominis*, *Chlamydia pneumoniae*), as well as fungi of the genus *Candida*, was determined using sets of "Litekh" NPF LLC (RF). DNA of viruses of the *Herpesviridae* family was detected using a reagent kit ("Genlab" LLC NPF, RF). Cloned DNA samples were analyzed by gel electrophoresis in 1.6% agarose on a TCP-25M transilluminator (Vilber Lourmat, France) in 312 nm ultraviolet light after 30 min staining with ethidium bromide (1 µg/ml) [13]. Dental examination of patients was performed by a qualified doctor - periodontist.

All patients signed informed consent to participate in this study, which was approved by the ethics committee of the A.I. Yevdokimov Moscow State University of Medicine and Dentistry.

Research results and discussion

A survey of 12 people with chronic diseases of the cardiovascular system, previously (from several months to 10 years) who had acute myocardial infarction, was performed. All patients were diagnosed with post-infarction cardiosclerosis, exertional angina 2-3 or 3-4 FC (according to

the classification of stable angina pectoris of the Canadian Cardiovascular Society), 2 (16%) people had multifocal atherosclerosis, and 1 (8%) had post-infarction aneurysm. Most patients had concomitant diseases of the gastrointestinal tract and genitourinary system. A follow-up examination revealed that 5 (42%) people had mild chronic periodontitis and 7 (58%) had mild chronic periodontitis. Oral hygiene was satisfactory in the third part of patients, and unsatisfactory in 8 (67%) patients. The average age of patients was 63.6 ± 1.6 years. In order to improve blood flow directed to the heart muscle, all patients underwent coronary artery bypass grafting at the Institute of Coronary and Vascular Surgery. During the operation, sections of vessels with atherosclerotic lesions were selected.

Bacterial growth in control seedings was absent. In vials with fragments of atherosclerotic plaques, clouding of the nutrient medium was observed after 12-24 hours of cultivation and the presence of sediment at the bottom of the tube. On the surface of cultivated biopsy specimens, the growth of microbes forming a continuous biofilm was also observed. In the prints of atherosclerotic plaques on glass after cultivation under fluid conditions for 24 hours or more, gram-negative and gram-positive bacteria, as well as yeast, were found. On dense nutrient media with imprints of atherosclerotic plaques, growth of bacteria of various shapes and consistencies was observed. From prints on solid nutrient media and planktonic cultures, seedings were again made on nutrient media M521; M832; M029; M304; M1297A; M1293. Petri dishes with M832, M304 medium were placed in an anaerostat to create conditions of anarabiosis; plates with medium M521, M029, M1297A, M1293 were cultivated under aerobic conditions for 24 to 336 hours.

After culturing of 12 fragments under fluid conditions, 4 strains of periodontopathogens (*A. actinomycetemcomitans* and *P. gingivalis*), 21 strains of pathogens of purulent-inflammatory infections (*S. aureus*, *Streptococcus agalactiae*, *E. coli*, *Proteus spp.*, *P. aeruginosa*, *E. faecalis/faecium*, *Enterobacter spp.*) and 6 strains of *Candida spp.* were isolated and identified, a total of 31 strains.

Using PCR, DNA was identified for 14 strains of periodontopathogenic microbes, 5 strains of nosocomial infections and 9 strains of *Candida spp.*, 28 strains in total.

In the studied material from atherosclerotic plaques, DNA of pigment-forming periodontopathogenic bacteria *T. forsythia* was detected in 3 (25%), and *P. gingivalis* in 2 (17%) patients. *A. actinomycetemcomitans* DNA was detected in 1 (8%) sample. In addition, markers of potentially periodontopathogenic bacteria *F. nucleatum* were detected in 2 (17%) atherosclerotic plaques; 1 (8%) of each sample contained DNA of *Capnocytophaga*

(*C. sp.*) and *E. corrodents*. We did not identify the DNA of *T. denticola*, *P. intermedia*, *P. micra*, *C. rectus*, and *E. nodatum*. The frequency of occurrence in atherosclerotic plaques of *Candida albicans* DNA was 4 (33%), *Candida krusei* - 1 (8%), *Candida parapsilosis* - 5 (41%). *Candida glabrata* and *Candida guilliermondii* were not identified. Moreover, in 4 (33%) samples, 1 species was revealed, and in 3 (25%) - 2 species out of 5 fungi of the genus *Candida* determined by us. Among the causative agents of nosocomial infections, DNA of *E. faecalis* was identified in 1 (8%), *E. faecium* in 4 (33%), *S. aureus* in 2 (17%) cases. EBV DNA was detected in 2 (17%), CMV - 5 (41%) and HSV1,2 - in 3 (25%) samples.

At the same time, genetic material of *T. forsythia* was detected in oral fluid (mixed gingival fluid and saliva) in 3 (25%), and *P. gingivalis* in 4 (33%) of the examined patients. *A. actinomycetemcomitans* was identified in 1 (8%) case. DNA of *F. nucleatum* and *Capnocytophaga (C. sp.)* was detected in half of the examined patients, in 2 (17%) - *E. corrodents* or *C. rectus*, 1 (8%) each had *T. denticola* or *P. intermedia*. DNA of periodontopathogens *P. micra* and *E. nodatum* was not detected in the oral fluid. *Streptococcus spp.* was determined in 10 (83%) people, *P. anaerobius* - in 3 (25%) people. Of the causative agents of nosocomial infections in 1 (8%) person, *S. aureus* was determined, and *E. faecium* in 3 (25%) people.

Thus, we have found that in the content of atherosclerotic plaques, it is possible to identify not only genetic material, but also living representatives of human microbiota, which may possibly play a role in the etiopathogenesis of atherosclerosis. Further studies are needed to study the long-term effects associated with the influence of microbiota on the nature of the development and progression of atherosclerotic processes, as well as anti-inflammatory, including periodontal, therapy for CVD. Along with this, patients with moderate to severe periodontitis with concomitant systemic and inflammatory diseases should be informed of a possible increased risk of CVD.

Conclusions

A method for modeling biofilms based on fluid technology has been developed and tested that allows the identification of previously undetectable types of microbiota in the walls of blood vessels and atherosclerotic plaques, on vascular stents and catheters in sufficient quantities to identify and study their properties.

In all samples isolated from atherosclerotic plaques, genetic material of at least one species, microbiota, including DNA of periodontopathogenic bacterial species, some pathogens of purulent-inflammatory diseases, viruses of the family Herpesviridae and *Candida spp.* was identified.

The isolation of viable, previously undetectable types of microbiota in the walls of blood vessels and atherosclerotic plaques of a person due to the restriction of their distribution by factors of nonspecific resistance and the immune system of the human body in vivo, provides new evidence of the direct and indirect participation of microbiota in the etiopathogenesis of non-infectious human diseases.

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SEROLOGICAL MONITORING OF THE EFFECTIVENESS OF POST-VACCINATION IMMUNITY AGAINST HEPATITIS B IN MEDICAL WORKERS IN REPUBLIC OF TATARSTAN

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Abstract. Immunization against hepatitis B virus is the most effective way to prevent this disease. The study of the tension of post-vaccination immunity against viral hepatitis B in 412 employees of healthcare institutions of the Republic of Tatarstan showed that immunization of employees of medical organizations against this type of infection provides long-term intense immunity in vaccinated in 51.7% of cases with no manifested forms of the disease. The duration of intense immunity depends on the age of people at the start of vaccination. The highest rates of immunity tension are found in people vaccinated at the age of 20-29 years (67.7%). A decrease in immunity in vaccinated health workers after 5 years from the moment of vaccination necessitates a booster vaccination against viral hepatitis B according to the results of a serological examination of vaccinated people.

Keywords: viral hepatitis B, healthcare providers, immunization, prevention, anti-HBs antibodies.

The implementation of a wide-scale campaign of specific prophylaxis of viral hepatitis B (HB) in various regions of Russia led to a decrease not only in acute hepatitis B, but also in the level of HBsAg carriage with a limited spread of chronic forms, including primary liver cancer [1,8].

Considering the fact that since 1996 in various regions of our country, including the Republic of Tatarstan (RT), recombinant vaccines of various manufacturers have become widely used to prevent HB infection among medical workers (MW). Serological monitoring of the tension of humoral immunity in the dynamics of observation is of great scientific and practical importance, it is very important for assessing the limiting values of the duration of immunity after vaccination and solving the question of the timing of booster vaccination (revaccination) against viral HB. In addition, the indisputability of the immunization of viral HB, as an effective method of preventing nosocomial infection in MW, is confirmed by the work of domestic researchers in recent years in various regions of the country [4,5,6,7,9].

Taking into account the beginning of immunization against HB of medical workers in the RT (1996), the lack of studies on serological monitoring of the duration, intensity and effectiveness of HB vaccination in MW in our region and its scientific and applied significance, we began research in 2004 with the aim of studying the duration and intensity of post-vaccination immunity against HB in MW of the Republic of Tatarstan vaccinated against HB in the long term with an assessment of its immunological effectiveness.

Material and methods: A retrospective analysis of the results of a serological examination of 412 medical workers immunized according to one of the standard regimens - 0-1-6 months with recombinant HB vaccines in 5 healthcare institutions of the Republic of Tatarstan was carried out.

From the start of vaccination to the examination, from 1 year to 14 years have passed. For the detection of HB markers (HBsAg, anti-HBs) in blood serum 412 of MW, the ELISA method was used by certified commercial test systems manufactured by Bio-Rad (France) and CJSC "Vector-Best" (Novosibirsk, Russia). In addition, when conducting serological monitoring to identify the possibility of transmission of latent forms of infection by the examined, in blood serum 54 of MW, which are at risk (frequent contact with blood), in 2004 and 2011, in addition to the above-mentioned serological markers of HB, anti-HBc were determined - antibodies.

Given that the intensity of post-vaccination immunity is characterized by the level or titer of specific antibodies, their quantitative determination was carried out. To characterize the tension of humoral immunity, the ranges of levels of anti-HBs antibodies proposed by WHO were used:

- 0 to 10 mIU/ml - lack of protection against HB;
- from 10 - 50 mIU/ml – low degree of protection;
- from 51 - 100 mIU/ml – medium degree of protection;
- over 100 mIU/ml – high degree of protection;

The results obtained in the work were subjected to statistical processing using generally accepted methods of variation statistics. The significance of the differences between the compared values was estimated using statistical methods, such as the Student t-distribution and Fisher's exact method.

Results: Immunization against HB in the RT in large numbers began in 1997 with the use of genetic engineering vaccines "EngerixB" from "Smith Klein Beach" (Belgium) and H-B-Vax-II from "Merck Sharp and Dohme". Pre-vaccination screening for antibodies to the envelope antigen of the HB virus was not conducted, the results of the clinical examination for HBsAg among all MW were negative.

Our analysis of the results of vaccination against viral HB MW for the analyzed period allowed us to determine the structure of the intensity of post-vaccination humoral immunity in the Republic of Tatarstan in MW, regardless of the period after vaccination against HB according to the standard scheme. Screening of anti-HBs antibodies in the blood serum of 412 MW of various treatment organizations revealed that among the examined patients, 48.3% (199) could not detect anti-HBs in a protective concentration. Persons with a protective level of antibodies accounted for 51.7%, including 27.4% with more than 100 mIU/ml, the rest with medium and low titers of protection, but the prevalence in 18.5% of cases of the latter.

Given that all employees were immunized according to the standard schedule in different years, we analyzed the distribution of titers of anti-HBs antibodies in the blood serum MW, depending on the duration of immunization.

An analysis of the distribution of titers of anti-HBs antibodies in the blood serum of the entire studied population depending on the timing of immunization showed that among vaccinated from 1 month to 1 year after the completed vaccination, the detection rate of anti-HBs in a protective concentration was 88.9, among those vaccinated from 1-2 years - 71.4%, and among vaccinated 3-5 and 6-8 years - 41.9% and 43.8%, respectively. The number of seronegative ones, on the contrary, increased - from 11.1% among vaccinated to 1 year after vaccination completed to 58.1% among vaccinated from 3-5 years or more, respectively. By the age of 15-17, the vast majority of vaccinees (80%) become seronegative.

During the study, calculations were carried out to determine the average time to detect anti-HBs antibodies after vaccination in MW. The analysis showed that 5.5 years elapse from the moment vaccination ends until the time of absence or presence of antibodies below the protective titer (10 mIU/L), which necessitates revaccination.

A study of the level of protective antibodies depending on age at the time of vaccination showed that the greatest proportion of seropositive individuals falls on the age group of 20-29 years (67.7%). The proportion of seronegative individuals increases with age, reaching a maximum in 69.2% by the age of 30-39. The employees of medical organizations vaccinated at the age of 50 years and above have protective titers only in 48.1% of cases. In connection with the above, it can be noted that with increasing age at the time of vaccination, the frequency and intensity of the immune response to vaccination decreases.

A comparative assessment of the dynamics of the distribution of antibodies to the surface antigen of the HB virus in 54 MW (table 1) 1 month or more than 5 years after vaccination showed that out of the total number of vaccinated, 37 MW (68.5%) had protective titers of antibodies, i.e. h with low titers of 20.4% (11), medium - 5.5% (3), with high - 42.6% (23).

Repeated indication of antibodies in blood serum after 7-14 years made it possible to establish a statistically significant decrease in the proportion of individuals with no protection from 31.5% (17) to 7.4% (4) ($P < 0.002$), while maintaining individuals with high protective levels from 42.6% (23) to 46.3% (25) and low titers of 20.4% (11) and 29.6% (16) ($P > 0.05$ and $P > 0.097$, respectively). We also found a statistically significant increase in the number of medical workers with average titers of protective antibodies by 3 times from 5.5% (3) to 16.7% (9) ($P < 0.048$).

Thus, the results of our studies have shown that after a long time (7-14 years) after receiving the full course of vaccination, the vast majority of MW (92.6%) is protected against viral HB.

Table 1
The dynamics of the distribution of titers of anti-HBs antibodies in serum of MW vaccinated against HB in%

Concentration levels of antibodies to viral HB envelope antigen	The distribution of titers of anti-HBs antibodies in MW vaccinated according to the 0-1-6 months scheme		The distribution of titers of anti-HBs antibodies in MW after 7-14 years after vaccination	
	tot.num.	%	ot.num.	%
Under 10 mIU/L	17	31,5	4	7,4
10-50 mIU/L	11	20,4	16	29,6
51-100 mIU/L	3	5,5	9	16,7
Over 100 mIU/L	23	42,6	25	46,3
Total	54	100	54	100

Along with the qualitative and quantitative determination of anti-HBs antibodies, we performed a serological examination of 54 MW blood serums with indication of HBs antigen and anti-HBc antibodies. The absence of HBs - antigen in all 54 sera and the specific gravity of the marker of non-manifest forms of the disease at the level of 24.1% were established.

The result of long-term serological monitoring of post-vaccination immunity against viral HB in MW of the Republic of Tatarstan immunized with recombinant vaccines indicates the presence of a rather large number of seronegative individuals (48.3%). By 3-5 years after receiving the full course of vaccination, a decrease in the protective level of antibodies is observed in 58.1% of cases.

Serological monitoring of antibody levels in MW should begin 3 years after vaccination, while the absence or presence of antibodies below the protective titer occurs after 5.5 years, which is consistent with the authors [4,5,6]. We also confirmed the position that with increasing age, the proportion of people with a lack of protective antibodies against viral HB increases [4,6].

The effectiveness of vaccine prophylaxis against viral HB is confirmed by the absence of surface antigen, viral HB and preservation of the detection rate of anti - HBc antibodies at the same level [4,5,6]. We agree with the authors [4,7] that a decrease in immunity in MW after 5 years from the moment of vaccination against viral HB necessitates revaccination according to the results of their serological examination.

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MORPHOMETRIC PARAMETERS OF FEET OF PREGNANT WOMEN IN THE FIRST TRIMESTER

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Abstract. A study was made of the morphometric parameters of the foot of women in the first trimester of pregnancy who did not have a history of musculoskeletal system diseases. By the method of computer plantography, the following were determined: the angle of 1 and 5 toes, feet heel angle, and also the length and width. A comparative analysis with the control group was performed.

Keywords: foot, pregnant, plantography.

The first pregnancy - is one of the most important stages in the life of every woman. During this period, there is an intensive increase in body weight, a change in the size of the chest, an active redistribution of the load on the bones of the pelvis, lower limbs and feet. More than 80% of pregnant women complain of swelling, cramps and pain in the lower extremities. The feet of pregnant women undergo morphological changes due to hormonal and general anatomical changes, which is reflected in a decrease in their quality of life [4]. Throughout the entire period of pregnancy, biomechanical parameters of the foot, pressure on its plantar surface, as well as its linear and angular parameters change [1]. Many authors attribute the loss of height to arches with changes due to physiological pregnancy [4,6]. Fundamental data on the patterns of changes in the basic structural elements of the feet of pregnant women will allow not only to identify their disturbances in time, but also provide a choice of conservative and surgical treatment, design and manufacture of corrective devices and products [1,3,6].

Purpose of the work

Identify the features of the morphometric parameters of the foot of women of 17-27 years old in the first trimester of pregnancy using the method of computer plantography.

Research methodology

To solve the tasks, a study was made of the anatomical and functional state of the foot of women in the first trimester of pregnancy using the technology of computer scanning of the foot, the originality of which is confirmed by the patent for the invention (RF patent № 2253363) [2]. The study involved more than 100 women aged 17-27 years who do not have a history of diseases of the musculoskeletal system. The first group included women with a first pregnancy for up to 12 weeks. The second (control) group consisted of girls 17-27 years old, who had no history of pregnancy. Anthropometric studies were carried out: measuring body weight, height, chest circumference. The method of computer plantography made it possible to determine the support and spring (K coefficient, Stritter, Weisslog index) foot functions, as well as linear (length, width, height) and angular (I, V finger angles and heel angle) foot parameters. Using the programs “Statistica-6” and Microsoft Excel in the environment of Windows XP, statistical processing of the obtained data was carried out.

Research results and discussion

The analysis of anthropometric data presented in table 1 showed that the increase in body weight of pregnant women was 1.4%, and the increase in chest circumference during the first trimester was 0.86% compared with the control group.

Table 1
Anthropometric indicators of the studied groups of women

Control group (n=80)			Pregnant 1 trimester (n=50)		
Height	Body mass	CC	Height	Body mass	CC
165,05±0,39*	54,68±0,38*	82,51±0,25*	164,52±0,78	56,14±1,17	83,94±1,5

Note: * - (p < 0,05).

The study of morphometric indicators such as the length of the forefoot (La) and the width of the foot (W) during the first trimester of pregnancy showed an increase of 0.06% and 0.6% (p < 0.05), respectively, in comparison with a control group. At the same time, the length of the middle part of the foot (Lm) was slightly higher (1.6%) in the control group (table 2).

Table 2
Indicators of the width and length of the forefoot and midfoot

Control group (n=80)			Pregnant 1 trimester (n=50)		
W	La	Lm	W	La	Lm
83,5±0,27*	94,06±0,36*	75,53±0,26*	84,57±0,68	94,16±1,31	73,22±0,82

Note: * - (p <0.05). W – foot width, La – forefoot, Lm – midfoot.

A comparative analysis of the angular parameters of the foot showed a significant increase in the 1 finger angle (NAP) by 14.6%; 5 finger angle (QBR) by 19.6%; heel angle indicator (HCK) by 35.8% in the group of pregnant women (table 3).

Table 3
Angular parameters of the studied groups of women

Control group (n=80)			Pregnant 1 trimester (n=50)		
NAP	QBR	HCK	NAP	QBR	HCK
7,69±0,28*	5,92±0,26*	6,52±0,35*	10,3±0,82	8,82±0,62	13,79±0,58

Note: * - (p <0.05). NAP – angle of 1 finger, QBR – angle of 5 fingers, HCK – heel angle.

The data obtained show that already in the first trimester of pregnancy there is a change in the morphometric parameters of the foot. As a result of changes in the load on the foot, to a greater extent on its back section and the outer surface, a characteristic “gait of pregnant women” is formed. Such anatomical changes are generally consistent with the literature [1,4,5]. At the same time, penetration of the anterior section causes an increase in the angle of 1 toe, which is consistent with data from other authors who have found an increase in pronation of the foot in women during pregnancy [5,6].

CONCLUSION. Using the method of computer plantography, new morphometric data were obtained on the increase in angular parameters (angles of 1 and 5 fingers, the heel angle), as well as the width and length of the forefoot in the first trimester of the first pregnancy. The data obtained on changes in the anatomical parameters of the foot in pregnant women 17-27 years of age testify to the specific features of the dynamics of their values, which will help in time to identify the risk of longitudinal and transverse flatfoot during pregnancy, ensure the selection of the correct conservative and surgical treatment, as well as rehabilitation measures, aimed at preventing further deformations of the foot, including the design of orthopedic shoes and orthoses.

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PERSONALIZED DIET THERAPY FOR AN OBESE PATIENT

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Abstract. The article discusses the clinical case of selecting individual diet therapy for a patient with obesity and hyperuricemia. It is proved that the calorie content of the recommended diet, as well as its macro and micronutrient composition, must correspond to the physiological needs of the body, depending on age, gender, nature of physical activity, features of body composition and metabolic status, as well as concomitant diseases. An important factor in the diet therapy of a patient with obesity and impaired purine metabolism is the qualitative and quantitative composition of protein in the diet. A decrease in body weight in a low-calorie diet leads to the loss of not only fat mass and total fluid, but also muscle mass. In this regard, a sufficient, individually selected amount of protein in the diet of a patient with obesity and hyperuricemia not only contributes to minimal loss of muscle mass during diet therapy, but also improves the effectiveness of complex therapy and improves the patient's quality of life.

Keywords: obesity, hyperuricemia, diet, protein, personalization

Introduction

Currently, a relationship has been established between an increase in the amount of adipose tissue and an increase in serum uric acid with hyperuricemia [1–5]. An increase in uric acid is associated not only with increased reabsorption of sodium in the proximal renal tubules, microalbuminuria, proteinuria, kidney damage, hypertriglyceridemia, low cholesterol high density lipoproteins, hyperinsulinemia, but also with obesity [6]. Moreover, patients with hyperuricemia often have concomitant diseases associated with obesity, such as arterial hypertension, hypertriglyceridemia, and carbohydrate metabolism disorders [5–8]. The main treatment for hyperuricemia is diet therapy with purine restriction [9–11]. However, standard diet therapy for hyperuricemia has a number of features, providing for pronounced caloric reduction and drastic protein restrictions in the diet, leading to active loss of muscle mass.

Case report

A 45-year-old man was hospitalized in the Department of Preventive and Rehabilitation Dietetics of the FSBI "Scientific Research Institute of Nutrition" with a diagnosis of Obesity of the II degree due to excessive intake of energy. Hyperuricemia Arterial hypertension of 1 degree. Upon admission, the patient complained of psychological discomfort associated with overweight, shortness of breath with moderate physical exertion, headache in the occipital region against a background of increased blood pressure. From the anamnesis: overweight for a long time, the weight gradually increased, which the patient associated with a violation of the diet and physical inactivity. Independent attempts to reduce body weight, without a positive effect. Arterial hypertension of the 1st degree over the past 2 years (maximum rises in blood pressure up to 150/90 against the background of psychoemotional stress), does not constantly take antihypertensive therapy, and does not control blood pressure (BP). From an objective examination at admission: the condition is relatively satisfactory. BMI = 36.9 kg/m² (height 182 cm, body weight 122 kg). Skin integument of physiological color, moderate humidity. Pastosity of the legs and feet. Musculoskeletal system without signs of inflammation. Ripple on a. dorsalis pedis saved. Subcutaneous fat is overdeveloped with a predominant distribution in the abdomen. In the lungs, vesicular breathing, wheezing is not heard, NPV 18 per minute. Heart sounds are muffled, the rhythm is correct. BP 150/90 mmHg Heart rate 78 per minute. Tongue: wet, no plaque. The act of swallowing is not broken. Belly: symmetrical, rounded, not swollen. With superficial palpation, the abdomen is soft, painless. Deep palpation of the abdominal organs is difficult due to the excessive development of subcutaneous fat in the anterior abdominal wall. The symptom of striking is negative on both sides. The defecation is regular, formed. Urination is free, painless. According to the results of surveys conducted in the Department of Preventive and Rehabilitation Dietetics: a general analysis of blood and urine without deviations. According to the biochemical analysis of blood: total cholesterol - 5.6 μmol/l, LDL - 4.0 μmol/l, ALT - 48.8 U/l, AST -51 U/l, uric acid - 442 μmol/l, the rest are biochemical blood counts were within normal values. Ultrasound examination of the abdominal cavity revealed diffuse changes in the type of fatty hepatosis. On the ECG: sinus, correct rhythm, heart rate 78 beats / min. The normal position of the EOS. Without focal and diffuse changes. The patient underwent bio-impedancemetry on a multi-frequency analyzer "Medass". According to bioimpedansometry, a significant increase in body fat (47.2 kg) and muscle mass (39.9 kg) was found, as well as a slight increase in total fluid (47.2 kg) in the body, which

was noted in other studies [12]. Using the computer program-questionnaire "Analysis of the state of human nutrition", the patient assessed the actual nutrition at home, the results of which revealed excess consumption of fat (129% of the recommended norm of consumption - RNC), protein (127% RNC), cholesterol in at home (143% of RNP), which significantly exceeded the recommended norms [13]. Carbohydrate intake (108% RNC) was in line with the recommended diet, but dietary fiber intake was inadequate (59.5% RNC). Thus, the analysis of the actual nutrition of a patient with obesity and impaired purine metabolism (asymptomatic hyperuricemia) showed the presence of pronounced deviations in the intake of nutrients from the recommended norms, namely a high intake of fat, protein, cholesterol and insufficient dietary fiber intake.

Within 2 weeks, the patient in the Department of Preventive and Rehabilitation Dietetics received a variant of a standard diet with a reduced calorie content (on average 1600 kcal/day). Of the medications, the patient was prescribed Losartan 50 mg/day to reduce BP. Against the background of the treatment, an improvement in the general condition of the patient, a decrease in shortness of breath, and normalization of blood pressure (BP 120/80 mmHg) were noted. According to a biochemical analysis of blood: total cholesterol decreased to 4.3 $\mu\text{mol/L}$, LDL - to 2.4 $\mu\text{mol/L}$, ALT - to 29.0 IU/L, AST - to 34.2 IU/L, and also a slight decrease in uric acid 409 (by 7.6%) $\mu\text{mol/L}$. According to the results of bioimpedansometry, against the background of standard diet therapy with reduced calorie content, the patient showed a significant decrease in fat mass (by 4.5%), total fluid (by 3.8%), but a significant decrease in muscle mass was noted (by 4.0%)) After a 2-week course of standard diet therapy, the patient was studied resting energy expenditure and the rate of oxidation of proteins, fats, carbohydrates by indirect calorimetry using a stationary QuarkRMR metabolograph (COSMED, Italy). According to the results of studies (bioimpedansometry and indirect calorimetry), a personalized diet was developed for the patient (an average of 2200 kcal/day) with a modification of the protein component and a controlled content of fats and carbohydrates. Within 2 weeks, the patient in the Department of Preventive and Rehabilitation Dietetics received a variant of a standard diet with a reduced calorie content (on average 1600 kcal/day). Of the medications, the patient was prescribed Losartan 50 mg/day to reduce BP. Against the background of the treatment, an improvement in the general condition of the patient, a decrease in shortness of breath, and normalization of blood pressure (BP 120/80 mmHg) were noted. According to a biochemical analysis of blood: total cholesterol decreased to 4.3 mmol/L, LDL - to 2.4 mmol/L, ALT - to

29.0 IU/L, AST - to 34.2 IU/L, and also a slight decrease in uric acid 409 (by 7.6%) $\mu\text{mol/L}$. Modification of the protein component in a personalized diet was carried out not only in quantitative, but also in qualitative composition. Products of animal origin rich in purines (mainly beef) were limited in the diet due to an increase in the consumption of dairy products (cheese, cottage cheese, cottage cheese casserole, kefir). It was allowed to include in the diet poultry meat no more than 1 portion per day up to 3 times a week. From a personalized diet, offal (liver, tongue, kidneys), canned meat and fish, salted fish, as well as meat and fish broths were excluded. The use of foods with a moderate purine content was limited, namely legumes, sorrel, cauliflower, mushrooms, spinach. The need for carbohydrates was provided by products with a low energy value and low glycemic index. At the same time, the use of rapidly absorbed carbohydrates was completely excluded. After a 2-week course of personalized diet therapy, a significant decrease in fat mass (by 7.0%), total fluid (by 3.8%), and a slight decrease in muscle mass (by 1.4%) were observed in the patient according to the results of bioimpedansometry. Against the background of a personalized diet with a modification of the protein component, a significant decrease in the level of uric acid was observed by an average of 12.5% (up to 354 $\mu\text{mol/L}$).

Results

The use of a standard diet in a patient with obesity and hyperuricemia leads to a slight decrease in the level of uric acid in the blood serum and a significant decrease in muscle mass, and the use of a personalized diet with a modification of the protein component based on an individual determination of the energy expenditure of rest and metabolic substrates contributes to a significant decrease in the level of urinary serum acid and a slight decrease in muscle mass.

Conclusion

One of the main tasks of diet therapy for obesity and hyperuricemia is to reduce the level of uric acid in the blood serum of this category of patients. In addition to restricting the intake of purine-rich foods in the diet, it is important to consider endogenous factors contributing to an increase in uric acid levels in obese patients. Such factors include a pronounced decrease in body weight in a short period of time against the background of hypocaloric diets, which in turn leads to a decrease not only in fat mass, total fluid, but also in muscle mass. In this regard, the nutrition of patients with obesity and hyperuricemia should meet the following principles: ensuring a sufficient amount of protein against a background of a moderate decrease in caloric intake (minimizing muscle loss, improving tolerance

to caloric restriction); exclusion or restriction in the diet of foods high in purines. The main difference between this approach and nutritional approaches for gout is a less pronounced restriction on the consumption of quantitative and qualitative protein equivalents against the background of a moderate decrease in calorie intake. The level of protein intake is at least 18% of the total calorie intake. The restriction on the number of purines in the diet is less pronounced in comparison with the diet for gout and is 300 mg per day. In this case, personalization of rations should be carried out taking into account the whole range of diagnostic measures, including analysis of the patient's actual nutrition, analysis of the composition of the body (the amount of fat mass, muscle mass, total fluid); determination of resting energy expenditures with an assessment of the minimum protein requirement (rate of oxidation of protein, fats, carbohydrates).

Thus, limiting the total level of purine intake in patients with obesity and hyperuricemia contributes to a decrease in the level of uric acid in blood serum, which is confirmed by previous studies on the basis of Federal State Budgetary Institution Nutrition and Biotechnology. An important condition is the preservation of a sufficient, individually selected amount of protein to prevent loss of muscle mass while limiting the caloric intake of the diet. Modification of diet therapy can affect not only the level of hyperuricemia, but also the pathogenetic mechanisms of development and progression of complications associated with obesity.

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THE ROLE OF A SCREENING PROGRAM FOR THE DIAGNOSIS OF SKIN CANCER

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Abstract. In Russia, the leading localization in the overall structure of cancer incidence in men and women is skin. One task remains to detect skin cancer in the early stages, which allows to radically cure these diseases. Screening programs for detecting malignant tumors have been developed and are actively used. Our experience in recording and monitoring patients with skin cancer gives positive results.

Keywords: skin cancer, malignant neoplasms of the skin, screening programs, diagnostics, dermatoscopy.

Concern and increased attention to oncology are due to a steady trend in the incidence rate worldwide, which will continue to increase in the foreseeable future, due to a number of subjective and objective reasons - aging of the population, environmental, economic and other factors [1].

It is known that the prevalence of oncopathology among adults is directly related to age, the largest number is diagnosed in age groups 60 years and older [3].

Malignant neoplasms of the skin (MNS) in 2017–2018 occupied the first place in the structure of oncological morbidity in the Russian Federation and in terms of growth rates had leading positions along with malignant tumors of the lungs and mammary glands [1,2].

In Russia, the leading localization in the overall structure of cancer incidence in men and women was skin (12.6%). In the structure of the incidence of malignant tumors among the male population of Russia, skin cancer was in third place after tumors of the trachea, bronchi, lung and prostate gland and amounted to 10.3% in 2017 and 10.2% in 2018, and among women - in second place after tumors mammary gland and amounted to 14.6% in 2017 and 2018 [1,2].

The absolute number of diagnosed skin cancer for the first time in 2017 in Russia amounted to 77962 cases, among them 29108 in men and 48854 in women, in 2018 - 78,699 cases, among them 29149 in men and 49550 in women. The ratio of men and women is 1: 1.7 [1,2].

In Moscow, in 2017, 5198 cases of skin cancer were detected, including 1939 (37%) and 3259 (63%) in male and female patients, respectively), in 2018 - 5258 cases, in 1980 (32%) men and 3278 (68%) women [1,2].

One of the main tasks of modern medicine remains the detection of MNS in the early stages, which allows to radically cure these diseases. Given the social and medical significance of this pathology, it is necessary to pay attention to both prevention and measures aimed at early diagnosis of skin cancer [4].

The purpose of our work was to analyze the incidence of basal and / or squamous cell carcinoma of the skin (cipher according to the International Classification of Diseases X revision C44: C44.1-C44.9) in the medical institutions of the Office of the President of the Russian Federation (OP RF), which are a complex, organized on the principle of providing family care and the continuity of patient management (clinic-hospital-rehabilitation center-clinic).

For malignant neoplasms, OP RF has developed and actively uses screening programs for the early and timely diagnosis of tumors. Information about inpatients and about the examined population as a whole is concentrated on the basis of the OP RF cancer registry, the work of which is based on the principles of strictly individual accounting of all cancer patients and subsequent monitoring of their health with annual reflection of the results of the examination and treatment [5].

The study was conducted from 01.01.2017 to 12.31.2018 based on the data of the OP RF Cancer Register. Over the indicated period, the share of MNS in the structure of cancer amounted to 23.5%, which is 2 times higher than the data for Russia as a whole.

During the study, 525 skin cancer patients were identified, among them 292 (55.6%) men and 233 (44.4%) women. The ratio of men to women was 1.25: 1, which differs from the data for Russia as a whole and for Moscow (1: 1.7). The distribution of skin cancer patients by sex and age is shown in Fig. 1.

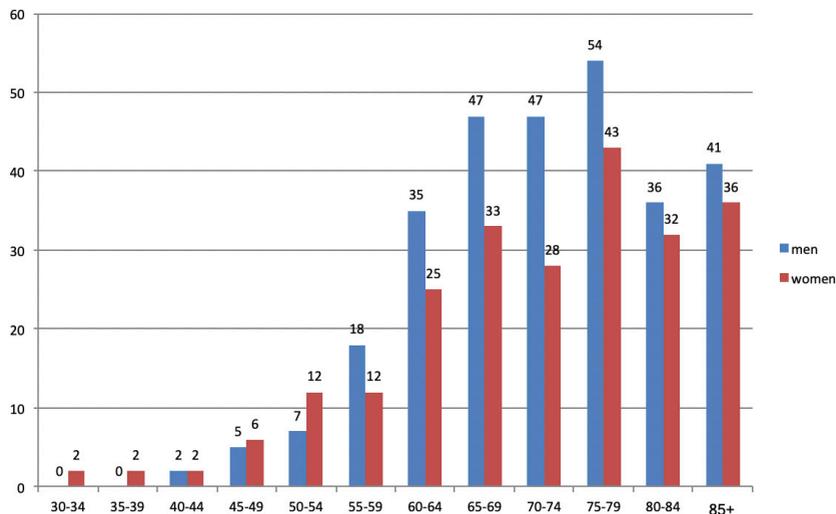


Fig. 1. Distribution of skin cancer patients by sex and age n=525 (abs.)

In 457 patients (87%), skin oncopathology was detected at the age of over 60 years. It is noteworthy that in almost all older age groups, MNS was more often diagnosed in men, which also differs from the data for Russia and Moscow, where skin oncopathology was more often detected in the female population [1,2].

The diagnosis of skin cancer was established on the basis of the clinical picture of the disease, the use of the method of dermatoscopy, a widely used non-invasive diagnostic technique for skin tumors, which allows examining the lesions with a ten- or more-fold increase. Given the predominant localization of MNS in open areas of the skin, in cosmetically significant areas, it is not always possible to conduct invasive diagnostic studies, in particular biopsies. In this connection, non-invasive diagnostic methods, allowing to suspect the development of tumors in a timely manner, acquire special relevance [6,7,9,10].

The diagnosis was verified using cytological and/or histological examination of the lesions.

The problem of cancer remains a priority for modern society. Research in the field of oncology is one of the most relevant and important problems of our time. An analysis of global and Russian trends in the incidence and mortality of malignant neoplasms shows that screening and early detection, timely and effective treatment are the main factors in reducing mortality. Screening is an effective way to diagnose preclinical cancer [3].

In addition, works on an increased risk of skin cancer and visceral oncopathology against cured skin cancer have been published [6,7].

Despite the fact that a number of foreign authors note the limited data on the benefits of skin cancer screening and the lack of direct evidence of a decrease in morbidity and mortality [9], our experience in recording and observing patients with skin cancer is giving positive results.

CONCLUSION: for the purpose of early diagnosis of repeated skin tumors, patients are shown an examination by a dermatologist:

1. In the presence of single foci of skin cancer 1 time in 3 months during the first two years of observation, then - 1 time per year.

2. After curing multiple foci of skin cancer, the frequency of examination should be 1 time in 3 months in the first 5 years, then 1 time in half a year for life. The examination of a dermatologist must be supplemented by non-invasive diagnostic methods: dermatoscopy, total mapping of the skin surface, and/or ultrasound examination.

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TREATMENT FOR LOCALIZED PROSTATE CANCER

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Abstract. In Russia, prostate cancer accounts for 5.0% of all malignant neoplasms in men, while prostate cancer (PC) is one of the most common. In the structure of diseases in a number of countries, PC goes to the 2nd-3rd place after lung and stomach cancer, and in the USA to the 1st place. The introduction into clinical practice of modern methods for diagnosing prostate cancer (PC) increases the likelihood that the disease will be revealed in the early stages when it is still possible to use radical methods of treatment.

Introduction

In Russia, prostate cancer (PC) accounts for 5.0% of all malignant neoplasms in men, and the increase in incidence from 1989 to 1999 was 60.2%, the growth rate was 31.4%. In the structure of diseases in a number of countries, PC goes to the 2nd-3rd place after lung and stomach cancer, and in the USA to the 1st place. However, mortality from PC among other oncological diseases takes the 2nd place after lung cancer. Despite the fact that PC is more common at the age of 70 years or more, in recent years there has been a tendency to increase the proportion of younger men in relation to the entire array of patients with PC. Information about the incidence of PC in younger men is contradictory and ranges from 3.5 to 8.2%. The introduction into clinical practice of modern methods of diagnosing prostate cancer (PC) increases the likelihood that the disease will be

detected in the early stages, when it is still possible to use radical methods of treatment. Unlike other malignant tumors, the clinical course and prognosis of prostate cancer is unfavorable, which indicates the need for not only more advanced treatment methods, but also effective approaches to the prevention of this disease.

In case of localized PC (T1-2), the following are used: expectant management, radiation therapy, surgical treatment. Expectant tactics are more often used in stage T1 (a tumor that cannot be clinically determined by chance during histological examination), in elderly patients with highly differentiated forms of tumors, which may be the so-called "Histological PC", which almost never develops into a "clinical" one. However, an active therapeutic approach, including the use of radiation therapy or surgery, is more common, since most urologists believe that radical prostatectomy is the best treatment for limited PC. This operation is advisable in cases where the life expectancy of the patient is at least 10 years.

Laparoscopic radical prostatectomy as a minimally invasive method is an alternative to open surgery. In recent years, the laparoscopic operation of radical prostatectomy is increasingly performed using the da Vinci robot, when the da Vinci S system provides three-dimensional visualization of the surgical field at the services of a "robotic" surgeon, increased functionality, expressed primarily in the unique freedom of movement of the manipulators, accuracy of manipulation and ergonomics. In the treatment of localized and locally advanced PCs, remote radiation and interstitial radiation therapy (brachytherapy) can also be used. Improving the methods of planning and technical support for radiation therapy led to the introduction of the so-called conformal exposure, which provides an exact match of the amount of exposure to the affected organ. These technological advances make it possible to use large doses of radiation (about 70 Gy) without increasing complications. Low-dose brachytherapy is the permanent implantation of palladium-103 or iodine-125 isotopes into the prostate gland. The treatment of disseminated prostate cancer has several features. The choice of treatment methods and their sequence depends on the stage of the disease, the general condition of the patient and the sensitivity of the tumor to a particular therapeutic effect. Prostate cancer is a hormone-dependent tumor; hormone therapy is the primary treatment for patients who cannot undergo radical treatment. Normal and malignant prostate cells are sensitive to androgens. Back in 1941, Huggins and Hodges first showed that castration and administration of estrogens can act on these cells. The essence of therapeutic measures for disseminated prostate cancer is to deprive PC cells of androgenic

stimulation. Another minimally invasive treatment that deserves attention is prostate cancer cryosurgery. It is also called cryodestruction. With this method, cancer cells are quickly frozen and thawed twice, which leads to their death. The method is most suitable for patients suffering from severe concomitant diseases of various organs and systems, the degree of operational risk for which, according to the classification of Schlegel, refers to III and IV. Some patients in this category have suprapubic urinary bladder fistula; the rest, sooner or later, must be applied due to the large amount of residual urine, frequent acute urinary retention, or increasing chronic renal failure. New generation technologies include **HIFU therapy** (HIFU: High Intensity Focused Ultrasound), which is an ablative ultrasound therapy for localized prostate cancer, uses the energy of ultrasonic vibrations to heat deeply lying tissues. In this case, adjacent healthy tissues are not affected. On the surface of the transducer (emitter), the ultrasound intensity is low and amounts to 5-8 W/cm², and in the focus area, i.e. in the tumor, it can reach a level above 2000 W/cm². This is enough to increase the temperature of the tissue in the focus area to 70-100 °C in less than one second and ablate the affected tissue. Indications for primary HIFU therapy: - the patient's life expectancy should be 5 years or more; - prostate cancer T1 - T2N0M0; - Gleason's score of 7 points or less; - without damage to the seminal vesicles and regional lymph nodes according to magnetic resonance imaging (MRI)); - without metastatic bone damage according to osteoscintigraphy (OSG); - prostate-specific antigen (PSA) should be up to 15 ng / ml; - absence of calcifications in the prostate larger than 1 cm; - ideally - prostate volume up to 40 cm³; If the size of the prostate pre they breathe permissible, in order to reduce the size of the gland, it is possible: - to conduct drug-mediated total androgen blockade for 3-6 months; - to combine HIFU therapy with TUR of the prostate (the so-called TUR-HIFU); Indications for salvage (rescue) HIFU therapy (second therapy line) - for the treatment of local relapse after unsuccessfully conducted radical treatment methods (radical prostatectomy, external radiation therapy, brachytherapy).

Clinical observation

Patient P., 72 years old. He entered the urology department with complaints of rapid, difficult urination, 3-4 times at night. From the anamnesis: he considers himself sick during the 1st year when he first began to notice a deterioration in urination. PSA– 11.2 ng/ml. An urodynamic study (uroflowmetry) and an IPSS questionnaire were conducted. The maximum urination rate (Qmax) is 11.4 ml/sec.; the sum of the IPSS points is 10. PG TRUS was made.



Figure. TRUS PG

TRUS from 02.10.12 PG volume - 32 cm³. The contours are clear, even. The shape is symmetrical. Echogenicity is not changed. The echotexture is heterogeneous due to the site: V - 10.71 cm³. Conclusion: Site of transitional echosons with cyst formation. Diffuse-heterogeneous changes in the structure of PG. Periurethral microcalcifications. In the study of microcirculation in PG, focal increase in blood flow in the left lobe of PG was noted (Figure).

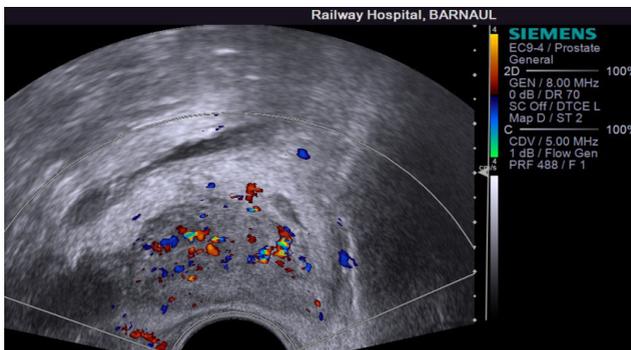


Figure TRUS in CDK mode

10.02.12 – microcirculation study in PG by LDF method.

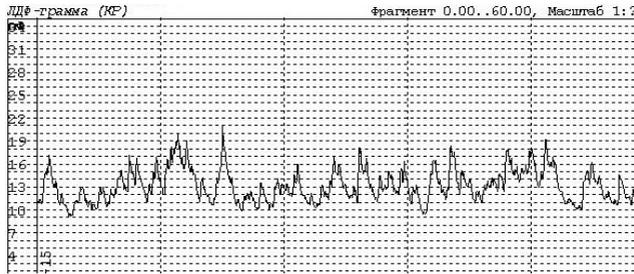
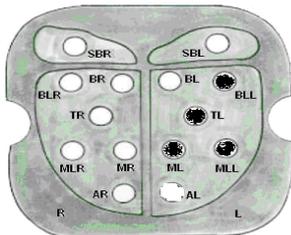


Figure LDF-gram of patient P., before treatment

In the study of microcirculation in PG by LDF, microcirculation characteristic of PC was noted. The main parameters of microcirculation were: microcirculation index (MI) - 5.8 perf. units; standard deviation (SD) - 2.6 perf.ed; coefficient of variation (CV) - 42.4%.

A PG transrectal biopsy was performed under the control of TRUS from 14 points.

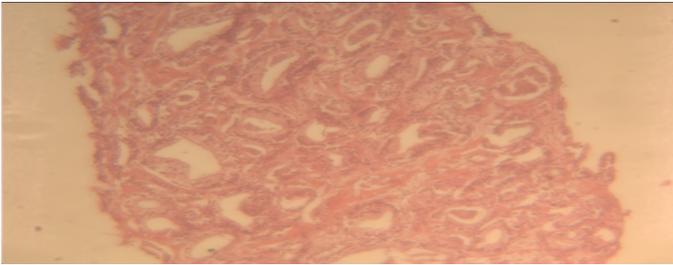
Figure Scheme of sampling biopsy material from PG



Areas with adenocarcinoma are highlighted in black

Pathological and histological examination № 123-11 of 02/14/12. - BLL (80%), TL (60%), ML (100%), MLL (80%) - acinar adenocarcinoma. According to Gleason - 6 points (3 + 3). In other biaptates - glandular-stromal hyperplasia.

The result of a PG biopsy showed a coincidence of the focal increase in blood flow in CDC with the area of malignant damage.



The result of a PG biopsy showed a coincidence of the focal increase in blood flow in CDC with the area of malignant damage

After discharge from the hospital, the patient underwent a comprehensive examination (ultrasound of the internal organs, MRI of the pelvic organs, osteoscintigraphy, chest x-ray). There is no data for generalization.

The patient is diagnosed with: **Prostate Cancer II, T2bN0M0. Concomitant pathology: CHD: angina pectoris III f.k. PEAKS (March 2008). Hypertension III, risk 4. Atherosclerosis of the aorta and its branches.** A bipolar transurethral resection of the prostate was performed. There were no complications. 1, after 3 days, a session of HIFU therapy was performed.



Figure HIFU procedure step: treatment of the left lobe of PG

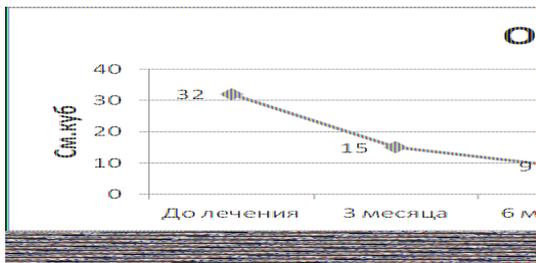
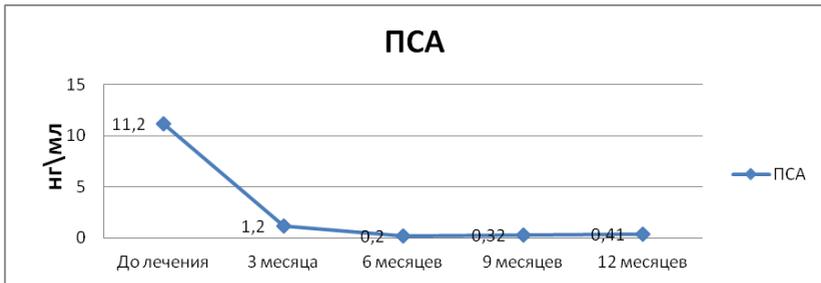


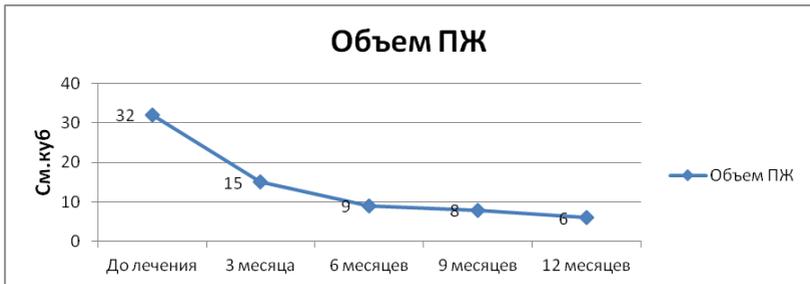
Figure HIFU procedure step: treatment of the right lobe of PG

The HIFU procedure time was 126 minutes. There were no early post-operative complications. In the postoperative period, patient received antibacterial therapy, anticoagulants, non-steroidal anti-inflammatory drugs (per rectum). The urethral catheter was removed on the 7th day. On the 8th day, the patient was discharged from the hospital.

The dynamics of PSA and PG volume are displayed in diagrams.

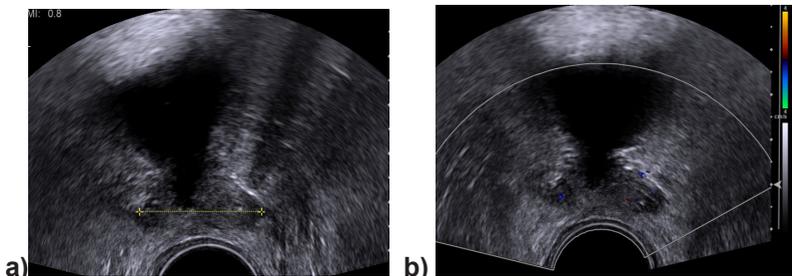


PSA dynamics diagram



PG volume dynamics diagram

There were no late complications and side effects. When assessing the symptoms of the lower urinary tract, a significant improvement in urination was noted 3 months after treatment. Uroflowmetry and IPSS questionnaires 1 year after treatment showed an increase in Qmax of 11.4 to 16.8 ml/s and a decrease in IPSS from 10 to 6.



**Figure. 12 months after HIFU. a). TRUS in B mode;
b) TRUS in CDK mode**

12 months after HIFU, the PG volume is 6 cm³. The heterogeneity of the echostructure due to areas of reduced echogenicity is noted. The prostatic section of the urethra is expanded to 8 mm., over 15 mm. With CDC, vascularization is sharply reduced. There are sites of calcification of peripheral tissues. These ultrasound changes are characteristic of the effect of focused ultrasound on PG tissue.

The study of microcirculation in PG by the LDF method showed a sharp decrease in microcirculation parameters and a decrease in microcirculation.

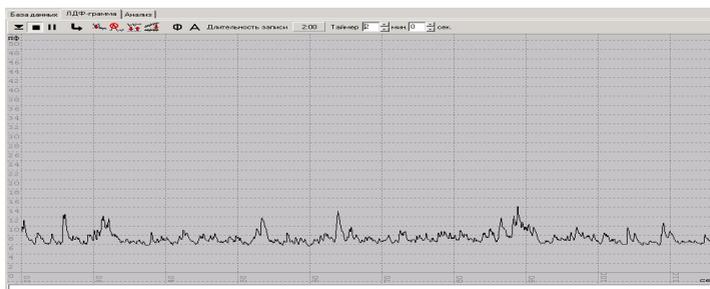
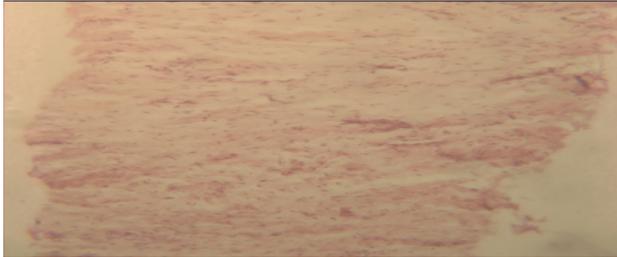


Figure. LDF-gram of patient P., 12 months after treatment

Twelve months after HIFU therapy, a PG transrectal biopsy was performed under control of TRUS from 12 points. In a morphological study, all biopsy specimens were represented by fibrous tissue with small areas of glandular hyperplasia.



Picture. Biopsy of PG after 12 months: fibrosis. Hematoxylin-eosin stain. Magnification x 100

This clinical observation demonstrates the efficacy and safety of HIFU therapy for localized PC in a patient who is not subject to radical treatment.

Conclusion

In the XXI century, prostate cancer has become one of the main culprits for the death of men from malignant tumors. According to experts of the World Health Organization, the total number of cancer cases in the world in 2007 amounted to 9.2 million people. Of these, prostate cancer - 460 thousand, 6.2 million died from malignant neoplasms, including 235 thousand from malignant neoplasms of the prostate. Leading oncologists of our country tell about risk facts, mechanisms of prostate tumor development, early diagnosis of this dangerous disease. Despite the variety of options and methods, the results of PC treatment are still not encouraging. In this regard, the search for ways to increase the effectiveness of PC therapy continues. An integrated approach is fundamental in the treatment of both localized and common forms of prostate cancer. We emphasize the relevance of conducting annual preventive examinations of men aged 45 years and older in order to detect prostate neoplasms. A digital rectal or transrectal ultrasound examination of the gland with the determination of the concentration of the prostatic antigen in the blood will reveal a number of patients at the preclinical stage of the disease, when the effectiveness of treatment methods is many times higher than at the clinical, late stage of the tumor process. The implementation of such a program will contribute to improving the quality of health of the male population of our country.

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THE ROLE OF ORGANIZED FATTY TISSUE IN THE FORMATION OF GERD AND HH IN PATIENTS WITH MORBID OBESITY

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Abstract. Over the past decade, there has been an increase in the incidence of gastroesophageal reflux disease (GERD) throughout the world and in Russia, which reduces the quality of life and leads to the development of complicated forms of the disease, such as Barrett's esophagus (BE) and esophageal adenocarcinoma (EA). GERD is a leader in the United States in treatment costs among other gastroenterological diseases. According to international statistics, the prevalence of GERD in the USA is 21–27% of the population, in Japan about 16%, in Asian countries 2–10% [1.3]. In Russia, two large multicenter epidemiological studies of the prevalence of GERD were conducted: MEGRE (Multicenter Study “Epidemiology of Gastroesophageal Reflux Disease in Russia”) and ARIADNA (Analysis of the prevalence of heartburn: a national epidemiological study of the adult urban population), according to which the prevalence of GERD was about 24% [2, 4].

Introduction

Obesity is a disease that globally covers the whole world. According to WHO, more than 1.9 billion adults aged 18 years and older are overweight, of which over 600 million are obese. Epidemiological evidence suggests that overall, obesity is a risk factor for both GERD and EA. A statistically significant increase in the risk of developing GERD, BE, and EA symptoms in obese patients was shown by a meta-analysis [5]. According to data from the US National Health and Nutrition Survey, in 2011–2014 the prevalence of adult obesity was 36.5% [9]. Cross-sectional epidemiological studies show a higher prevalence of GERD among obese patients compared with healthy volunteers. Small studies also confirm the link between obesity and GERD. In a study conducted by El-Serag et al, 453 clinic staff were interviewed and weekly symptoms of heartburn or regurgitation were detected in 26% of respondents. [7, 8]. Upper endoscopy was performed in 196 patients who agreed to the study, as a result, the proportion of patients with GERD symptoms was 23.3%, 26.7% and 50% for their respective groups with BMI <25 kg/m², BMI - 25-30 kg/m² and BMI> 30 kg/m², respectively. The presence of a fatty organized substrate of various sizes (FOS) in the gastroesophageal junction (GEJ) is largely a universal pathogenetic link in the formation of gastroesophageal reflux disease (GERD) and hiatal hernia (HH). In modern medical publications, the frequency and possible significance of lipomas of the gastroesophageal transition in patients is poorly explored. The role of lipomas formed after operations for hernia recurrence, dysphagia, or GERD recurrence is not indicated.

The purpose of the study was to analyze recent GERD, HH surgeries and the role of GFR in the formation of the latter in overweight patients.

Materials and methods

The study included 14 patients aged 32-70 years in the period 2017-2019 with diagnosed hiatal hernias and accompanied by gastroesophageal reflux disease due to overweight and morbid obesity (BMI 40 and above). All patients underwent standard preoperative diagnostic measures (complaints collection, examination, clinical minimum, EGD, esophageal manometry with InSIGHT G3 Sandhill Scientific (manufactured in the USA), EUS with Pentax EB-1970UK combined with Hitachi Prerius ultrasound and esophageal fluoroscopy in the Trendelenburg position).

According to the survey, all patients had clinical signs of GERD, manifested by dysphagia in 26%, heartburn 56%, cardiac syndrome 5% and bronchial syndrome 3%, according to the SF-36 questionnaire.

The endoscopic criteria for GERD 1 - 2 according to the Los Angeles classification without the effect of treatment with proton pump preparations amounted to 100%.

According to esophageal manometry, 100% of patients had functional disorders of the lower esophageal sphincter, manifested by its functional failure.

The pressure of the lower esophageal sphincter (LES), the average amplitude of the peristaltic wave in the distal esophagus and the ineffective motility of the esophagus were evaluated, the data are presented in table № 1.

Table № 1 - Esophagomanometry Results

Esophagomanometry parameters	Before surgery	After surgery	P
Rest pressure of LES, mmHg. (N8-25)	6,0±1,15	8,25±1,7	p>0,05
The average amplitude of the peristaltic wave of the esophagus (N30-180 mmHg.)	32,65±3,5	39,35±2,8	p>0,05
Ineffective motility of the esophagus (% of the number of patients)	60%	30%	

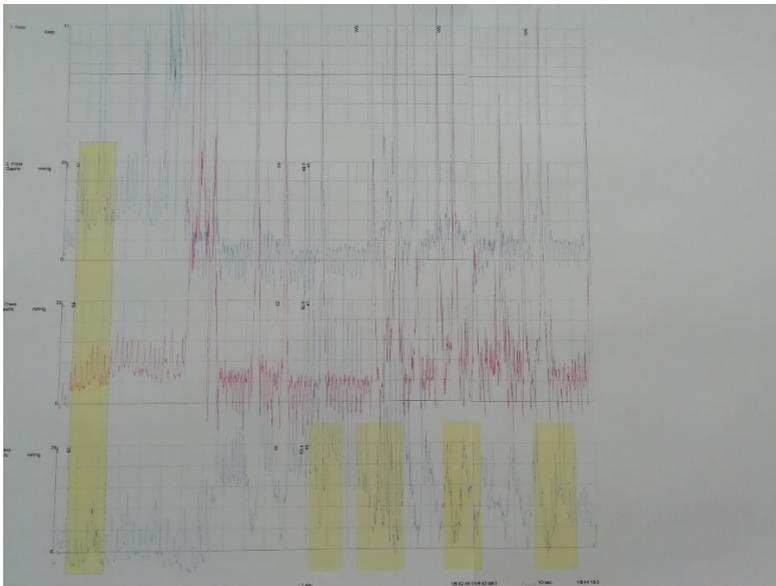


Figure 1: Manometry of a patient with GERD on the background of morbid obesity before surgical treatment

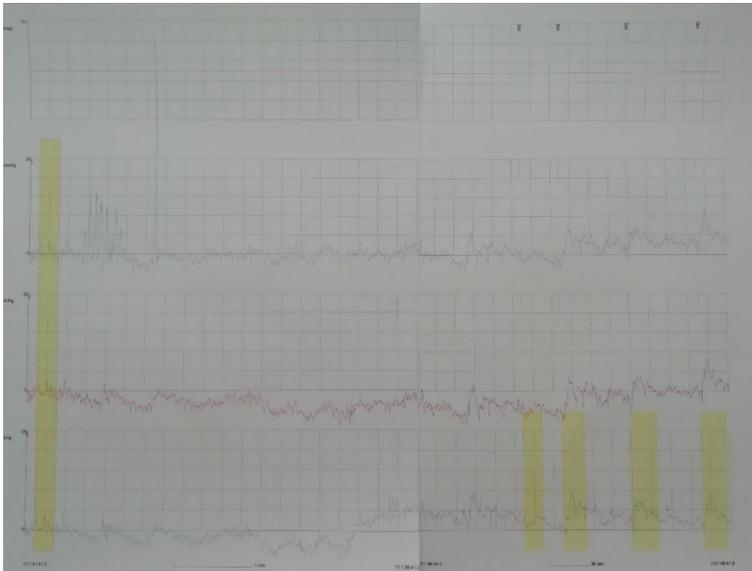


Figure 2: manometry of a patient with GERD on the background of morbid obesity after surgical treatment

According to fluoroscopy in the Trendelenburg position in all patients, one of the forms of HH of the 2nd to 3rd degree was revealed.

During ESU, in the posterior mediastinum, at the level of the gastroesophageal junction, hypoechoic, avascular formations were revealed that were similar in structure to the fat component ranging in size from 22x25 mm to 50x55 mm, having clear contours that were not dislocated during a respiratory test (Figure 3)

All patients underwent surgical treatment in the amount of: laparoscopic mobilization of the esophagus at the level of the diaphragmatic legs, removal of an organized fatty substrate of various sizes in the posterior mediastinum, curoraffia, Nissen fundoplication.

Results. After 6 months, all patients underwent a control ESU in order to evaluate the effectiveness of surgical interventions. GERD endoscopic criteria, endosonographic criteria for the consistency of the legs of the diaphragm, and the absence of an organized fatty substrate of various sizes were evaluated (Fig. 4)

All patients lacked endoscopic GERD criteria. Endosonographically, the formation in the projection of the gastroesophageal transition, as well as the clinical manifestations of dysphagia, heartburn, cardiac syndrome, were not found. (Fig 5)



Figure 3: Endosonography of an organized fatty substrate in the projection of the legs of the diaphragm



Figure 4: Endosonography: lack of organized fatty substrate in the projection of the legs of the diaphragm



Figure 5: Endoscopic picture in NBI mode in patients, 6 months after surgery

In parallel, during the entire observation period, all patients underwent examination, treatment and observation with a nutritionist in order to correct body weight. Weight loss on average ranged from 12 to 47 kg over a period of 18 months.

Conclusions

Thus, the presence of a fatty organized substrate of various sizes of GFP in the gastroesophageal compound GEJ in patients with morbid obesity is the main pathogenetic link of GERD and HH, along with the theory of increasing intra-abdominal pressure. Removal of the fatty substrate in combination with crura-fusion and fundoplication leads to a complete relief of the GERD phenomenon in patients with morbid obesity and overweight.

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**GENETIC DETERMINANTS OF ATRIAL FIBRILLATION ON THE
BACKGROUND OF ARTERIAL HYPERTENSION IN COMBINATION
WITH EXTRACARDIAL DISEASES**

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Abstract

Purpose. To study the polymorphism rs1378942 of the CSK gene and 174G / C (rs1800795) of the IL6 gene in patients with atrial fibrillation on the background of arterial hypertension in combination with various extracardial pathologies. **Methods.** A prospective cohort study included 167 patients with paroxysmal and persistent forms of AF and stage II GB without IHD. The average age of the studied patients was 53.3±7.1 years. DNA was isolated from blood leukocytes by phenol-chloroform extraction. Testing the rs1378942 polymorphism in the CSK gene, the -174G/C polymorphism (rs1800795) of the IL6 gene was performed by PCR with RFLP. Statistical hypotheses were tested at a critical significance level of $p = 0.05$, i.e. the difference was considered statistically significant at $p < 0.05$. The lower limit of the evidence power was taken equal to 80%. **Results.** This study shows the association of rs1378942 polymorphisms of the CSK gene, rs1800795 of the IL6 gene with atrial fibrillation in the presence of concomitant diseases: arterial hypertension, chronic obstructive pulmonary disease, hypothyroidism, type 2 diabetes mellitus, and abdominal obesity. Associations of rs1378942 and rs1800795 polymorphisms with a risk of recurrence of atrial fibrillation against the background of certain concomitant diseases were also found. In addition, associations were identified: rs1378942 with glucose levels, HDL cholesterol, triglycerides, GFR, creatinine, systolic and diastolic blood pressure, left atrial wall thickness. **Conclusion.** The paper contributes to the study of such a complex phenomenon as the secondary form of atrial fibrillation, contributes to

the accumulation of knowledge, approximating the time when therapeutic interventions will be individualized, based on an understanding of the characteristics of the pathological process in each patient.

Keywords: Atrial fibrillation, polymorphism, SNP, rs1378942 CSK gene, rs1800795 IL6

Introduction

Atrial fibrillation (AF) is the most common persistent arrhythmia, especially in elderly patients. At a young age (under 50), this arrhythmia occurs in 1 in 1000 people. Currently, AF is registered in 1 out of 25 people 60 years of age and older and in 1 out of 10 - in the age group over 80 years [1]. Over the past 20 years, there has been a twofold increase in the incidence of AF among the male population, and the hospitalization of patients with AF has increased by 66%. The reasons for this growth are ambiguous and not quite clear, among the possible reasons are considered: an increase in the proportion of elderly people, an improvement in the diagnosis of AF at the outpatient stage, an increase in the number of survivors after acute myocardial infarction (MI), etc. [2]. It is important that the tendency to increase the frequency of AF does not disappear, and moreover, the tendency to progression increases. The term "AF progression" is understood as the process of the steady development of the paroxysmal form of AF in the direction of the chronic form [3]. It is estimated that 2.2 million US residents had a paroxysmal or persistent form of AF, which over the course of 5 years turned into chronic in 67% of patients. In Europe, with a population of about 513 million people, 8.2 million patients with AF are registered, the risk of AF progression is 1:4 for men and women aged 40 years and older. It is predicted that the number of people with this arrhythmia in the United States will increase from 2.5 million in the early 2000s. up to 15 million in 2050 [4].

Today, there are many clinical studies devoted to the study of risk factors for AF, including the main factor - AH, which contributes to ventricular hypertrophy and atrial dystrophy. However, AF progression is not given sufficient attention [5]. Abdominal obesity (AO) is a frequent risk factor for hypertension and contributes to structural and functional myocardial rearrangements, known as the "lipotoxicity phenomenon". Lipotoxicity involves the accumulation of blood plasma triglycerides in the myocardium and leads to myocardial steatosis. Thus, with obesity, cardiac cavity dilatation is formed. Therefore, both AH and AO contribute to myocardial dysfunction, the development of electrical instability and the appearance of AF, and with irrational management of patients and progression to a chronic form [6].

As new discoveries in the field of genetics, the group of idiopathic AF becomes smaller each time. There are known forms of AF with mutations in many genes — familial polygenic atrial fibrillation [7].

Hereditary AF can be an independent nosological unit, or can accompany canalopathies, such as long or shortened QT interval syndrome, Brugada syndrome and catecholaminergic polymorphic ventricular tachycardia. In addition, AF can be associated with structural genetic cardiomyopathies such as family dilated cardiomyopathy, hypertrophic cardiomyopathy, idiopathic restrictive cardiomyopathy, arrhythmogenic right ventricular dysplasia, and also with unclassified diseases (non-compact cardiomyopathy, fibrolast).

The association of CSK gene rs1378942 polymorphism with blood pressure was first shown by Newton-Cheh C. et al in 2009 when analyzing the results of a large international GWAS study [9,10]. In 2010, it was confirmed in Korea [10]. But due to the fact that there are significant geographical differences in the allelic frequencies of SNPs associated with CVD, studies in ethnic groups are required to confirm previously found associations [12]. In seven studies of hypertension (16,368 cases/19,707 control) performed in East Asia, no significant association with hypertension was found.

Purpose of the study

To study the polymorphism rs1378942 of the CSK gene and 174G/C (rs1800795) of the IL6 gene in patients with atrial fibrillation on the background of arterial hypertension in combination with various extracardial pathologies.

Methods and materials

A prospective cohort study included 161 patients. Inclusion criteria: age 45–65 years, stage III hypertension (ESH / ESC, 2013, 2018), atrial fibrillation, paroxysmal or persistent form (RKO, VNOA and ASCX, Moscow, 2017) and one of the following diseases: sugar type 2 diabetes (EASD / ESC, 2017), subclinical hypothyroidism (ETA, 2013), abdominal obesity (AACE / ACE, 2014), chronic obstructive pulmonary disease (ERS, 2017). All patients signed an informed consent to participate in the study. The study was approved by the local ethics committee of FSBEI HE NGMU (Minutes No147 of May 18, 2017). Clinical, anthropometric and laboratory indicators were evaluated, the results of instrumental diagnostics: ECG; XM ECG, SMAD using the daily monitoring system SCHILLER (Schiller, Switzerland), EchoCG in M and 2D modes on a Vivid 7 apparatus (General Electric, USA). The level of galectin-3 was determined in blood serum by enzyme-linked immunosorbent assay using a set of "Hu-

man Galectin-3 ELISA kit; eBioscience" (Bender MedSystems GmbH, Austria), the minimum concentration of determination is 0.12 ng.m. The concentration of NT-proBNP was determined using the NTproBNP - ELISA - Best reagent kit. CRP (C-reactive protein) was determined by ELISA using the ELISA test system (Biomerica), USA. DNA was isolated from blood leukocytes by phenol-chloroform extraction [Smith K., 1990]. Testing the rs1378942 polymorphism in the CSK gene, the -174G/C polymorphism (rs1800795) of the IL6 gene was performed using PCR with RFLP according to previously published methods. Statistical analysis. Empirical data distributions were tested in accordance with the law of normal distribution according to the criteria of Shapiro-Wilk and Shapiro-Francia. Due to the small number of indicators corresponding to the normal distribution in the study groups for comparison, the nonparametric Mann-Whitney and Kraskell Wallis criteria were used. To compare binary and categorical indicators, Fisher's exact two-sided criterion was used. Statistical hypotheses were tested at a critical significance level of $p=0.05$, i.e. the difference was considered statistically significant if $p<0.05$. The lower limit of the evidence power was taken equal to 80%. All statistical calculations were carried out in the program Rstudio (version 0.99.879 – © 2009-2016 RStudio, Inc., USA, 250 Northern Ave, Boston, MA 02210 844-448-121, info@rstudio.com)

Results and discussion

At the first stage, the frequencies and genotypes and alleles of the CSK gene rs1378942 polymorphism were analyzed in groups of patients with various concomitant diseases: atrial fibrillation in patients with arterial hypertension (AH/AF), atrial fibrillation in patients with arterial hypertension and chronic obstructive pulmonary disease (COPD), atrial fibrillation in patients with arterial hypertension and hypothyroidism, atrial fibrillation in patients with arterial hypertension and type 2 diabetes mellitus (DM), atrial fibrillation in patients with hypertension and abdominal obesity (AO). Significant differences in the frequencies of the rs1378942 genes of the CSK gene were obtained between groups with COPD and diabetes ($p < 0.001$). The odds ratio for finding a carrier of the AA genotype in the group with diabetes is significantly higher compared to the group with COPD (72% vs 13.3; $p < 0.001$). There are also differences in the frequencies of the rs1378942 genotypes between groups with diabetes and with AO ($p < 0.001$), with diabetes and with hypertension ($p = 0.001$), with diabetes and with hypertension/AF ($p = 0.001$). Carriage of the C allele was least likely to occur in the group with diabetes, and the A allele, on the

contrary, was more common in this group than in all other groups. What is the reason for this difference in the frequencies of genotypes and alleles between groups with abdominal obesity and diabetes mellitus remains unclear. But according to Chinese researchers, rs1378942 is associated with hypertension in children with obesity, while there is no such association in the group without obesity [12]. In the study group, the highest frequency of the C allele was recorded in patients with AO and COPD.

During the observation period, relapses in AF were recorded in some patients. When comparing the frequencies of the rs1378942 genotypes and alleles, significant differences were found in patients with and without relapses of AF ($p=0.023$ and $p=0.006$, respectively). The relative risk of AF recurrence in carriers of allele c is 1.94 times higher than in carriers of allele a (95% CI 1.21-3.09). Carrier of the AA genotype is a conditionally protective factor in relation to the development of AF recurrence (RR 0.41; 95% CI 0.21-0.80; $p=0.010$). Relapses of AF occurred at different rates in groups with different concomitant diseases: the largest proportion of patients without relapse of AF was in groups with hypertension and diabetes (about 50%), while in groups with COPD and hypothyroidism, there was no relapse of AF only in every third patient (about 33%), and against the background of abdominal obesity, only 3 out of 33 patients did not have recurrence of AF (9.1%). When analyzing the frequency of the CSK gene polymorphism rs1378942 genotype polymorphisms in groups of patients with AF against various concomitant diseases with and without relapses, significant changes were found: the frequency of the AA genotype in the group with hypothyroidism does not differ in individuals with and without relapse, although in the general group this genotype was regarded as protective against the development of recurrence of AF.

Against the background of various concomitant diseases, significant changes in the frequencies of genotypes were found: the frequency of the AA genotype was 11% in hospitalized patients with COPD and 83.3% with diabetes. The relative risk of hospitalization during the year turned out to be less in patients with diabetes carriers of heterozygous AS genotype compared with carriers of two other genotypes (RR = 0.09; 95% CI 0.01-0.86 $p=0.041$).

The lowest average values of these indicators were recorded in carriers of the AA genotype, compared with carriers of two other genotypes, including systolic blood pressure (Figure 1). That is, the association of this SNP with AD, shown by Newton-Cheh C. et al in 2009 and confirmed later in other studies [13] on different ethnic groups, was also con-

firmed in the studied group of patients with hypertension and AF (without gender separation, age, concomitant diseases and other factors). When comparing the level of the studied parameters in carriers of the homozygous genotype AA with the combined group of carriers of the AS and SS genotypes (carriers of the C allele), a significant decrease in HDL cholesterol, creatinine, diastolic blood pressure and an increase in TG were found.

In the course of a large meta-analysis including more than ten GWAS (genome wide association research - or GWAS) of different ethnicity, associations of polymorphisms with a number of phenotypic characters were found: high density lipoproteins, triglycerides, and blood pressure. Some of the identified loci were found to be common to all traits, some lie in the extragenic spaces, some are in genes encoding proteins, which were not previously known to be involved in the biological pathway for the formation of this trait. One of the SNPs included in the analysis was rs1378942. It turned out to be associated only with DBP, the risk allele - C [14]. At the same time, in the present study, this polymorphism was associated with a number of features. That is, rs1378942 can be considered as a marker candidate for inclusion in the respective risk meters. The found associations with phenotypic traits expand the idea of the possible mechanisms for the effect of substitution in the nucleotide chain on the phenotype. GWAS have successfully identified new and unexpected genetic loci common to diseases and traits. Since information in the form of genotypes is fixed with minimal variability, it is useful in predicting risk at an early age. However, these options explain only a small fraction of the observed variance of these characters. Therefore, the usefulness of genetic determinants in assessing risk at later stages of life has limited direct clinical impact. Probably, the future use of genetic screening will consist in the formation of risk groups at an early age for targeted preventive measures [15]. The task of reducing the genetically determined increased risk of developing the disease can be difficult to solve. So, in England, they assessed the effect on BP of the inclusion of fish oil in the diet of healthy individuals. It turned out that a significant effect in the form of a decrease in SBP and DBP was only in carriers of the AA rs1378942 genotype. The carriers of the risk allele (C) did not have a significant effect from the inclusion of fish oil in the diet [16].

When assessing the frequency of genotypes and alleles of the -174G / C polymorphism (rs1800795) of the IL6 gene in patients with concomitant diseases, significant differences in the frequencies of the IL6 gene rs1800795 genotypes between groups with diabetes and hypertension

were obtained ($p=0.047$). The ratio of the chances of finding a carrier of the SS genotype in the group with diabetes is much less than in the group with hypertension (5.6% vs 27.0; $p=0.024$). There are also differences in the frequency of the rs1800795 SS genotype between groups with diabetes and with hypothyroidism ($p = 0.025$), with diabetes and with AO ($p = 0.020$). No significant increase in the frequency of the C allele in the group with COPD was obtained. Although Volchkova E.A. et al. (2015), testing the hypothesis that the development of AF in patients with COPD is directly related to the inflammation system, found an association with rs1800795. Factors associated with AF were: the volume of the left atrium ($p=0.027$), the volume of the right atrium ($p=0.021$) and the carriage of the C allele of the polymorphic marker G (-174) C of the IL-6 gene ($p=0.003$).

When comparing the frequencies of the rs1800795 genotypes and alleles of the IL6 gene in patients with recurrence of AF and without it, no significant differences were found. Perhaps this is due to the relatively small size of the study group. Earlier, a number of authors showed the association of rs2200733 and rs1800795 polymorphisms with postoperative atrial fibrillation. The IL-6 protein is produced by endothelial cells, vascular smooth muscle cells, and myocytes during ischemia. Its level is associated with AF in coronary disease, after cardiac surgery, cardioversion and catheter ablation [17].

When analyzing the frequencies of the genotypes of rs1800795 polymorphism of the IL6 gene in groups of patients with AF against various concomitant diseases with relapse of AF and without it, their significant fluctuations were found: the frequency of the SS genotype is higher in patients with relapse of AF in groups with hypothyroidism and with hypertension, in the group with COPD - lower, and in the group with diabetes it is the same in patients with recurrence of AF and without it. In the group with hypothyroidism, recurrence of AF significantly less frequently developed in carriers of the CG genotype, $p=0.030$.

Significant differences in the level of HDL cholesterol, creatinine, and diastolic blood pressure were obtained, revealed by comparing the average values of a number of indicators in groups of carriers of different genotypes of rs1800795 polymorphism of the IL6 gene using the Kruskal-Wallis test. When comparing the level of the studied parameters in carriers of the genotype SS with the combined group of carriers of the genotypes CG and GG, the significance of the differences is preserved. In carriers of the SS genotype, the level of galectin-3 was significantly higher than in carriers of two other genotypes, $p=0.022$.

Conclusion

The secondary form of atrial fibrillation as a multifactorial disease develops under the influence of many factors, both the external environment and hereditary nature. The complexity of the etiopathogenesis of the disease poses an extremely difficult task for researchers to search for factors that play a leading role in the development of the pathological process. This study shows the association of rs1378942 polymorphisms of the CSK gene, rs1800795 of the IL6 gene and with atrial fibrillation in the presence of concomitant diseases: arterial hypertension, chronic obstructive pulmonary disease, hypothyroidism, type 2 diabetes mellitus, and abdominal obesity. Associations of rs1378942 and rs1800795 polymorphisms with a risk of recurrence of atrial fibrillation in patients with diabetes, hypertension, AO and COPD were also found. In addition, associations were identified: rs1378942 with glucose, HDL cholesterol, TG, GFR, creatinine, systolic and diastolic blood pressure, left atrial wall thickness, and rs1800795 with HDL cholesterol, creatinine, diastolic blood pressure, galectin-3. In this regard, further, larger studies are needed, involving other institutions and increasing the sample of patients, which will make it possible to predict the progression of atrial fibrillation with the determination of additional molecular criteria for assessing the effectiveness of pathogenetic therapy and targeted treatment options. In addition, associations were identified: rs1378942 with glucose, HDL cholesterol, TG, GFR, creatinine, systolic and diastolic blood pressure, left atrial wall thickness, and rs1800795 with HDL cholesterol, creatinine, diastolic blood pressure, galectin-3. In this regard, further, larger studies are needed, involving other institutions and increasing the sample of patients, which will make it possible to predict the progression of atrial fibrillation with the determination of additional molecular criteria for assessing the effectiveness of pathogenetic therapy and targeted treatment options.

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MICROBIOLOGICAL CHARACTERISTICS OF THE ORAL CAVITY AFTER EXPOSURE OF VARIOUS FILLING MATERIALS

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Resume. In dental practice, different types of filling materials are used, but their side effect on the microbiological status of the oral cavity gives different indicators. The degree of quality of the filling material, the varying degree of adhesion of microorganisms, the formation of plaque on the restoration surface is closely related to the raw materials of the filling materials.

Key words: filling materials, composites, cements, amalgams, oral cavity, microbiocenosis.

To date, the dental market has a huge selection of filling materials. However, the question of the interaction of these materials with the microflora of the oral cavity, as well as its effect on these materials, remains practically unstudied. In this regard, the problem of adhesion of microorganisms of the oral cavity to various structural materials used in dental practice is urgent, since the high contamination of these materials can reduce the effectiveness of local anti-inflammatory therapy, and cause relapses of caries and inflammatory diseases of the oral cavity.

It has been proven that many composites have a high bacteriostatic character, while *S.mutants* growth rates are definitely reduced. In recent years, scientific studies have proven that modern caries-causing composites reduce the adhesive property of microbes. The change in the adhesive ability of the microflora of the oral cavity is associated with the type of raw material of the filling [2,4].

Working on the problem of bacterial contamination of various filling materials (cement, amalgams, macro - and microfilled composite materials), it has been found that there is a definite tendency of tooth plaque formation depending on the type of filling material. A more massive plaque was formed

using cement and amalgam, a smaller one was using macro-filled, and a minimal one was formed using hybrid and micro-filled composite materials. When analyzing the frequency of occurrence of strains of various types of bacteria, it was established that anaerobic streptococci, *P.anaerobius*, *S.intermedius* (32%), dominate on amalgam fillings. Anaerobic actinomycetes are found 1.5 times less common, *A.naeslundii*, *A.viscosus*, *A.israeli* (20%). Anaerobic and facultative anaerobic bacteria - 10%. When using cements as filling material in the oral cavity, anaerobic actinomycetes predominated - *A.naeslundii*, *A.viscosus*, *A.israeli* (18%), while the rate of anaerobic cocci excretion was slightly lower (12%). A rather high frequency of occurrence of fusobacteria (11%) and microaerophilic streptococci (12%) is noteworthy. Strains of other types of bacteria were single. When using macro-filled composite materials, a clear frequency shift was observed towards the coccal flora. So anaerobic streptococci were found in 28%, and microaerophilic in 18%. Less commonly observed were anaerobic actinomycetes - 16%, and fusobacteria - 10% [4,6,9,13].

Although PMMA has been commonly utilized in the fabrication of removable denture bases, a number of polymeric materials, such as high-density polyethylene (HDPE), polyamide (PA), and poly (L-lactide) (PLLA), have been studied for their prosthodontic applications. Furthermore, polystyrene polyvinyl acrylic and light-activated UDMA have also been used in the construction of denture bases. These materials must be durable and strong enough to withstand masticatory forces, particularly for patients with parafunctional habits. However, none of these polymers provides the unique combination of physical and aesthetic properties exhibited by PMMA. Thus, PMMA remained a main component of denture base polymer for many years because it is hard, rigid, and easy to repair and can be color-matched to the patient's teeth and gum tissue [11].

The maximum load that dental fillings teeth can be carried without premature wear depends upon the radii of curvature of tooth profiles, young modulus and roughness limits of specimens. Toughness results play an important role to resist fracture while hardness has an acting effect such as resistance to wear rate as well as wear coefficient, scratching and deformation [12].

In a study by several authors, a wide range of microorganisms was isolated from the oral cavity of caries patients: *S.sanguis*, *S.milleri*, *S.downei*, *S.salivarius*, *S.mutans* and fungi - *C.albicans*. When studying the adhesive activity of the isolated strains for chemical filling materials ("Prism") and light curing ("Unirest"), the degree of adhesion to composite filling materials is different for different types of microorganisms inhabiting the oral cav-

ity. As a result of an invitro experiment, it was found that the most resistant composite filling materials to the adhesion of cariogenic microflora of the oral cavity is the light curing material "Unirest" [1,3,13].

The colonization of *S.mutans* and *S.oralis* on the surface of the "Evikrol" macro-filled composite material was studied. A study of the surface of the dental material before and after the colonization of *S.mutans* and *S.oralis* revealed that microbial colonization after 30 days leads to a significant increase in the roughness of "Evikrol". This helps to fix microorganisms on the surface of the filling and favors their accumulation, due to which plaque is formed [5,7].

It was also proved the antimicrobial effect and physicommechanical properties of the new composite material "Restavrin" enriched with the antiseptic chlorhexidine acetate, to justify the optimal concentration of the administered antiseptic and the possibility of using it to reduce the risk of secondary caries [4].

For the first time it was established that the composite material "Restavrin" with 0.5% and 5.0% CHG has a significant antibacterial effect on microorganisms. Data were obtained on the local antimicrobial effect of CHG added to the composition of the composite filling material. It has been established that due to weak diffusion from the composition of the CHG filling material, the "Restavrin" composite material has a local antibacterial effect and, therefore, it does not inhibit the normal microflora of the oral cavity. This allows its wide use in clinical practice in the treatment of caries of the chewing group of teeth, primary teeth and for temporary restorations of any groups of teeth [1,4,9].

The effect of the composition of the organic matrix and the fullness of composite filling materials on the adhesive activity of the microflora of the oral cavity. For the first time, adhesion of cariogenic and periodontopathogenic oral microorganisms on Estelite composites was studied. "Estelite" (82.0%) and "Estelite Flow Qtiick" (74.0%) have the least ability to 7 adhere and accumulate cariogenic and periodontal pathogens on their surface. Materials "Estelite LV Low Flow", "Estelite LV High Flow" with 65.0% and 68.0% content, respectively, showed a significantly higher frequency of detection and accumulation of cariogenic and periodontopathogenic microorganisms on their surface. The material containing the UDMA organic matrix revealed the lowest rates of occurrence and colonization of cariogenic and periodontopathogenic oral microflora [2,5,13].

When studying the effect of composite photocurable filling materials with and without fluorine on the growth of fungal and bacterial flora of the oral cavity, it was found that the presented (Charisma, Latelux, Stomazit

LS, Herculite, Acryloxide) filling materials have an effect on the growth of microorganisms. The lowest sensitivity to the used filling materials among the test microorganisms was observed in *Pseudomonas aeruginosa*. The growth retardation zone of this microorganism was noted in the samples of the material "Acryloxide", "Latelux" - 10.22 ± 2.49 and 8.78 ± 2.17 mm, respectively. Sensitivity to other materials of this microorganism was not observed, and growth retardation zones corresponded only to disk diameters of $6 \text{ mm} \pm 0 \text{ mm}$. The zone of growth retardation of strains of *Staphylococcus aureus*, *Escherichia coli*, *Candida albicans* on all the studied materials is the same and does not exceed a diameter of 10-15 mm, which indicates a low sensitivity of the bacteria to the studied filling materials. Analyzing the research data, we note that the most pronounced bacteriostatic effect against opportunistic microorganisms living in the human oral cavity has the reference material "Acryloxide" [1,9,10].

According to a number of authors [1, 4, 11], the data obtained make it possible to predict possible complications when using filling material with high adhesion rates of cariogenic and periodontopathogenic microorganisms in patients with obvious disorders of the oral microbiocenosis.

The information obtained will contribute to an individual approach to the treatment of dental caries, a rational choice of filling material, taking into account the microbial landscape of the oral cavity. Therefore, when choosing a material for certain interventions, it is necessary to take into account the degree of adhesive ability of the resident microflora of the oral cavity to dental materials. To date, the dentist has no practical recommendations on the use of this or that material in patients with various forms of diseases of the oral cavity.

To date, the study of this direction in dentistry is relevant and once again proves that it is necessary to conduct further scientific research on the effect of filling materials of various groups on the microbiological and immunological state of the oral cavity.

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BONE INTEGRATION WITH CONTAMINATED DENTAL IMPLANT SURFACE: AN EXPERIMENTAL STUDY ON RABBITS

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Abstract.

The aim of the present study was to assess the clinical efficacy of implant surface debridement protocols using the rabbit tibia model.

Material and Method: There were ten rabbits under the study. To every rabbit under general anesthesia were implanted two Megagen implants (AnyOne)..The site of implantation in every case was rabbit tibia. All implants in the study before the surgery were intentionally contaminated with peri-odontopathogenic microflora and kept for 48 hours in KittTarotstsi media.

The quality of implant osseointegration was being assessed with the help of ISQ test (Megagen, OSSTELL technology) and TORQUE GAUGE (Tohnichi, Japan) for the assessment of removal torque (RT) in 30 days after implantation.

Results: Results of the study have demonstrated, that in both groups of implants the level of osseointegration was high enough to withstand loading. ISQ in the 1st group was -77.2 ± 2.58 in the 2nd – -78.7 ± 3.16 ; RT in the 1st group – -86.5 ± 24.5 in the 2nd group – -85.0 ± 32.83 . Statistical analysis demonstrated no any significant difference between two study groups.

Conclusion. The successful integration of infected implant is not only dependent on treatment modality which is used. Host individual response plays inevitable role on the outcome of experiment. That is why further studies should be made to discover the mechanism of bone healing around contaminated dental implants.

Key Words: Osteointegration, dental implants, peri-implantitis, bacterial contamination, doxycycline hydrochloride, Vector® Paro / Scaler

Introduction. Osseointegrated implants have been demonstrating predictable and reliable results in patients with partial and full edentulism. Despite the long-term success shown by many longitudinal studies the failure in some clinical cases is inevitable.[1, 2, 4]

In order to speed up osseointegration of contemporary dental implants the second generation of them was introduced into surgical practice. New implants unlike the first generation with machined surface have advanced surface ultrastructural characteristics the main purpose of which was to retain the blood clot and to stimulate more intimate bone healing around them.[5, 17]

In accordance with many studies, late dental implant loss may happen in up to 10-15% of cases and marginal bone loss associated with partial exposure of roughened implant surface is the one main problem of advanced peri-implant disease to be resolved.[9, 18, 12, 20]

Usually, the etiologic factors of peri-implant disease development and advancement are the same as in periodontitis: improper hygiene, excessive occlusal load, parafunctional habits, smoking, thin gingival biotype, absence of attached gingival band and etc. In case of dental implantation, disparities between the sizes of implant and recipient site or quality of bone and implant design may also be contributing to pathology evolution.[7, 13]

In any case, bacterial contamination of exposed implant surfaces is unavoidable and changes in physiology of surrounding dental implant hard and soft tissues are imminent.[3, 10, 21, 19]

Therefore, the rate of successful treatment of peri-implantitis is mainly dependent on two goals; quality of implant surface decontamination and proper management of adjacent soft and hard tissues. In spite of many studies indicating on satisfactory therapy outcomes of complications of dental implantation, it is still not clear which of two goals could play a major role and lead to restoration of lost attachment.[6, 11, 14]

It could be noteworthy, that bacterial load in peri-implant and periodontal inflammatory conditions is similar, and one of the paradigm of contemporary periodontology says that tissue healing can occur in the presence of residual calculus.[8, 15, 16, 22]

There are many publications which offer “guidelines” on how to manage the peri-implant inflammatory cases and much of them based on the results of in vitro studies.

The **aim** of the present experimental study was to assess the reaction of sound bone and soft connective tissues on implantation of contaminated titanium implant treated with clinically available methods.

Material and Methods

There were ten rabbits under the study. To every rabbit under general anesthesia were implanted two Megagen implants (AnyOne). All implants were of equal size (4.5/7.0). The site of implantation in every case was rabbit tibia. All implants (n=20) in the study before the surgery were intentionally contaminated with periodontopathogenic microflora and kept for 48 hours in KittTarotstsi media (**Fig. 1**). In respect to surface treatment modality implants were divided into two groups: in the 1st group (n=10) decontamination was performed with the help of chlorhexidine solution (0.05%), freshly prepared doxycycline hydrochloride solution and gauze for removal of extrinsic debris; in the 2nd group (n=10) cleaning was made ultrasonically (c, DÜrrDental) which was alternated with chlorhexidine and doxycycline hydrochloride solutions rinsing.

The quality of implant osseointegration was being assessed with the help of ISQ test (Megagen, OSSTELL technology) and TORQUE GAUGE (Tohnichi, Japan) for the assessment of removal torque (RT) in 30 days after implantation. Results were statistically processed using the software package Statistica 6.1. A probability value of $P < 0.05$ was considered statistically significant.



Fig. 1. Implants in KittTarotstsi media



Fig. 2a. Implant Stability Quotient (ISQ)



Fig. 2b. Removal Torque (RT)

Results and discussion. The present experimental study has demonstrated, that in both groups of implants the level of osseointegration was high enough to withstand loading. The average ISQ value in the 1st group of implants was 77.2 ± 2.58 and in the 2nd – 78.7 ± 3.16 . As to the RT assessments, the average value in the 1st group was 86.5 ± 24.5 and in the 2nd group – 85.0 ± 32.83 . Statistical analysis demonstrated no any significant difference between two study groups.

Considering the limitations of this experimental study, it was revealed, that the success rate of proper integration of infected implant is not the only matter of treatment modality which is applied. Host individual response and physiologic status of a recipient site can play an important role in the outcome of treatment.

It is clear, that used treatment modalities could not kill every germ in the site and it would be of great value first of all to assess microbiologically the effectiveness of applied decontamination protocols for infected implants in both study groups.

However, the main purpose of this research was to assess the initial response of sound connective tissues on implantation of not sterile dental implant and obtained results were indicating on the important influence of it.

Conclusion. The successful integration of infected implant is not only dependent on treatment modality which is used. Host individual response plays inevitable role on the outcome of experiment. That is why further studies should be made to discover the mechanism of bone healing around contaminated dental implants.

Competing interests

The authors declare that they have no competing interests.

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EFFECT OF RESIN COMPOSITE PREHEATING ON TOOTH RESTORATION: AN EXPERIMENTAL STUDY

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Abstract.

Introduction: Numerous studies have demonstrated that preheating and sonic vibration of traditional composites decreases their viscosity and therefore the need of flowable resins application can be excluded.

The aim of this study was to evaluate experimentally the effectiveness of preheating and sonic vibration on micro-leakage of fillings made of packable composites.

Material and methods: There were 30 noncarious premolars on the proximal surfaces of which artificial cavities of similar size were created. Mesial cavities were indicated for filling with Filtek P60 (3M, ESPE) and for distal cavities P-Fill (Megadenta, Germany) was used. All cavities (n=60) were divided into 6 subgroups with 10 cavities in each to be restored. Cavities of the subgroups 1M and 1D were filled with a room temperature (24-26 ° C) composite materials Filtek P60 and P-Fill; in the subgroups 2M and 2D utilized composite materials were preheated up to 55 ° C before application; in the subgroups 3M and 3D same preheated materials were placed and adapted to cavity walls with the help of sonic vibration (Compothixo, KERR, ~ 140 Hz). After completion of filling procedures, all tooth samples were subjected to standardized thermocycling with following immersion in a methylene blue solution for 24 hours. Prepared tooth samples were cut through the center of composite filling longitudinally and assessed for

dye penetration. The depth of dye micro-leakage was calculated in values from 0 to 4 in accordance with conventional method. Statistical analysis for identification of differences between groups was performed with ANOVA and Tukey's post-hoc tests; Mann-Whitney U-test was used to identify differences in subgroups.

Results: Analysis of the results of micro-leakage study revealed that the mean value of the 1M subgroup was significantly better in 2.6 times ($p < 0.05$) than in 1D subgroup and made up 0.8 ± 0.82 versus 2.1 ± 0.63 . In the subgroups 2M and 2D, as well as in 3M and 3D, where average micro-leakage rates were 1.0 ± 0.96 versus 1.2 ± 0.88 and 0.6 ± 0.62 versus 1.0 ± 1.12 , no significant differences were revealed.

Conclusion: preheating of P-Fill resin composite and sonic method of its application may contribute to the formation of a significantly smaller marginal gap between filling and tooth dentin. As to the packable Filtek P60, it was found that composite preheating in conjunction with sonic vibration may cause the better adaptation of material and reduce the depth of dye penetration at a dentin-resin interface. In cases, when only preheating of Filtek P60 composite was used, the rate of micro-leakage, on the contrary, was slightly more pronounced.

Key words: packable composite material, viscosity, preheating, sonic vibration, micro-leakage.

Introduction

Resin composite restoration is one of the most popular types of dental services for the patients. High performance, aesthetics and relative reliability are considered to be its proper characteristic features (1,2). However, despite the constant growth of innovative developments in the field of polymer chemistry, the main disadvantages of modern composite materials are still polymerization shrinkage and which are the key factors of marginal gap formation (3, 4).

In order to eliminate these shortcomings, the flowable composites as another evolutionary level of dental resins were introduced into the practice. The distinctive feature of flowable resins is a capacity of easy adaptation to the walls of the cavity and low polymerization stress. However, due to the low content of the inorganic filler, this type of materials has a low rate of wear resistance, which, in turn, is unacceptable for posterior group of teeth (5-8).

It is known that dental composites are viscoelastic systems, which are able to change their physical properties and become more fluid under the influence of high temperatures. Several studies had demonstrated that

thickness of microhybrid composite layer significantly decreased by approximately 30% when filling material was heated up to 54 ° C (9-12).

Thus, it may be excluded that preheated universal or packable composite can be used as an alternative to low viscosity resins and technical compromise related to reduced filler content in flowables would rather be eliminated.

However, the other studies were indicating on a rapid cooling of preheated composite when being placed into the prepared cavity and adapted to its walls. In this regard, some composite materials got even more rigidity, which, on the contrary, led to the manipulation difficulties with them (13, 14).

Taking into account the latter circumstances for the usage of highly viscous composites a sonic vibration of filling material was introduced. The effectiveness of a novel method of resin adaptation largely depends on its thixotropic properties (15).

Thus, the aim of this study was to assess in experiment the efficacy of preheating and sonic vibration on composite restoration.

Material and methods.

There were 30 noncarious premolars extracted for orthodontic indications purposes and used in the study. On the proximal surfaces (mesial - M and distal - D) of each tooth sample there were cavities of similar size and configuration (3 mm in diameter, 1 mm deep) which were artificially created. Mesial cavities were indicated for filling with Filtek P60 (3M, ESPE) and for distal cavities P-Fill (Megadenta, Germany) was used.

All cavities (n=60) were divided into 6 subgroups with 10 cavities in each to be restored. Cavities of the subgroups 1M and 1D were filled with a room temperature (24-26 ° C) composite materials Filtek P60 and P-Fill; in the subgroups 2M and 2D utilized composite materials were preheated up to 55 ° C before application; in the subgroups 3M and 3D same preheated materials were placed and adapted to cavity walls with the help of sonic vibration (Compothixo, KERR, ~ 140 Hz).

Etching of dentin in the study was made with FineEtch 37 etching gel (SPIDENT, Korea), adhesion protocol was performed with the help of Peak Universal adhesive system (Ultradent Inc, USA), for curing of material Bluephase 20i LED lamp (Ivoclar, Vivadent) in "High" mode was used. After completion of filling procedures, all tooth samples were subjected to standardized thermocycling with following immersion in a methylene blue solution for 24 hours. Prepared tooth samples were cut through the center of composite filling longitudinally and assessed for dye penetration. The depth of dye micro-leakage was calculated in values from 0 to 4 in accord-

ance with conventional method.

Statistical analysis for identification of differences between groups was performed with ANOVA and Tukey's post-hoc tests; Mann-Whitney U-test was used to identify differences in subgroups.

The results of the study.

Analysis of the results of micro-leakage study revealed that the mean value of the 1M subgroup was significantly better in 2.6 times ($p < 0.05$) than in 1D subgroup and made up 0.8 ± 0.82 versus 2.1 ± 0.63 . In the subgroups 2M and 2D, as well as in 3M and 3D, where the average micro-leakage rates were 1.0 ± 0.96 versus 1.2 ± 0.88 and 0.6 ± 0.62 versus 1.0 ± 1.12 , no significant differences were revealed.

It was also noted that preheating of P-Fill composite material or sonic application of it may contribute to the formation of a significantly smaller marginal gap between filling and dentin of a tooth.

As to the packable composite Filtek P60, it was found that preheating in combination with sonic vibration in time of material adaptation had become the reason of reduced dye penetration along a dentin-material interface, while in the subgroup where the viscosity of material was decreased with only preheating, the micro-leakage rate was, on the contrary, slightly more pronounced.

Discussion

Currently, the micro-leakage problem of composite restorations is still relevant. The solution of this serious problem depends on the consideration of a large number of factors, among which are type and size of the polymer of organic matrix (16), the size and shape of inorganic filler, the principle of photo-activation of polymerization process, and many others.

In order to improve the quality of resin adaptation to the cavity walls, methods of preheating and sonic vibration of composite materials with high values of viscosity have gained great popularity. However, taking into account the analysis of the results of a large number of studies, the choice between two methods should have a scientifically based approach.

In this study, due to the selected protocol, it was possible to evaluate the behavior of two composite materials (Filtek P60 and P-Fill) on one tooth specimen placing them into cavity in preheated condition and with assistance of sonic vibration.

Composite materials Filtek P60 and P-Fill fall under category of packable or condensable, which have approximately the same average filler particle size ($0.6 \mu\text{m}$ for FiltekP60 and $0.7 \mu\text{m}$ for P-Fill), but different polymer shrinkage parameters (1.6% for FiltekP60 and 2.4 % for P-Fill), which is associated with a difference in qualitative and quantitative compositions

of polymer matrices of two composites.

A great proportion of TEGDMA (short-chain polymer) in organic matrix of P-Fill may certainly be responsible for having a large polymer shrinkage, but in the same time it softens filling material. Hence, in accordance with the results of this experimental study, preheating of P-Fill can be effective in terms of filling micro-leakage.

As to the Filtek P60, the amount of TEGDMA in organic matrix of this composite is reduced by UDMA and BIS-EMA, which are long-chain polymers. In this regard, in time of placement and adaptation of preheated material into cavity, the warm composite was cooling down and its stiffness was increasing more rapidly, which in turn could become an obstacle for quality adaptation of resin. Therefore, in case of Filtek P60, the use of sonic vibration may be the most effective method for material manipulation.

Thus, taking into account the results of the study, the following conclusions can be drawn: heating of the composite material can be effective for polymers with a high TEGDMA content; for composite materials in which the TEGDMA content is compensated by other, long-chain polymers, the sonic vibration should be in priority.

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**METHOD OF CHEMICAL MUTAGENESIS INTEGRATED WITH THE
METHOD OF REMOTE HYBRIDISATION IN CREATING OF THE
COMPLEXES OF THE VALUABLE TRAITS IN THE SOFT WINTER
WHEAT**

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Abstract. An analysis is made of the genetic structure of the constant initial variety of soft winter wheat of the Wheat-bluegrass hybrid (WBH) 186 and its role in chemical mutagenesis with an analysis of the possible reasons for the high mutability of this variety. Rare complexes of valuable chemomutant signs were received. The high combining ability of chemomutants was used when crossing them with non-mutant varieties. An increase in the efficiency of selection has been achieved. New valuable varieties were created by chemical mutagenesis in integration with methods of distant hybridization and traditional selection.

Keywords: chemical mutagenesis. Integration with remote hybridization. New complexes of valuable signs.

In the process of studying the laws of the method of chemical mutagenesis, a high frequency of chemomutations was obtained, including selection valuable ones. With different methods of accounting for the frequency of mutational changes, the results were as follows: 50% or more of families

carrying mutations and more than 100% of mutations in relation to all analyzed families; up to 15% of plants carrying mutations in relation to all analyzed plants [1,2,3,4]. The mutagenic activity of the ethyleneimine supermutagen (EI) is higher compared to ionizing radiation, for example, gamma rays more than 10 times. The frequency of mutations in the latter case is 1.5–2% of mutant plants in relation to all analyzed plants [1,2,4]. A wide variety of chemomutant characters phenotypic and genotypic was obtained. This corresponds to the number of mutant plant types, which is more than 50, including morphological, physiological, functional changes that were observed visually, or with special methods of accounting [4,5,6,7]. This variety includes complexes of [4,5,15] chemomutant valuable traits, including those that are difficult to obtain outside the method of chemical mutagenesis, and in some cases it is impossible. All this was obtained in the variants with the chemical supermutagen ethyleneimine (EI) at the lowest of the studied doses of 0.01 - 0.04 volume percent when exposed for 24 hours on the original cultivar WBH 186 when treating air-dried seeds [1,2,3,4,8]. In these variants, exclusively chemomutant characters arise, characterized by mild externally morphological visually observed mutational changes without disturbances in the nuclear apparatus of the cell [2,3,4,8] (Fig. 1) and only by gene mutations.

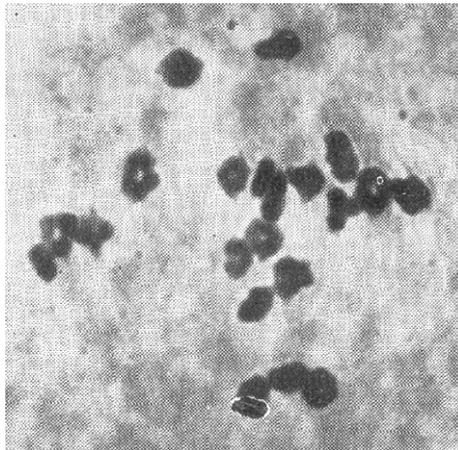


Fig. 1. The first metaphase of meiosis is normal, which is typical for chemomutants with gene mutations obtained using the low-dose chemical mutagen ethyleneimine (EI). 21 bivalents of the closed type

The question is whether anything is dominant in this triad: mutagen - dose - the original variety presented above, or all the components of this combination are equally important in achieving high efficiency of the mutagen. To try to answer this question, we first increased the dose (concentration) of mutagen at the same exposure for 24 hours.

With an increase in dose to 0.05 - 0.08% at the same total mutation frequency that was at low doses, the spectrum of chemomutations changed, to which sharp changes in visible externally-morphological characters were added. So-called, according to Mac-Key [9] terminology, "sharp" mutants with a sharp change in the appearance of externally-morphological characters associated with violations of the nuclear apparatus of the cell [8, 10, 11] with a decrease in the number of selection-valuable traits that, in contrast from the action of EI in low doses, we were not always able to use in breeding.

When studying the effect of the highest of the studied doses (concentrations) of EI - 0.09 - 0.12%, a rather high level of the total mutation frequency is observed [8, 10]. It is close to the level corresponding to low and medium doses of EI, but includes only 4 - 5 types of mutational changes [4]. The mutation spectrum here is especially narrow and consists solely of "sharp" mutants that are characterized by disturbances in the nuclear apparatus of the cell [4, 8, 11] in the absence of selection-valuable traits that could be used at the moment in selection. According to a narrow spectrum of mutational changes corresponding to high doses, EI approaches the densely ionizing hard radiation of fast neutrons. We believe that in these doses EI has a radiomimetic effect [8, 10, 11]. By the effect of different doses of EI, we can judge its specificity.

When replacing EI with other supermutagens at optimal doses and when replacing the original WBH 186 variety with other varieties, the mutation frequency decreases, and the spectrum of mutational variability narrows compared to the action of EI in optimally low doses on WBH 186 variety.

Thus, in all respects - a high frequency of mutations, including economically valuable ones, and a wide variety of mutations - the most effective EI is in the range of the lowest of the studied doses in the original cultivar WBH186.

How can one explain such a high mutability of this variety? We assume that the role is played by the fact that the genome of the original constant variety WBH 186 contains some amount of bluegrass genetic material. Obviously, it is small, since the phenotype of WBH 186 is completely wheat. Some signs of bluegrass were observed: an increase in the intensity of wax plaque compared with *Lutestens* 329, which was crossed with the bluegrass *Agropyron glaucum* and was originally the ancestor of WBH 186. WBH 186 has higher winter hardiness [12] and technological properties

compared to the variety Lutestens 329.

The assumption of the presence of the bluegrass genetic material in the WBH 186 genome is also associated with some deviations of normal meiosis. In some cases, an open type heteromorphic bivalent was found [13] in the first metaphase of meiosis. One of the chromosomes of the heteromorphic bivalent is much shorter than the other. It looks like a telocentric and may have come from bluegrass. In part of cases, the chromosomes of this bivalent prematurely diverge to the poles in the first ana-telophase of meiosis [13]. Moreover, in dyads and tetrads it is observed the micro core [13]. The latter does not lead to a decrease in viability, fertility and constancy. Variety WBH 186 is characterized by high viability, well-grained and constant [14].

The assumption of the presence of bluegrass genetic material in the genome of the WBH 186 variety is confirmed by the fact that in the first, second, and subsequent generations after treatment of the seeds of this variety with a mutagen, bluegrass phenotype plants sometimes cleave [11].

All three positions for WBH 186 variety presented above: a) the presence of some phenotypic signs of bluegrass, b) the presence of deviation in meiosis, c) the elimination of bluegrass plants after treatment of seeds of the WBH 186 variety with mutagen - all this confirms the possibility of assumption the presence in genome of WBH 186 bluegrass genetic material. It is also possible to assume that all three of these WBH 186 positions are related to its high mutability. The reason for it may consist in the increased heterozygosity of the variety due to the presence of bluegrass genetic material in the genome of the variety WBH 186, or, conversely, in hemizygosity in the absence of the corresponding allele. The latter may be the reason for the greater openness of the corresponding chromosome for the action of the mutagen. It should be noted that in the unsharp mutants obtained under the action of the lowest doses of EI, meiosis disturbances occurring in the original WBH 186 variety [13] in the form of a heteromorphic bivalent with premature chromosome divergence of this bivalent [13] were not detected. Apparently, these disorders were cleared, or meiosis under the action of a mutagen was restored, as a result of which chromosome conjugation occurs without deviations (Fig. 1).

Analyzing the characteristics of the chemomutants of our collection in the part that corresponds to the lowest doses of EI, we found that all mutants in this dose range have economically promising signs. Among them, complexes of valuable signs are observed, including those difficult to combine [4.15]. The complexes of such signs characterize both mutants and constant hybrids obtained by crossing the best collection mutants with va-

rieties, including non-mutant origin. Among the latter, constant hybrids of the 3rd, 4th, 5th generations obtained from the crossbreeding of chemo mutants with high combining ability with varieties Mironovskaya 808 and Kavkaz, which also have good combining ability, are most distinguished. The latter is especially characteristic of the Mironovskaya 808 variety, the complexes of valuable traits in the hybrid material of which are the most diverse, complete and numerous. Apparently, this was the reason that among chemomutant varieties, varieties of hybrid origin are more common. Among them, the varieties obtained by hybridization of chemomutants with the cultivar Mironovskaya 808 prevail. Selective valuable samples were identified that gave rise to chemomutant varieties: Rapoport, Solnechnaya (included in the State Register of Selection Achievements Approved for Use in the Central Region of Russia), variety Metel (passes State tests). New valuable promising samples are being prepared for transfer to the State Testing. With the participation in hybridization with chemo mutants of the Caucasus variety, Bulava variety (in the State Register of selection achievements approved for use in the East Kazakhstan region) and Bodryy (in the State Register of selection achievements in the central region of Russia) were created.

Without participation in hybridization, immediately after propagation of the corresponding chemomutants, the varieties Sibirskaya Niva (in the State Register for the West Siberian Region of Russia) and the Stavropol Forage were obtained.

Most of the chemomutant varieties and breeding valuable samples were created by crossing chemomutants with varieties of non-mutant origin - Mironovskaya 808 and the Caucasus with a predominance of variety Mironovskaya 808. These are varieties of mutant-hybrid origin. In second place are varieties directly of mutant origin. Their number is smaller in comparison with mutant-hybrid varieties. The reason, obviously, is the difference in the complexes of valuable traits in these two groups of varieties, as discussed above.

Complexes of valuable signs in mutants and hybrids in hybrid progeny after crosses consist in the fact that several valuable signs are combined in the same form or in the same variety and new traits may appear. It was possible to concentrate in one variety or in one form such rarely combined signs as high stable yield + high adaptive properties (Fig. 2) + good and excellent technological properties (including high food baking qualities (Fig. 3) [15]) + resistance to phytopathogens. This complex may be expanded or may be incomplete. However, stable productivity, food quality, high adaptive properties often accompany each other.



Fig. 2. Excellent wintering chemomutant variety soft winter Rapoport wheat

Moscow region, Podolsky district. Year 1998, extremely unfavorable: conditions for wintering, getting wet, aging, development of snow mold, ice crusts. Low agricultural background. a) On the left is a chemomutant Rapoport variety, 95% of overwintered plants, yield 46.7 c / ha. b) On the right (through the gap) the non-mutant variety Inna, standard, 95% plant death after winter, harvest 0.

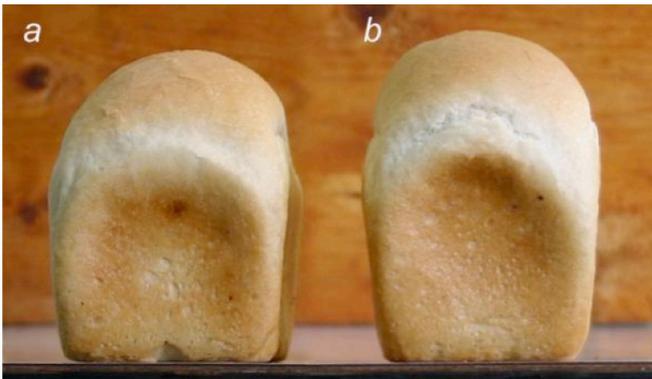


Fig. 3. Bakery properties of the chemomutant variety of soft winter wheat Solnechnaya

a) Left: a loaf of non-mutant standard variety Moskovskaya 39. Volume 690 cm³. Bakery score 4.2 points (good). b) Right: the chemomutant variety Solnechnaya. Volume 710 cm³. Bakery score 4.7 points (excellent).

We are interested in chemomutant varieties and samples that most fully and vividly display complexes of economically promising traits. One example is a group of varieties with high food properties, which are combined with high stable yields, high adaptive properties, and in some cases with resistance or tolerance to certain phytopathogens.

In addition, this group of varieties is characterized by some other properties that increase their value, for example, stability in the manifestation of high food properties. This stability is manifested in the preservation of food properties under different conditions: for a long period of time; at different agricultural backgrounds (Fig. 4); under different climatic conditions [16]; against the background of high yields [15]; preservation of food properties and their increase during storage of grain; when stopped standing, lodging in conditions of high humidity [16], a different number of sunny days.

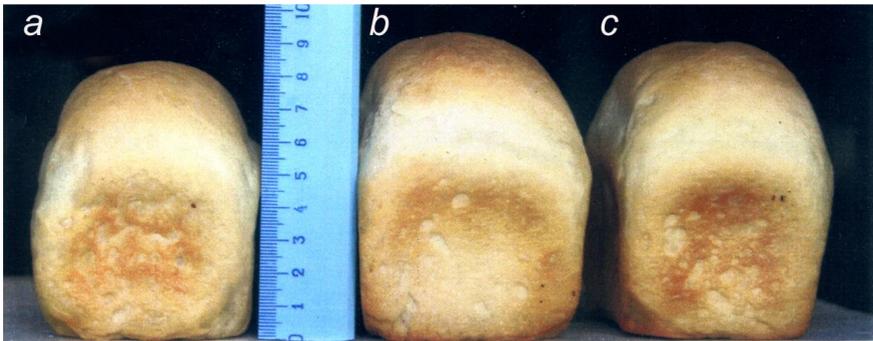


Fig. 4. Bakery properties of the chemomutant Rapoport variety on different agricultural backgrounds

a) Agricultural background of the experimental field. Non-mutant variety Moskovskaya 39 (standard). Volume 510 cm³. Bakery score of 3.7 points (quite satisfactory), filler. b) Agricultural background of the experimental field. Volume 690 cm³, baking score 4.6 points (excellent), food quality. c) The agricultural background is extremely low, the occurrence of groundwater is close to the surface of the soil. A chemomutant Rapoport variety. Volume 540 cm³. Bakery score 4.2 points (good), preservation of food quality.

All these characteristics of food properties in chemomutant varieties and samples are observed as stable for 20-30 years, in contrast to varieties created only by traditional methods. The latter have a dependence on the above conditions and a lack of stability. Comparison in terms of food properties in chemomutant varieties and samples was carried out with varieties of non-mutant origin Moskovskaya 39, Scipetr, Angelina. Their tech-

nological properties largely depend on the above, including natural conditions, since according to our data they are less dependent on the genotype and are more dependent on the mentioned conditions.

In chemomutant food varieties and samples, on the contrary: their food properties are much less dependent on the conditions listed above, which we explain by the fact that they are more determined by the genotype and less external conditions. Therefore, their food properties are much more stable unlike varieties obtained outside the method of chemical mutagenesis. This phenomenon is a novelty.

The method of chemical mutagenesis, on which our studies are based, was discovered in Russia by I.A. Rapoport [17]. This discovery in 2016 turned 70 years old.

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**STRESS-PROTECTION ACTION OF DINAMIC
ELECTRONEUROADAPTIVE STIMULATION**

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Abstract. As a result of assessment of behavior of rats in the "open field" test at an immobilized stress it is revealed that dynamic electroneuroadaptive stimulation has stressprotektorny effect.

Keywords: stress, "open field" test, adaptation

Psycho-emotional stress is currently a "disease of an industrial society", the basis of which is the connection of adaptation and maladaptation processes with psychosomatic diseases. Violations of an adequate response to stressful conditions can cause a number of functional disorders of the central nervous system (CNS) and, accordingly, behavioral activity [3]. Post-stress changes in the CNS, in turn, are accompanied by disruption of the central regulatory mechanisms, leading to the development of a number of pathologies at the peripheral level of hypertension, gastric ulcer, coronary heart disease and several others. In this regard, studying the body's response to stressful effects, choosing the right behavioral response strategy that allows the body to adequately adapt to the action of stressors and finding possible ways to correct post-stress disorders is an urgent task of modern physiology.

Of great interest is the search and application of new non-invasive, affordable, low-cost and effective technologies that would significantly optimize the results of the therapy by increasing the adaptive capacity of the body.

Dynamic electroneuroadaptive stimulation (DENAS) – is a new method of percutaneous electroneurostimulation, which consists in influencing the direct projection of a pathological focus and certain active reflexogenic zones and acupuncture points with short current pulses, constantly react-

ing with their shape transformation to changes in skin resistance in the subelectrode zone. Due to this, the phenomenon of accommodation does not develop (getting used to the procedures) and there are practically no contraindications [4,5].

DENAS-therapy is a treatment method officially approved by the Ministry of Health of the Russian Federation (registration certificate № FS-2005/004 dated March 04, 2005). The therapeutic effect of DENAS is based on multilevel reflex and neurochemical reactions that trigger a cascade of regulatory and adaptive mechanisms of the body.

Purpose of the work: evaluate the effect of dynamic electroneuro-adaptive stimulation on rat stress resistance in an experimental stress model.

Materials and research methods

The experiments were carried out on white outbred male rats weighing 200–250 g in the autumn-winter period. Animals were kept under standard conditions of specialized vivarium. The work was carried out in accordance with the European Convention for the Protection of Vertebrate Animals Used for Experiments or for Other Scientific Purposes (Strasbourg, March 18, 1986), and according to the order of the Ministry of Health of the Russian Federation dated June 19, 2003 № 267. Immobilization stress was modeled by daily hourly fixation of animals to laboratory machines upside down for 30 days. Prior to the experiments, in both series of rats, 10 animals in each of the experimental and control groups were divided. The experimental group of animals was subjected to dynamic electron-neurostimulation daily (using the Dia DENAS-PKM device), applying electrodes of the device to the rat tail for 10 minutes. To the control group of animals at the same time, unpowered device was applied. At the end of the experiment, the behavioral reactions were evaluated in animals of both groups in the open field test in a white arena, under standard lighting conditions, for 5 minutes [1,2]. During the test, video was filmed and the following behavioral indicators were recorded: latent period of the first movement, time to exit to the center, number of crossed squares, number of racks, freezing duration and vegetative indicators: grooming duration and number of boluses. To verify stress before and after the experiments, the content of 11-hydroxycorticosteroids (11-HCS) was determined in the blood of animals of both groups

Results and discussion

Prolonged immobilization of experimental animals caused increased secretion of glucocorticoid hormones. So, in the control group of animals by the end of the experiment, the content of 11-HCS increased to

456.3±0.08 µg/L, with the initial level of 115.31 µg/L ($P < 0.05$), while in the experimental group of animals the content of glucocorticoids increased to 124.37 mcg/L. In the control group of animals after immobilization, the maximum freezing time was 161.84±13.44 sec, while in the animals of the experimental group this indicator had a lower value of 93.48±3.47 ($p < 0.01$). A characteristic feature of the behavior of rats in the control group was a high grooming time in comparison with the rats of the experimental group 120.62±8.08 sec ($p < 0.01$). The behavior of the rats of the experimental group relative to rats of the control group was characterized by an increased level of motor activity of 122.8±9.92 ($p < 0.05$). Along with high motor activity in rats of this group, the exit time to the center, compared with animals in the control group, was less and amounted to 18.10±10.76, and in the control group 108.30±37.97 ($p < 0.01$) The number of boluses in the experimental group was significantly lower than in the control group, and amounted to 0.40±0.52 ($p < 0.01$).

Based on the fact that motor activity reflects the magnitude of CNS excitation processes, and grooming and defecation in the "open field" test are reliable indicators of the level of excitation of the autonomic nervous system [6], it can be assumed that dynamic electrostimulation has an inhibitory effect on the nervous system. A decrease in the motor activity of rats against the background of increased grooming, according to several researchers [6,7,8], indicates the development of severe stress and anxiety-depressive behavior. It can be assumed that the inhibitory effect of DENAS is probably due to its ability to activate protective inhibition processes in CNS, as a result of which the psychoemotional stress of rats decreases, the level of anxiety and passive-defensive reaction decrease, and orientational research behavior increases. Thus, the experimental data allow us to conclude that dynamic electro-neuroadaptive stimulation prevents the development of a stress response, that is, it has a stress-protective effect.

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WASTE MINIMIZATION IN BIOCHEMICAL SYNTHESIS

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Abstract. The paper presents the opportunity to develop an effective methodology for processing the biomass of bacteria *rhodobacter capsulatus* by extracting biological raw materials by chromatography and extraction.

Keywords: Bacteria biomass; *rhodobacter capsulatus*; chromatography; extraction; carotene; bacteriopurpurine; b-carotene; bacteriochlorophyll.

The purpose of the work is to develop an effective methodology for processing the biomass of bacteria *rhodobacter capsulatus*, which is an effective producer of bacteriochlorophyll a; provitamin A. Bacteria produce many useful substances throughout their life cycle. In *rhodobacter capsulatus*, the end product is bacteriochlorophyll a. Bacteriochlorophyll a is used in many scientific fields; effective photosensitizers that can treat cancer are created on its basis. Since biomass contains little bacteriochlorophyll a, the rest of the mass, meal, are the remains of cell walls, carotenoids, and other products. Carotenoids are a rather valuable component of biomass, these include b-carotene and provitamin A. The components of this biomass provide great opportunities for scientists around the world. A powerful photosensitizer gives a chance to identify many diseases, therefore *rhodobacter capsulatus* is a demanded material, which in the future can become a life-saving medicine for many people.

Results and discussion

In this work, we study a strain of *rhodobacter capsulatus*, which is a producer of lipopolysaccharide, an endotoxin agonist. Bacteriopurpurine is obtained from the biomass of *Rhodobacter capsulatus*, which can be used for medical purposes. Also, this biomass can be a source of various other biologically active compounds. The chromatograph found tocopherols, carotenoid carbohydrates, higher fatty acids, acid-containing carotenoids and higher fatty alcohols.

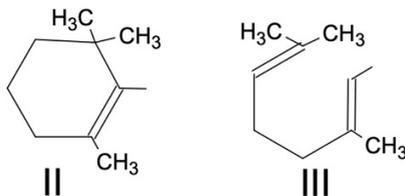
The biomass composition of Rhodobacter capsulatus

Bacteriochlorophyll a	0,3 – 0,6 mg/g
Carotenoids	7 mg/g
Including B-carotene	0,7 mg/g
Grist (proteins and lipids)	

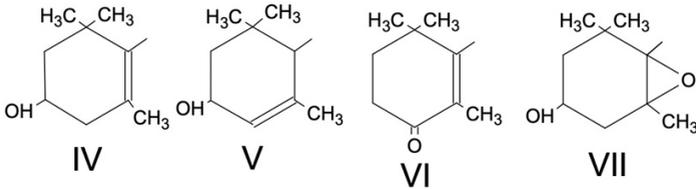
The percentage composition of the selected concentrates from the lipid residue of the biomass Rhodobacter capsulatus

Composition of the concentrates	Content, %
Carotenoid hydrocarbons	3.9
Tocopherols	5
Oxygen-containing carotenoids and higher fatty acids (HFA)	65.5
HFA	5
HFA and phytol	19.7

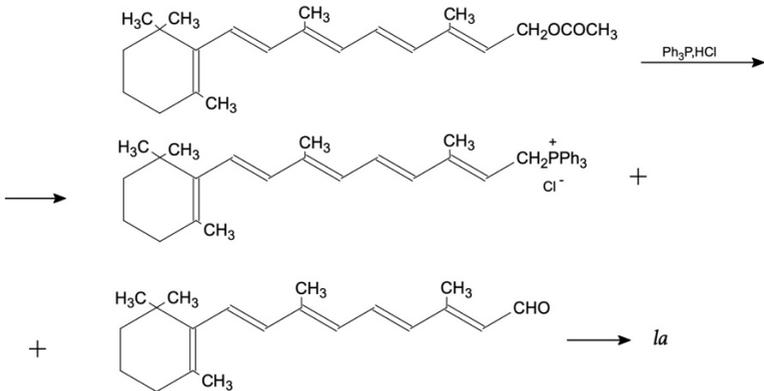
Carotenoids are common natural pigments that are found in plants and animals, which is why they are able to provide the natural yellow, red and orange colors of various foods, are widely used as identical or natural dyes. They have the structure of isoprenoids and are divided into oxygen-containing derivatives of tetraterpene hydrocarbons (xanthophylls), tetraterpene hydrocarbons (carotenes) having the general formula $C_{40}H_{56}$, and carotenoids containing more or less than 40 carbon atoms in the molecules. In higher plants, carotenoid hydrocarbons are most commonly found, mainly B-carotene ($R = R' = II$; approximately 20-30% of natural carotenoids), γ -carotene ($R = II, R' = III$) and lycopene ($R = R' = III$). Carotenoid hydrocarbons are capable of dissolving in fats and oils, chloroform, ethers and benzols, but they are not able to dissolve in water. They are easily oxidized in oxygen, unstable in the light, and also when heated in the presence of acids, alkalis [1; 7].



Among oxygen-containing carotenoids, carotenoids, whose molecules have hydroxyl groups, are more common. Examples include cryptoxanthin (R = IV, R' = I; yellow crystals, t_{mel} 174°C) and lutein (R = IV, R' = V; yellow crystals, t_{mel} 193°C). Carotenoids may be found that contain carbonyl groups, for example, canthaxanthin (R = R' = VI), carboxyl groups, for example, bixin (R = COOH, R' = COOCH₃), epoxy groups, an example is violaxanthin (R = R' = VII) and others.



B-carotene - is a dark ruby crystals, it is distributed in nature in the form of a stable trans-isomer in each double bond. B-carotene is isolated by extraction from palm oil, buckwheat, dry carrots, alfalfa and other plant materials. In industry, B-carotene is obtained by the microbiological method, in which the *Blakeslea trispora* heterotrophic mucorhizal fungus is used, using waste from flour milling (soybean and corn flour) or starch-syrup production, as well as a synthetic method from vitamin A derivatives, following the scheme [2; 3; 4; 5; 6]:



The use of b-carotene:

- Part of the chloroplasts of all higher plants and algae
- Dye in food, feed

Process Management and Scientific Developments

- Perfume and cosmetics industry
- Included with eye photoreceptors
- Participates in the protection of cells from the damaging effects of light
- In humans, they increase the immune status, protect against photodermatosis
- They prevent sunburn, thereby protecting the skin from the harmful effects of ultraviolet radiation, and also has a cosmetic effect on nails, skin and hair.
- Indispensable during the treatment of diseases of the genitourinary system and diseases of the stomach.

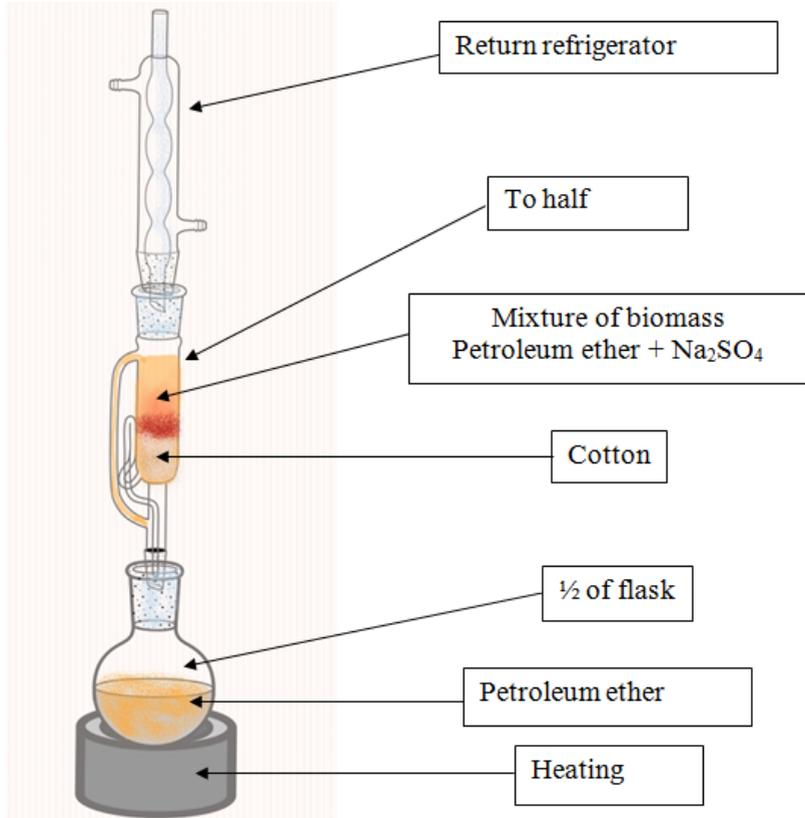
The aim of the work is to isolate B-carotene from this biomass of *Rhodobacter capsulatus*. Materials and tools that we will need in future work are:

- Silica gel on TLC AL foils silica gel matrix, L * W 20cm * 20cm
- Test tube serological PS-2-10-120 (12 pieces)
- Round-bottom flask K-1-1000-29/32
- Light bottle (bottle), 100 ml, with a stopper (wide neck)
- Conical microtube with integrated Eppendorf cap, 1.5 ml, aseptic (4 pcs)
- Tip for dispensers type 2 (100-1000 μ l.), aseptic (30 pcs)
- Ditch spectrophotometric 4 ml, in a tripod, aseptic
- Rubber syringe №1 type A
- Low glass, N-1-400
- Laboratory balance ViBRA AB 3202RCE
- Tip for Soxhlet extractor 500 ml
- 12-seater high-speed microcentrifuge D2012 plus DLAB
- Rotary evaporator Hei-VAP Value G5B, Heidolph
- A support for test tubes with a diameter of 16 mm, 60 sockets, p/p, Kartell
- VITLAB micropipette pipette, 10-100 μ l
- UV-1800 spectrophotometer
- Methylene Chloride H
- Petroleum ether 40 70 ChP
- Propanol 2
- Silica gel KSMG
- Ultrasonic laboratory bath Sonorex Technik RM from Bandelin
- Double camera, for 10 x 10 cm plates, Camag

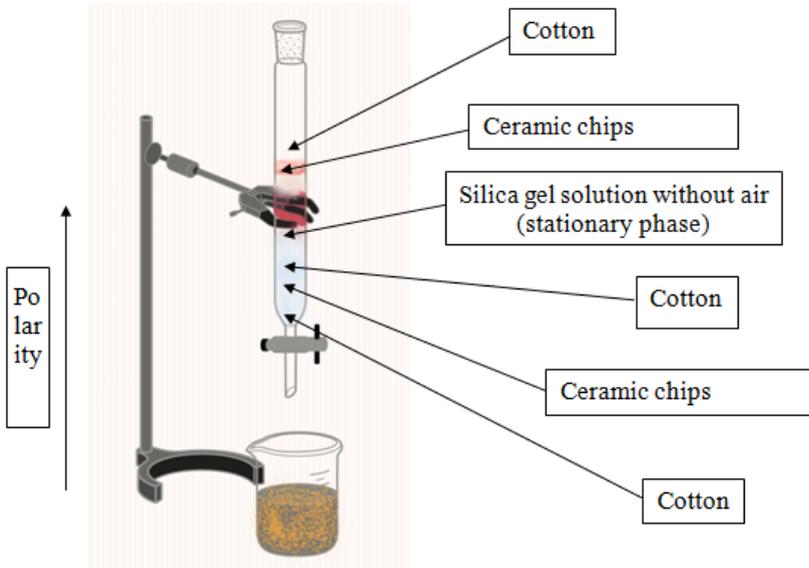
A solvent is required for this *Rhodobacter capsulatus* biomass, we divide the biomass into 4 equal parts, three of which are dissolved in methylene chloride, propanol 2 and petroleum ether, respectively. Samples of mixtures are sent to a high-speed microcentrifuge for 3 minutes to further have the ability to do thin layer chromatography. After TLC and centrifugation, it became clear that working with biomass and methylene chloride is inconvenient, since carotene is mixed with fats. Add Na_2SO_4 to the remaining biomass in order to remove water. For us, the best solvent is petroleum ether since:

- I. Has a low boiling point (40-60 °C)
- II. Low losses during solvent regeneration (up to 5%)
- III. Carotenoids dissolve better in petroleum ether

The Soklet extractor is installed on a round-bottom flask, where the extraction solvent is located, we supply it with a reflux condenser. This device will help us to carry out continuous extraction of carotenoids from the biomass of *Rhodobacter capsulatus*.

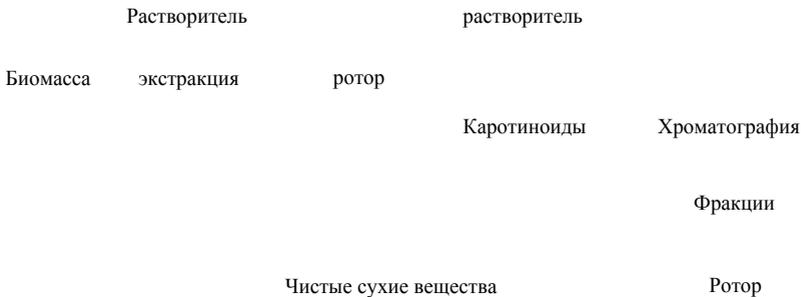


Next, filter the carotenoids from various residues and water with Na₂SO₄, cotton and hexane. In a rotary evaporator, B-carotene is evaporated, then methylene is added, due to which the color changes sharply to bright red, air bubbles are emitted in an ultrasonic bath. We dissolve silica gel with chloroform, after which we establish a chromatographic column, where the components of the mixture are absorbed by the adsorbent.



Using a Pasteur pipette, drip the carotenoids onto the ceramic chips that are in the column. The solvent goes down under gravity, after which the carotenoids are separated into fractions (each phase is in a separate tube). A total of 12 fractions was obtained, we carry out thin-layer chromatography (chloroform+methylene is in the chamber):

- 1 – 4 test tubes: $Rf_1=0,5$; $Rf_2=0,73$
- 5 – 8 test tubes: $Rf_1=0,33$; $Rf_2=0$
- Initial solution: $Rf_1=0,43$; $Rf_2=0,57$; $Rf_3=0,73$; $Rf_4=0,86$



We compare the results of the spectrophotometer and find patterns, we determined that B-carotene is mixed in 5-7 tubes. Next is the reinstallation of the chromatographic column for the next purification of B-carotene. After the rotary evaporator, pure and dry B-carotene was obtained. Having analyzed the mass spectrum and NMR, it was confirmed that B-carotene is in the tube. Weighing the resulting B-carotene, we determined that 0.74 mg of B-carotene falls per 1 g of *Rhodobacter capsulatus* biomass.

Conclusion

We managed to develop an effective methodology for processing the biomass of bacteria *rhodobacter capsulatus*, which is an effective producer of bacteriochlorophyll a, while this method is quite practical and economical, since 15 mg of B-carotene costs 1200 rubles, and 1000 g of biomass costs 5000 rubles. To get 15 mg, we need only 20.3 g of Biomass, that is 110 rubles, given that all the equipment was purchased earlier. But for industry this method is not suitable, as it consists of a large number of stages and takes a lot of time.

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EXPERTISE OF INNOVATION TECHNOLOGY AND USE IN RENEWABLE ENERGY

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Abstract. The article touches upon the urgent problems of implementing marketing innovative strategies in the activities of modern entrepreneurial structures and the implementation expertise. A scientifically based classification and methods for calculating expert judgment are given. The factors of innovative technologies of renewable energy sources that affect the nature of environmental and economic strategies and benefits are systematized. The focus is on agricultural growth strategies and a table illustrates solar-energy technology and its possible combinations by indicators.

Keywords: solar energy technologies, innovative strategies, technology expertise, Turkmenistan.

Introduction

Relevance of the problem. All over the world there is an unfavorable socio-economic situation associated with the country's low innovative potential, which requires a constant objective assessment of the current situation and the search for rational solutions to problems. Moreover, the complexity of choosing effective solutions increases dramatically.

Of particular importance was the expert activity due to the fact that often the success of a project is determined precisely by the quality, timeliness and feasibility of a special final analysis [1,2].

The President of Turkmenistan Gurbanguly Berdimuhamedov repeatedly emphasized the practically significant role of using innovative technologies in Turkmenistan in his speeches and in a number of signed Government documents. These documents marked a turn from the expert-the-

oretical to the practical phase of administrative reform in terms of changing the structure of public authorities and the transition to program-targeted methods of planning and budgeting, focused on the results of the introduction of innovative technologies [1,2].

The conceptual basis for reform is a new management and implementation model. An analysis of the concepts of the mentioned management model shows that the implemented set of reform tools is not complete: it does not include such an integral component as an expert evaluation of policies and programs. In developed countries, the institutions for evaluating policies and programs was introduced following the implementation of public administration reforms, and at present, the importance of these institutions is generally recognized [1,2].

Under the expert evaluation of programs, an analytical procedure is adopted aimed at diagnosing and understanding the achievement of goals and the impact of public policy (political and administrative measures) [4].

Expertise in the field of innovation development policy should be considered as a variant of applied interdisciplinary research that arose at the intersection of political science, economics, sociology and law, as well as with the mandatory involvement of engineering and technological knowledge.

The first president of the German Society for Evaluation X. Wolmann writes about this, "in this case, we start from a broad understanding of evaluation as an analytical procedure and tool designed to extract all the information for an expert evaluation of the performance, process and result of a political program or measure" [5].

And the French researcher B. Perret, "assessment is applied to objects of various nature (policies, programs, projects), at various geographical levels (local, regional, national) and in various areas of public activity (health, education, ecology, safety, economic intervention). Evaluation can give both an explicit and an implicit end product: a decision change, an analytical report, a form of management, mediation, training "[5].

Turkmenistan is an energy-producing country; the estimated hydrocarbon reserves are estimated at 45.4 billion tons in oil equivalent. According to an audit conducted by Caffney, Cline & Associates (Great Britain), the reserves of the South Yolotan-Osman deposit range from 4 to 14 trillion cubic meters of blue fuel, this field is one of the five largest fields in the world. Significant oil and gas reserves are located on the Turkmen shelf of the Caspian Sea, and the estimated hydrocarbon reserves are estimated at more than 12 billion tons of oil and 6 trillion cubic meters of natural gas [1,2].

Such reserves of fuel and energy resources can provide the country's demand for heat and electricity for hundreds of years. However, their actual use is due to significant difficulties and dangers, does not meet the energy needs of many regions, is associated with irretrievable losses of fuel and energy resources, and threatens an environmental catastrophe in places of extraction and production of fuel and energy resources. About 200 thousand people live in areas of autonomous energy supply or unreliable centralized energy supply, occupying more than 80% of the territory of Turkmenistan (the Karakum desert).

Introduction of innovative renewable energy technologies. What is innovative development? The key to innovative development is innovation. In a document adopted by the OECD in 1993 in the Italian city of Frascati, innovation is defined as the end result of innovative activity, embodied in the form of a new or improved product introduced on the market, a new or improved technological process used in practice, or in a new approach to social services [7].

For the full disclosure of the essence of the examination of the policy of innovative development, it is necessary to identify the specific goals and objectives of this institution. The main goal of the innovative development path is to increase the economic level. For this, it is necessary to achieve more operational sub-goals, which together will provide the desired final economic results. The following levels are related to increasing innovative potential:

- microeconomic (increasing the innovative potential of business entities);
- mesoeconomic (increasing the innovative potential of sectors, industries and regions);
- macroeconomic (increasing the innovative potential of the country).

The main tasks of the examination of the innovation development policy are as follows:

- identification - the conformity (effectiveness) of measures taken to increase the level of technology innovation;
- forecasting - the ability of planned program activities to ensure the implementation of the stated goals and objectives;
- impact on the result - the impact of activities on the achievement of goals and objectives;
- adjustment - the need to change the political development program of the country.

Local benefits. Turkmenistan possesses more than 40 million hectares of pasture land in the arid zone of mountain regions, which contain

more than 17 million heads of sheep, goats, cattle, camels. Pasture technologies for raising animals due to the use of natural fodder resources are the most profitable and allow providing the population of Turkmenistan with domestic meat products, as well as raw materials for light industry (wool, leather products, etc.).

Socio-economic aspects. The most important means of intensifying the production of pasture complexes and improving the socio-economic conditions of life of rural producers (remote from the energy system) is renewable energy. If resources are available, using these environmentally friendly energy sources, it is possible to solve the local problems of energy supply in Turkmenistan in the desert regions where livestock breeders, drillers, railway workers, etc. live.

Energy supply of desert territories is provided by diesel and gasoline power stations, imported kerosene and gas in cylinders, and wood fuel. Most livestock farms do not have modern energy supply facilities. The indicated category of people is a potential consumer of solar and other renewable energy sources. The development of innovative solar energy in desert territories will help to solve a number of social problems of improving the quality of life of the population, accelerate the development of pastoral livestock and agriculture, sustainable economic development, the development of small businesses and the creation of new jobs in the regions of Turkmenistan and the implementation of the National Program for the Development of Desert Territories of Central Karakum.

Ecological strategy. A new development trend in Turkmen and world energy is an increase in the share of decentralized production of electric and thermal energy by environmentally friendly power plants.

The number of large environmentally hazardous power plants will be reduced. This trend is explained, on the one hand, by climate change and the need to implement the Kyoto Protocol to reduce greenhouse gas emissions, on the other hand, the decentralization of fuel and energy supplies increases the energy security of the regions and the country as a whole [1,2].

Turkmenistan has ratified the UN Convention on Climate Change and the Convention to Combat Desertification. Since 1996, intensive work has been carried out to implement the National Program for the Development of Desert Territories in the Central Karakum, including the construction of solar systems in the desert.

In addition, distributed and non-fuel energy production using local energy resources reduces the costs and risks of oil importing countries and increases the export potential of fuel and energy exporting countries. Ac-

According to the achieved results in solar energy, the technical potential of low-potential solar technology in Turkmenistan has an equivalent of $1.4 \cdot 10^9$ tons of equivalent fuel per year, while the reduction of CO₂ emissions is 3.4 Pg [13].

Market liberalization in the field of electricity will lead to the connection of millions of independent energy producers to the energy system. Managing energy flows in the presence of millions of manufacturers and consumers is possible only with the help of infocommunication technologies and electronic commerce tools. Therefore, the problems of the development of information technologies and innovative technologies of solar energy are closely related and progress in each of these two areas of technology will contribute to the development of the other.

There are psychological, economic, technological, legislative and informational barriers to the development of the market for renewable energy sources.

Economic barriers are associated with the relatively high unit costs of renewable energy equipment. The domestic market for renewable energy does not develop due to low solvent demand and the lack of legislation protecting the rights of independent producers of clean energy.

Technological barriers can be overcome with the help of new energy technologies, which, when developed by industry, increase the competitiveness of renewable energy in the energy market and help reduce economic barriers.

The legislative barrier is connected with the absence of legislative and regulatory acts and economic regulators ensuring the free supply and sale of electricity to the energy system by small and independent energy producers, as well as the absence of a market and competition between electricity producers.

Maintaining a unified energy system as a monopoly with a controlling stake in the state and creating a regulated market for energy producers and consumers is a prerequisite. Regulation of the volume of sales and energy flows will ensure energy needs at peak hours, maintain the stability of the power system and reduce losses in the networks [11-14].

Examination of innovative technologies. The country does not have a holistic system of expert evaluation of innovative technologies and programs, only some of its fragments are present.

If we conduct monitoring of the implementation of social and economic development programs with economic institutes of the Ministry of Economic Development of Turkmenistan and together with expert organizations, we could reveal significant deviations from the goals.

The need to use an expert tool in the field of innovative development policy of Turkmenistan, since over the years of the country's economic growth, new technologies based on renewable energy sources have not been introduced in a systematic basis of market relations.

Similar situations occur when countries have a low technological, industrial, and information potential and live off their natural resources. At present, the development of advanced science-intensive industries and technologies, the creation of high value-added products competitive with their subsequent delivery to world markets.

In conceptual terms, given the geopolitics of President of Turkmenistan Gurbanguly Berdimuhamedov, his contribution to science, education and culture, only such a course of events is acceptable, to distinguish the trajectory and move forward [1,2].

A statistical analysis of world indicators shows that the results of public policy are in no way correlated with the tasks of modernization. In Russia, R&D expenses are less than in the USA, almost 45 times, than in Japan - 22 times, than in Germany - 7.5 times. Only 8-10% of innovative ideas and projects are being implemented (in the USA - 62%, in Japan - 95%). Only 5% of registered inventions and effective models are objects of commercial transactions. More than 70% of all inventions are aimed at maintaining or slightly improving obsolete types of equipment and technologies. Russia's share in the global market for high-tech products is 0.3%.

The consequences of the global financial and economic crisis clearly demonstrate the need to change the prevailing stereotypes of public administration of the national economy [8]. One of the most effective solutions to this problem is the examination of the innovation development policy, which is able to evaluate the measures taken to increase innovative economic growth. It will make it possible to identify the state, indicate the goals, methods, tools and consequences of the innovation policy, orient the sectors of the national economy on the indicative implementation of high-tech, highly efficient and resource-saving technologies, taking into account the necessary institutional transformations.

For example: to measure the state of innovation processes, one should pay attention to the integral criterion of expert assessment, covering at the same time three levels: I - country, II - veloyat (region), III - etrap (district).

$$IECL(I) = [(p(T-1)/p(T) - 1) * 100\%, \quad (1)$$

where IECL (I) – innovativeness of the economy at the country level; $p(T-1) = P(T-1) / GDP(T-1)$ – resource intensity of gross domestic product in the base period (resource consumption per unit of GDP); $P(T) = P(T) / GDP(T)$ – resource intensity of gross domestic product in the analyzed period.

$$P = MR + SR + TP, \quad (2)$$

where MR – the volume of consumption of material resources; SR – the volume of consumption of "stock" resources; LR – the volume of costs for the use of labor resources.

$$IEVL (II) = [(pp (T-1)/pp (T)) - 1] * 100\%, \quad (3)$$

where IEVL (II) – innovativeness of the economy on a velayat level; pp (T-1) = PP(T-1)/ GVP(T-1) – resource intensity of the gross velayat product in the base period; pp(T) = PP(T)/ GVP (T) – resource intensity of gross velayat product in the analyzed period.

$$LIEE (III) = [(pn (T-1)/pn (T)) - 1] * 100\%, \quad (4)$$

where LIEE(III) – level of innovation of the enterprise economy; pn (T-1) = EE (T-1)/ AV(T-1) – resource intensity per unit of value added in the base period; pn (T) = RIP(T)/ AV(T) – resource intensity per unit of value added in the analyzed period.

From the above expressions it follows that with equal resource intensity levels in the base and analyzed periods, the level of innovativeness of the economy will be zero. With an increase in resource intensity in the analyzed period compared to the basic level of innovation, it will have a negative value. Accordingly, a decrease in resource intensity in the first case compared to the second will show the presence of an innovative level.

The scale for measuring the level of innovativeness of the economy is selected as a percentage by analogy with the scale for measuring levels of profitability [9.14].

The results of the analysis are shown in the table of environmental and economic indicators from the use of innovative solar technologies in Turkmenistan.

Of course, the inverse proportion of the expert assessment will take place in the analysis of the dynamics of high technology economy, since an increase in the share of high technology in the analyzed period relative to the base one directly characterizes the growth of innovative potential at a certain economic level.

Today, the relevance of expertise in the field of innovation policy is not limited to assessing the level of innovativeness of the economy on one scale or another.

Not every innovative growth will ensure macroeconomic competitiveness. However, determining an acceptable combination of growth rate and overall competitiveness is a very important priority task requiring careful expert intervention.

Difficulties in such assessments often arise because the state structures responsible for the development of innovative activities in the country

do not fully utilize the relevant achievements of Turkmen scientists and specialists. At the same time, work on assessing the scientific, technological and innovative potential of Turkmenistan is often carried out by foreign experts who give their conclusions and recommendations to the Turkmen government based on their understanding of our country's place in the global economy. As a result, government support for the scientific, technological and educational complex is often inadequate, which, ultimately, does not allow solving the problems of transition of the economy to an innovative development path [11-14].

Therefore, we believe that an interdepartmental coordinating council for the examination of the innovation development policy is needed, which would include representatives of the Ministry of Economic Development, the Academy of Sciences of Turkmenistan, the State Standard, velayat and etrap state authorities, private business, etc. Taking into account the fact that Turkmen law belongs to the Roman-German legal system, we consider that the current state of Turkmenistan's expert activity in the field of evaluating policies and programs is similar to the state of the German executive authorities in 1989, which the Accounts Chamber of Germany described as follows:

- there is no streamlined procedure for monitoring the effectiveness of state programs; at best, it is in the process of formation;
- in almost all departments, already in the planning phase, the process is structured in such a way (in terms of formulating goals, determining results, introducing performance indicators) that full control over the effectiveness of government programs is impossible;
- there are practically no attempts to study the direct and indirect effects of the implementation of government programs or measures;
- the available opportunities to assess the effectiveness of public policy measures are practically not used;
- the results of evaluating the effectiveness of the further formation of government programs are not used;
- employees responsible for conducting performance monitoring do not understand well the goals, significance and necessity of such monitoring.

Conclusions

Almost all the provisions of the above conclusions are applicable to the considered area in our country. Due to the lack of legislative support for innovation, the regulatory framework does not have adequate terminology and criteria for innovation, and without a single legislative conceptual framework, a full-fledged examination of the innovation de-

velopment policy is difficult to implement. The negative consequences of the lack of a unified approach to the basic definitions and criteria of innovation can lead to the development of such an innovative process management tool that will not produce the desired results. Moreover, measures to support innovation can easily be used in the interests of corrupt groups.

Table of technical and economic potentials and environmental indicators from the use of innovative solar-energy technological [13]

Installation Name	Technical potentials	Economic potentials	Environmental performance
Solar dryers	For melon - 80m ³ volume, specific productivity for dry products 0.8 - 1.0 kg/m ² of dried melon per day.	The use of solar dryers for processing agricultural products will save 540 tons of equivalent fuel over 20 years, an estimated cost of \$ 7,000, a payback period of 2-4 years; for raisins, respectively - 4200 m ³ ; 0.3 kg/m ² ; \$ 3000, 3-4 years.	The use of solar dryers for processing agricultural products will save 540 million tons of equivalent fuel over 20 years and reduce CO ₂ emissions by 1310.7 Tg.
Solar water heaters	On average, 0.55 MW-h per year is required per villager; with the help of a solar collector, 85 l of hot water with a temperature of 60–65 °C can be obtained.	The use of solar energy for heating water will save 0.15 tons of equivalent fuel per 1 m ² of water heater per year, during summer daylight hours with a solar radiation density of 1100 W/m ² . In these cases, it is possible to provide 80% of the annual heat load, 20% - due to the thermal doubler.	The use of solar energy for heating water will save 0.15 tons of equivalent fuel per square meter per year from 1 m ² of the water heater, and will reduce CO ₂ emissions by 0.364 Mg.
Solar desalination plants	The annual output from 1 m ² of the installation with an average filling depth of 0.16 m, with a maximum salt concentration of 0.158 kg/l, is 1.2 m ³ /m ² · year.	The heat consumption for desalination of 1 m ³ of sea water is 2512 MJ (0.60 Gcal).	The heat consumption for desalination of 1 m ³ of sea water is: 2512 MJ (0.60 Gcal), or a reduction in CO ₂ emissions of 0.146 Mg.

Installation Name	Technical potentials	Economic potentials	Environmental performance
Solar biogas plant	The volume of emitted gas is 340 l/kg dry matter, the characteristics of the emitted gas: 60–70% methane, 20–40% carbon dioxide, 1–3% sulfuric acid, approximately 1% hydrogen, oxygen, hydrogen sulfide, nitrogen and carbon monoxide.	The introduction of new technologies for biogas production will make it possible to obtain a biogas calorific value of 20–26 MJ/m ³ .	The introduction of new technologies for biogas production will make it possible to reduce methane emissions into the atmosphere by about 4.4 tons of CO ₂ equivalent.
Solar plant for growing microalgae (chlorella, spirulina, stagedesmus)	Chemical analysis of chlorella dry matter shows that it contains up to 45% protein, 20–30% carbohydrates, 7–10% fat and up to 23 amino acids, including tryptophan and methionine.	Fuel economy for a given volume of chlorella biomass production due to the use of solar energy, according to preliminary estimates, will be 30 thousand tons of equivalent fuel per year, Electric energy consumption for the production of 1m ³ of conditioned biomass in a solar installation does not exceed 70 kWh, which is 8 times less than in conventional plants with artificial heating and lighting.	Fuel economy for a given volume of chlorella biomass production due to the use of solar energy, according to preliminary estimates, will be 30 thousand tons of equivalent fuel per year, will reduce CO ₂ emissions by 0.072 Tg.

Table of technical and economic potentials and environmental indicators from the use of innovative solar-energy technological [13]

A full-fledged examination in accordance with the established goals of assessing the policy of innovative development should bear a “cross-cutting” burden on micro- (introduction of innovative systems in production), meso- (increasing the competitiveness of the industrial sector, development of high-tech industry) and macro- (actions of executive, legislative and judiciary to stimulate innovative development) to economic levels, taking into account the mega-economic environment (achievements and practices of developed countries).

This requires a comprehensive, including cross-financial, political, legal, managerial and technical expert analysis of the forecast, actual and final results of innovative development programs.

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**DETERMINATION OF THE OPTIMAL RECOVERY TIME OF THE
RHEOLOGICAL CHARACTERISTICS OF MARINE DIESEL ENGINE
LUBRICATING OILS**

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Abstract. The results of studies to determine the optimal recovery time of the rheological characteristics of marine oils of marine diesel engines are presented. It was experimentally established that an increase in the intensity of replenishment of the lubricating system with new oil supports and restores the operational and rheological characteristics of the oil, and also contributes to a more reliable operation of marine medium-speed diesel engines.

Keywords: marine medium speed diesel engine, lubrication system, viscosity, density, rheological stability

During the operation of internal combustion engines of sea and river vessels, continuous and periodic monitoring is carried out not only of indicators characterizing the diesel duty cycle (pressure and temperature at characteristic points, speed, power, temperature of exhaust gases), but also the operational and rheological characteristics of engine oils. In this case, the main parameters, the control of which is mandatory during the operation of the diesel engine, are: viscosity, density, acid number, flash point, water content and mechanical impurities. During operation, these parameters are constantly changing, and in some cases they can exceed the maximum permissible values (rejection indicators). This inevitably leads to an increase in contact stresses in the main tribological systems and an increase in the energy losses spent on overcoming them. The simplest, and therefore the most common way to restore the rheological characteristics of motor oils is to clean them (by partial or full flow filtration and separation), as well as adding fresh oil (both pure and with special additives) to the volume of the oil system [1].

Due to the increase in pressure and temperature of the cycle, increase in torque, design change, complication of operating conditions, increase in the operating time of modern diesel engines at maximum loads, the operating conditions of oils in both lubricator and circulation lubrication systems

have become more stringent. At the same time, the terms for the replacement of oils are continuously increasing due to the improvement of their operational properties. Premature replacement of oils is not economically feasible, since their consumption, maintenance costs, spare parts, etc. increase. On the other hand, an increase in the service life of oils leads to increased wear of diesel parts, which reduces its reliability, increases failures in operation, and contributes to an increase in irreversible energy losses. Determining the optimal oil change frequency is a laborious, long-term operation, initially determined by the manufacturer, adjusted according to the results of operation, and entails financial and operating costs. Therefore, it is relevant to solve the problem of restoring the rheological characteristics of oil in the process of its operation [2].

Periodic addition of oil during operation partially restores its original properties, first of all, it relates to such parameters as viscosity, acid number, flash point. However, in spite of the possible restoration of the rheological characteristics, after a certain time the engine oil must be completely replaced. The frequency of such a change depends on the properties and characteristics of the oil; type, technical condition and operating conditions of the diesel engine; technical condition of all components of the oil system; oil filtration method; fuel used and other factors. The need for a complete replacement is due to the loss of the basic operational properties of the oil, i.e. its aging.

The frequency of oil changes is established on the basis of a thorough study of the operational properties of oils and their changes during operation. At the same time, the frequency of replacing motor oils is not yet sufficiently substantiated. This is due to the fact that at the design stage of the oil system it is impossible to fully take into account the dynamics of the process of changing the physicochemical, operational and rheological characteristics of the oil, which are influenced by both internal (structural composition of the fuel, technical condition of the diesel components) and external (moisture content of the air, the presence of dust and abrasive inclusions in it) factors [3]. Therefore, it is constantly necessary to adjust the timing of the replacement of oils established by the manufacturer, after sufficient accumulation and study of operating results.

A complete oil change in ship conditions requires the engine to be decommissioned, and this period includes not only the oil change procedure itself, but also the cleaning of the friction surfaces from operational pollution. The fulfillment of this task for the main engines occurs while the ship is stationary and can be pre-planned taking into account the voyage, cargo characteristics and upcoming cargo operations. In connection with

the constant change in the load of a ship power plant, it is rather difficult to predict long-term decommissioning for diesel engines that perform auxiliary functions [4]. Therefore, for their lubrication systems, the process of periodically adding oil is the most effective [5].

Based on the foregoing, the aim of the study was to determine the optimal timing for the replacement or replenishment of the volumes of the oil system, which will contribute to the resumption and maintenance of the rheological characteristics of motor oil within the established limits.

As a rule, under the conditions of operation of internal combustion engines, the oil is replenished by circulating the system by adding oil when the minimum level is reached in the crankcase (if the diesel engine has a wet crankcase) or in a waste tank (if the engine has a dry crankcase). The frequency of this process is once every 3 ... 5 days, depending on the type of lubrication system, the load on the engine and its operating time. At the same time, fresh oil, mixing with oil having a certain operating time in a diesel engine, does not completely restore the operational and rheological characteristics of the mixture thus obtained. Deviations in these parameters are greater, the longer the period between the replenishment of oil in the system.

Studies have been carried out for Castrol TPL 203 marine engine oil with the following main characteristics:

- SAE classification – 30,
- density at 15° viscosity at 50°
- base number – 20 mgKOH/g

Castrol TPL 203 oil is intended and recommended for providing lubrication of tron engines when they are running on heavy fuel and was used in the circulating lubrication system of Yanmar 6EY22AW marine diesel engines, which have the following main characteristics:

- type – four stroke;
- number of cylinders – 6 (inline arrangement);
- nominal power – 885 kW;
- rotation frequency – 900 rev/min;
- cylinder diameter – 220 mm;
- piston stroke – 320 mm.

The dynamics of changes in the main operational indicators of the oil are given in table 1 and indicates that the values of all parameters deteriorate and eventually approach the maximum allowable rejection indicators. Thus, maintaining a regulated time for adding oil to the system takes the engine to the border of reliable operation of the system, and in a critical situation it can lead to an accident. That is why, there is a need to find the optimal timing of replenishment of the lubrication system with new oil.

Table 1

Change in the rheological characteristics of the oil during operation

Indicator	Base value	Operating time, hour			
		25	50	75	100
Viscosity at 50°	102	109	114	118	121
Rheological stability, %	+10,36	+8,76	+6,38	+5,95	+5,44
Density at 15°	920	897	881	853	846
Acid number, mgKOH/g	0,75	0,78	0,8	0,82	0,83

In this regard, in the research we set the task of rationally increasing the frequency of adding oil to the system, which was determined by monitoring the operational and rheological characteristics of motor oil. Its solution was carried out directly in the ship's conditions, while the auxiliary power plant of the vessel consisted of three identical Yanmar 6EY22AW diesels operating on a four-cycle, which made it possible to conduct parallel experiments with different intensities of replenishing the oil into the volume of the circulating oil system. Diesels worked alternately with almost the same load, the range of which varied over a fairly wide range (250 ... 750 kW), with the same operating time during the day (12 ... 15 hours). Given the energy intensity of the studied objects, as well as the complexity of the processes occurring in the oil system, we can assume that the engines were in the same experimental conditions, and the results can be considered correct.

One of the diesels remained the "control" and there was no change in the frequency of adding oil to the system. Thus, this diesel engine worked for 100 hours without replenishing the oil system. Over a given period of time, the amount of oil in the system did not fall below the limit level, and the engine was operated in compliance with all the requirements.

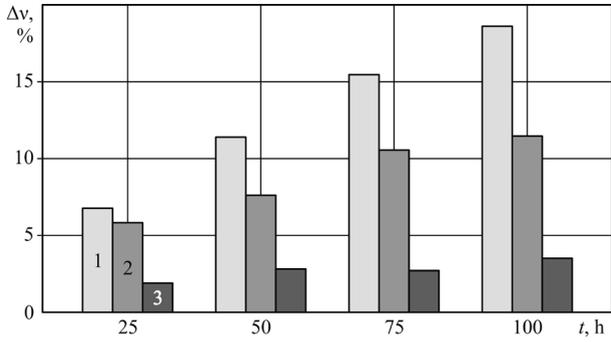
In the oil system of the second diesel engine, oil was added to the upper permissible level every 25 hours of operation. In the third oil system - every 10 hours. The results obtained during the experiment are shown in Table 2 and are shown in Fig. 1, in which the change in parameters is given in percent.

Table 2
Change in the characteristics of the oil during the experiment

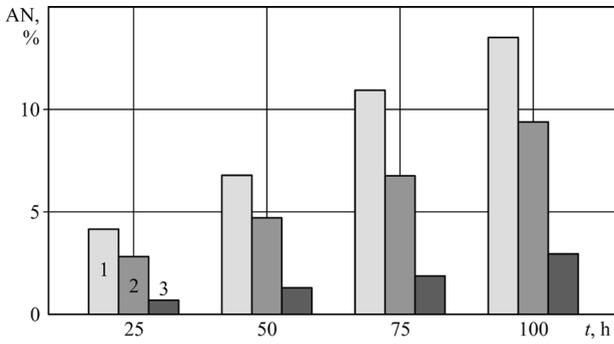
Indicator	Base value	Operating hours			
		25	50	75	100
Oil filling interval 100 hours					
Viscosity at 50°	102	$\frac{109}{6,86}$	$\frac{109}{11,76}$	$\frac{118}{15,69}$	$\frac{121}{18,63}$
Rheological stability, %**	10,36	$\frac{8,76}{-15,44}$	$\frac{6,38}{-38,42}$	$\frac{5,95}{-42,57}$	$\frac{5,44}{-47,49}$
Density at 15°	920	$\frac{897}{-2,5}$	$\frac{881}{-4,24}$	$\frac{853}{-7,28}$	$\frac{844}{-8,24}$
Acid number, mgKOH/g [*]	0,75	$\frac{0,78}{4,00}$	$\frac{0,80}{6,67}$	$\frac{0,83}{10,67}$	$\frac{0,85}{13,33}$
Oil adding interval 25 hours					
Viscosity at 50°	102	$\frac{108}{5,88}$	$\frac{110}{7,84}$	$\frac{113}{10,78}$	$\frac{114}{11,76}$
Rheological stability, %**	10,36	$\frac{9,32}{-10,04}$	$\frac{7,80}{-24,71}$	$\frac{7,13}{-31,18}$	$\frac{6,72}{-35,14}$
Density at 15°	920	$\frac{903}{-1,89}$	$\frac{883}{-4,02}$	$\frac{880}{-4,35}$	$\frac{875}{-4,89}$
Acid number, mgKOH/g [*]	0,75	$\frac{0,77}{2,67}$	$\frac{0,785}{4,67}$	$\frac{0,80}{6,67}$	$\frac{0,82}{9,33}$
Oil adding interval 10 hours					
Viscosity at 50°	102	$\frac{104}{1,96}$	$\frac{105}{2,94}$	$\frac{105}{2,94}$	$\frac{106}{3,92}$
Rheological stability, %**	10,36	$\frac{9,86}{-4,83}$	$\frac{9,44}{-8,88}$	$\frac{8,83}{-14,77}$	$\frac{8,64}{-16,60}$
Density at 15°	920	$\frac{912}{-0,87}$	$\frac{908}{-1,30}$	$\frac{905}{-1,63}$	$\frac{904}{-1,74}$
Acid number, mgKOH/g [*]	0,75	$\frac{0,755}{0,67}$	$\frac{0,76}{1,33}$	$\frac{0,765}{2,00}$	$\frac{0,77}{2,67}$

* – in the denominator, the percentage change in the parameter compared to the base value;

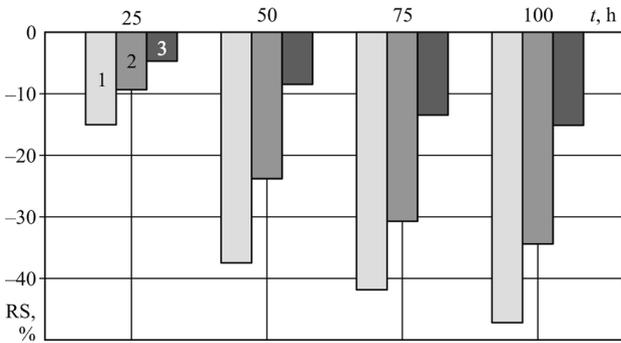
** – symbol «-» denotes a decrease in the parameter compared with the base value.



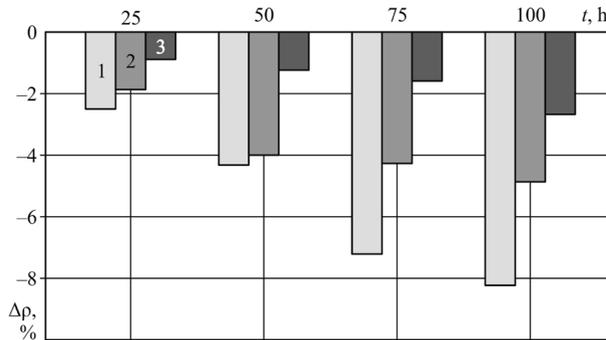
a)



b)



c)



d)

Fig. 1. Change in the characteristics of motor oils during operation at different intensities of oil addition:

- 1 – after 100 hours of operation; 2 - after 25 hours of operation;
- 3 - after 10 hours of operation;
- a) viscosity; b) acid number; c) rheological stability; d) density

The above results indicate a positive effect of increasing the intensity of adding oil to the oil system on its rheological and operational characteristics.

Better condition of the contact surfaces of diesel engines with a more intensive oil refill should also be noted. Thus, during routine inspections of diesel engines, it was found that the details of the cylinder group and the motion bearings of the “experimental” diesel engines have less carbon formation and surface roughness than the “control” diesel engine, which indicates a better lubrication process. Thus, a more frequent replenishment of the oil system not only maintains and restores the operational and rheological characteristics of the oil, but also contributes to a more reliable operation of marine diesel engines.

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SELECTION OF OPTIMAL OPERATING MODES OF EXHAUST GAS RECIRCULATION SYSTEM FOR MARINE LOW-SPEED DIESEL ENGINES

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Abstract. A method for meeting the Annex IV MARPOL requirements for the emission of nitrogen oxides from marine diesel engines using an exhaust gas recirculation system is considered. It has been experimentally established that for a 7UEC60LS Mitsubishi marine low-speed diesel engine in the exhaust gas bypass range of 3 ... 21%, a reduction of nitrogen oxide emissions by 3.9 ... 45.72% is ensured.

Keywords: marine low-speed diesel, concentration of nitrogen oxides in exhaust gases, Exhaust gas recirculation system

The main task of the operation of sea vessels (like any transport process) is to obtain commercial profit, which is achieved through the transportation of goods or passengers. At the same time, there is a need not only to ensure the safety, quality and timing of cargo delivery, as well as creating comfortable conditions for passengers to relax, but also to maintain the required environmental performance of the ship's power plant. Operation of sea and river vessels is carried out with strict observance of the requirements of the international convention MARPOL. The Annex IV Prevention of Air Pollution from Ships of this convention regulates the level of air pollution by harmful emissions contained in exhaust gases, including nitrogen oxides – NO_x .

Annex IV MARPOL establishes a tiered approach to NO_x emissions:

- Tier I limits the NO_x content of diesel emissions from ships built before 2011;
- Tier II - the standard for the content of NO_x in exhaust gases for the engines of ships built after January 1, 2011;
- Tier III - standard for the NO_x content in exhaust gases of engines installed on ships built after January 1, 2016 (Fig. 1) [1].

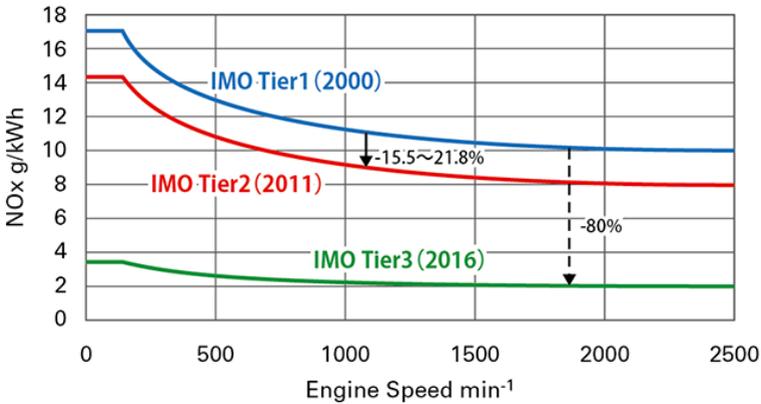


Fig. 1. MARPOL Annex IV emission requirements for marine diesel engines

Modern sea transport vessels comply with Tier II and Tier III levels. In this case, the NO_x emissions of the engines of Tier II level ships, depending on the nominal frequency of the diesel crankshaft p in rpm, should be:

- 14,4 g/(kW·h) – when $n < 130$ rpm;
- $44n^{-0.23}$ g/(kW·h) – when $130 < n < 2000$ rpm;
- 7,7 g/(kW·h) – when $n \geq 2000$ rpm.

Tier III engines must meet the following NOX requirements for diesel exhaust:

- 3,4 g/(kW·h) – when $n < 130$ rpm;
- $9n^{-0.2}$ g/(kW·h) – when $130 < n < 2000$ rpm;
- 2,0 g/(kW·h) – when $n \geq 2000$ rpm.

It should be noted that compliance with the requirements of the Tier II level is possible due to a change in the design of the engine. At the same time, achieving Tier III standards is impossible without the use of special technologies, which may include technologies for the catalytic reduction of nitrogen oxides to elemental nitrogen with the help of ammonia or urea additives, as well as exhaust gas recirculation or conversion to liquefied natural gas [2].

The use of the Selective Catalytic Reduction (SCR) system on ships contributes to the greatest reduction in the concentration of NOX in the exhaust gases, however (like the use of any complex technogenic system) requires maximum (compared with other methods of purification of exhaust gases) financial costs and (most important) is associated with increased danger to the ship's crew.

The use of liquefied natural gas (currently) is practiced on ships carrying it as cargo. However, even in such conditions, the diesel engines installed on these ships operate on a double gas-diesel cycle - in order to ensure the movement of the vessel in conditions of a return (ballast) transition (without a load of liquefied natural gas). In addition, the use of natural gas as the main fuel is associated with difficulties in replenishing its reserves (bunkering), which is only possible in certain seaports.

The initial use of the Exhaust gas recirculation (EGR) system was carried out in road transport for small-capacity gasoline engines, as well as diesel aircraft engines. Currently, this method of reducing NOX emissions has begun to be actively used in marine power plants. Structurally, the EGR system is implemented using an external duct connecting the exhaust manifold and the purge receiver. The combustion products passing through the recirculation system are cooled. This provides only a minimal increase in the specific volume of the mixture of fresh air pumped by the air compressor and the combustion products entering through the recirculation system. The effect of mixing the exhaust gases (low temperature combustion products) with a fresh air charge can be considered as diluting the fresh mixture with an inert gas, mainly consisting of carbon dioxide CO₂ and water vapor H₂O. These products have a high heat capacity and effectively remove heat from the reaction zone, reducing its temperature, which ensures a reduction in the emission of nitrogen oxides NOX with exhaust gases [3].

In the last decade, exhaust gas recirculation systems have been actively used in marine power engineering to reduce exhaust toxicity (mainly to reduce the concentration of nitrogen oxides NOX in the exhaust gases of marine diesel engines). These systems are equipped with both main ship engines transmitting power directly to the propeller and powerful auxiliary engines that provide energy to the ship's power station.

Mathematical modeling of gas exchange and combustion processes using the EGR system involves the need to take into account the complex phenomena of heat and mass transfer, while the results do not take into account the technical condition of both the diesel engine and its fuel equipment, and the EGR system. Therefore, it is advisable to improve the EGR system and select the most optimal modes of its operation on the basis of experimental data obtained directly from the operation of EGR systems already installed on the internal combustion engines of ships.

EGR systems are installed on a number of marine vessels and are characterized by relative simplicity of operation and maintenance, while the task of marine engineers is to determine the optimal recirculation mode that meets the requirements of Annex IV MARPOL while minimizing diesel power and minimizing fuel consumption [4].

A set of studies (as a result of which the influence of the exhaust gas recirculation process on the environmental, energy and economic performance of the internal combustion engine was determined) was carried out on a 7UEC60LS Mitsubishi marine low-speed diesel engine equipped with an ERG system.

The main characteristics of the diesel engine:

cylinder diameter – 600 mm;

piston stroke – 2400 mm;

number of cylinders – 7;

rated power – 12600 kW;

rotation speed, corresponding to the rated power – 82 rpm.

The schematic diagram of a Mitsubishi 7UEC60LS diesel engine with an ERG system is shown in Fig. 2.

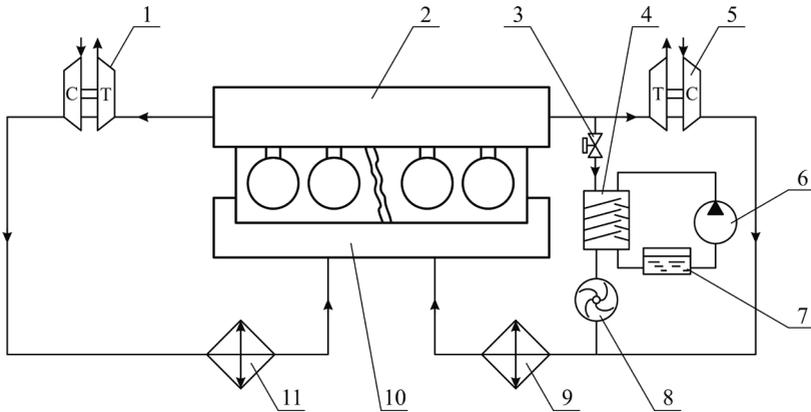


Fig. 2. Schematic diagram of the Mitsubishi 7UEC60LS marine diesel engine ERG system:

1, 5 - gas turbocharger; 2 - exhaust manifold; 3 - control valve exhaust gas recirculation system; 4 - scrubber; 6 - water pump; 7 - water tank;

8 - gas supercharger with electric drive; 9, 11 - charge air cooler; 10 - air receiver

The exhaust gases from the diesel cylinders enter the common exhaust manifold 2 and then to the gas turbochargers 1 and 5, after which they are discharged into the atmosphere through the exhaust pipe. Gas turbochargers take air from the engine room and, after compression, direct it through coolers 9 and 11 into the air (purge) receiver 10. Moreover, the gas tur-

bocharger 5 is equipped with an exhaust gas recirculation system, which consists of a control valve 3, a gas scrubber 4, a gas blower 8, and a water tanks 7 and a water pump 6. In the case of using an exhaust gas recirculation system, their amount is regulated by valve 3. The exhaust gases are cleaned and pre-cooled in a scrubber 4, after which by additional supercharger 8 they are mixed with air (coming from a gas turbocharger 5) and fed to a cooler 9, an air receiver 10 and then to the diesel cylinder. Gas supercharger 8 - a fan with a constant flow-through geometry.

Research was carried out on the following diesel operating conditions: $N_e=0,25N_{enom}$, $N_e=0,5N_{enom}$, $N_e=0,75N_{enom}$, $N_e=N_{enom}$ (where $N_{enom}=12600$ kW – nominal diesel power). Monitoring and regulation of the effective power value was carried out using the Doctor's ship diagnostic system, which ensures the accuracy of maintaining the value with a deviation of no more than $\pm 1,5\%$. In this case, at any of the modes, the diesel worked for at least 3 ... 5 hours, which ensured a steady thermal state and a constant range of measured parameters.

The degree of exhaust gas recirculation during the experiments varied in the range 0 ... 21% by changing the flow of gases returned to the diesel air receiver (using valve 3 controlled by the controller - Fig. 2).

The controlled parameters during the research were:

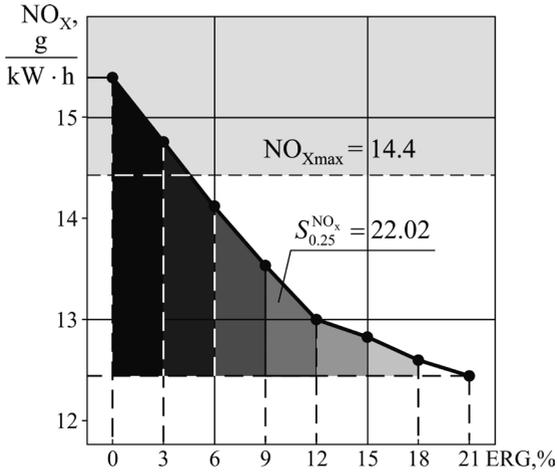
- concentration of nitrogen oxides NO_x in exhaust gases, $g\ NO_x/(kW\cdot h)$;
- specific fuel oil consumption (SFOC), $b_e, g/(kW\cdot h)$;
- diesel shaft rotation speed, n, rpm ;
- effective diesel power, N_e, kW .

The results of measuring NO_x emissions for different loads and degrees of EGR are shown in table 1.

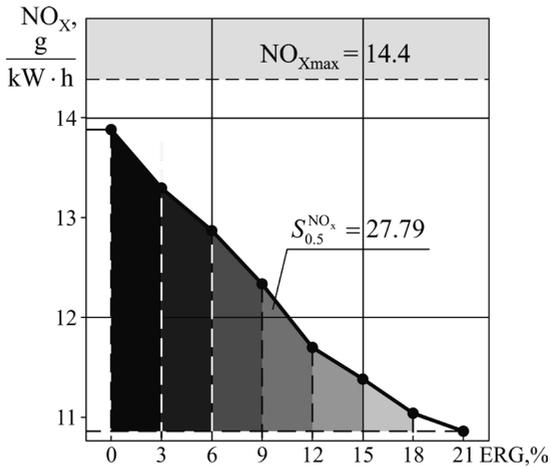
Table 1
Emission of $NO_x, g\ NO_x/(k\cdot W\cdot h)$

Load, %	EGR degree, %							
	0	3	6	9	12	15	18	21
25	15,35	14,73	14,16	13,52	13,04	12,83	12,65	12,49
50	13,86	13,32	12,84	12,55	11,68	11,35	11,03	10,82
75	11,67	11,02	10,16	9,21	8,52	8,16	7,88	7,64
100	8,18	7,86	7,19	6,58	6,03	5,38	4,82	4,44

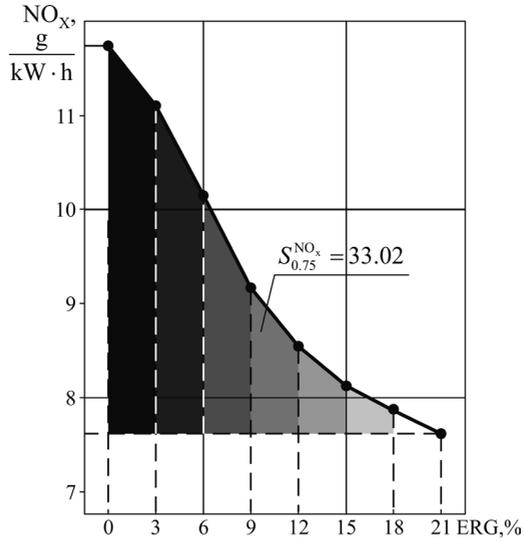
Graphical dependencies confirming a reduction in NO_x emissions when using the EGR system are shown in Fig. 3.



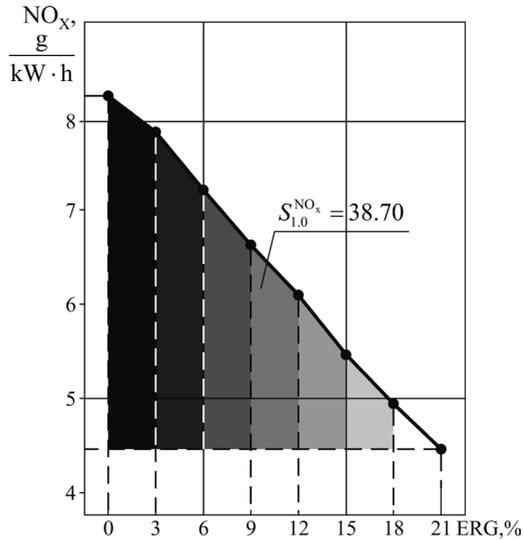
a)



b)



c)



d)

Fig. 3. Change in NO_x emission depending on the degree of EGR at various loads of 7UEC60LS Mitsubishi marine diesel:

$a - N_e = 0,25N_{enom}$; $b - N_e = 0,5N_{enom}$; $c - N_e = 0,75N_{enom}$; $d - N_e = N_{enom}$

The effectiveness of using the EWG system for each of the diesel engine operation modes can be determined by evaluating the area under the curve $NO_x = f(EGR)$. For the dependencies shown in fig. 3, this value is: $S_{0.25}^{NO_x} = 22.02$; $S_{0.5}^{NO_x} = 27.79$; $S_{0.75}^{NO_x} = 33.02$; $S_{1.0}^{NO_x} = 38.70$. Using an EGR system changes the stoichiometric ratio of fuel to air, which reduces the temperature of combustion and leads to a decrease in NO_x emissions. At the same time, the SFOC increases by 1.4 ... 2.88% (depending on the diesel load) and the effective diesel power decreases.

An analysis of the results of the studies allows the following conclusions.

1. For marine low-speed diesel engines, an EGR system can be used as a method to ensure compliance with Annex VI MARPOL requirements, in which part of the combustion products is returned to the diesel cylinder.

2. The use of an EGR system reduces NO_x emissions in exhaust gases. In the range of EGR changes of 3 ... 21% at a load of $0.25N_{enom}$ the reduction in NO_x emissions is 4.04...18.63%; at a load of $0.5N_{enom}$ – 3.90...21.93%; at a load of $0.75N_{enom}$ – 5.57...34.53%; at the nominal load – 3.91...45.72%.

3. Evaluation of the effectiveness of the exhaust gas bypass system to reduce NO_x emission can be carried out by determining the area according to the graph of the dependence $NO_x = f(EGR)$, while the larger the area, the greater the reduction in NO_x emission.

4. Use of an EGR system reduces the amount of air entering the diesel cylinder and increases SFOC by 1.4...2.88%.

5. The optimal operating modes of the EGR system, as one of the ways to meet the requirements of Annex VI MARPOL to limit NO_x emissions, should be selected by a comprehensive assessment of the following diesel operation parameters: the amount of NO_x in the exhaust gases, the increase in SFOC. As an optimal degree of EGR, values should be taken that correspond to a maximum decrease in NO_x emissions with a minimum increase in SFOC.

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DRILLING WASTE DISPOSAL TECHNOLOGY

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Abstract. A technology for the disposal of drilling waste was proposed, which provides inexpensive ecologically safe building material that binds pollutants in its structure, eliminating their migration into the environment.

Keywords: drilling waste, drilling fluids, drilling sludge, building materials, environmental protection.

The oil and gas sector of the Russian economy largely provides for the economic, defense and other types of national security of the country and at the same time is one of the most “environmentally dirty” sectors of the Russian economy. The main companies in this industry have a negative impact on the environment: during geological exploration, field development, production, transportation and processing of oil and gas, bringing products to consumers and selling them, decommissioning fields and facilities [1].

During the construction of oil and gas wells from the bowels of the earth from various geological formations, a significant amount of drilled rocks, or drilling sludge, is extracted. One of the most important tasks is to protect the environment from liquid and solid drilling waste (DW) generated during the operation of drilling equipment. They consist of drilling wastewater (DWW), depleted drilling solution (DDS) and drilling sludge, in some cases mixed in slurry pits. The main factors of the impact of DDS on the surrounding elements of the biocenosis are determined by the composition of the BR and the oil products and mineralized waters falling into it from the drilling area.

Most drilling waste consists of 30–45% of cuttings (clay and sand particles), 30–45% is DDS, and 10–20% is possible technological discharges of underground water and oil.

The article discusses the method of neutralizing drilling sludge in an optimal way with minimizing economic costs with subsequent use in construction and production of building materials [2].

The object of research was drilling waste obtained by drilling exploration wells in the gas-bearing formation of the Yamburgskoye oil and gas condensate field (YaNGCF) from a depth of 3400–3800 m.

Drilling waste includes: drilling wastewater (DWW), depleted drilling solution (DDS), drill sludge.

Fig. 1 is a roentgenogram of drilling sludge waste.

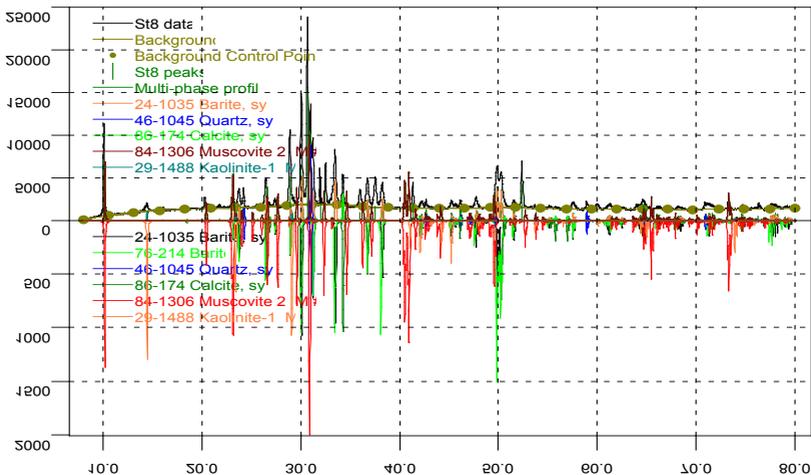


Fig. 1. Roentgenogram of drill sludge

Table 1 presents the chemical composition of drilling waste.

Table 1
Chemical compositions of drilling waste

Component	Percentage
Drilling wastewater	
Humidity (water)	96,45
Calcium chloride	0,02
Magnesium chloride	0,01
Sodium chloride	0,70
Sodium bicarbonate	0,03
Sodium sulfate	0,25
Ammonium chloride	0,39
Mechanical impurities	2,13
Depleted drilling solution	
Humidity (water)	74,96
Petroleum products	0,80
Sodium bicarbonate	0,07
Calcium chloride	1,99
Magnesium chloride	0,68
Clay	5,23
Sodium sulfate	0,78
Drilling sludge, including when drilling bore - wells	
Humidity (water)	18,74
Petroleum products	7,56
Magnesium bicarbonate	0,04
Calcium chloride	0,81
Sodium chloride	58,97
Sodium sulfate	1,02
Clay	12,86

Table 2 and in fig. 2 shows the particle size distribution of drilling sludge.

Table 2
Particle size distribution

Fraction Size, mm	1-0,25	0,25 - 0,05	0,05-0,01	0,01-0,005	0,005 – 0,001
Content, %	25,81	25,59	23,12	4,72	6,62

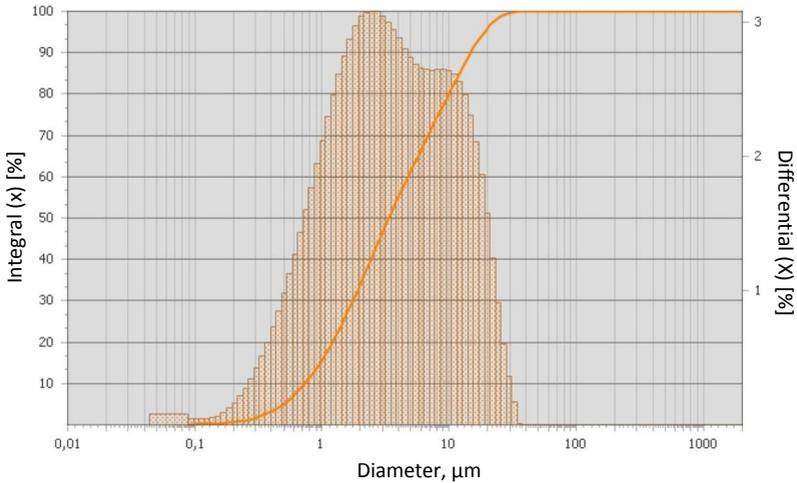


Fig. 2. Particle size distribution

To obtain samples of composite materials based on drilling sludge, clays of the Stary Oskol field were used, the chemical composition of which is shown in Table 3.

Table 3

The chemical composition of clay of Starooskolskoe deposits (wt.%)

SiO ₂	Al ₂ O ₃	K ₂ O ₃	Na ₂ O	MgO	CaO	Fe ₂ O ₃	TiO ₂
70,81	18,13	2,32	0,47	1,45	1,13	4,80	0,89

Fig. 3 presents samples obtained at various ratios of sludge and mineral additives.



a



b

Fig. 3 Samples Received

a) on water; b) on solution

Dependence of the strength of the samples on the composition of the mixture is presented in Fig. 4.

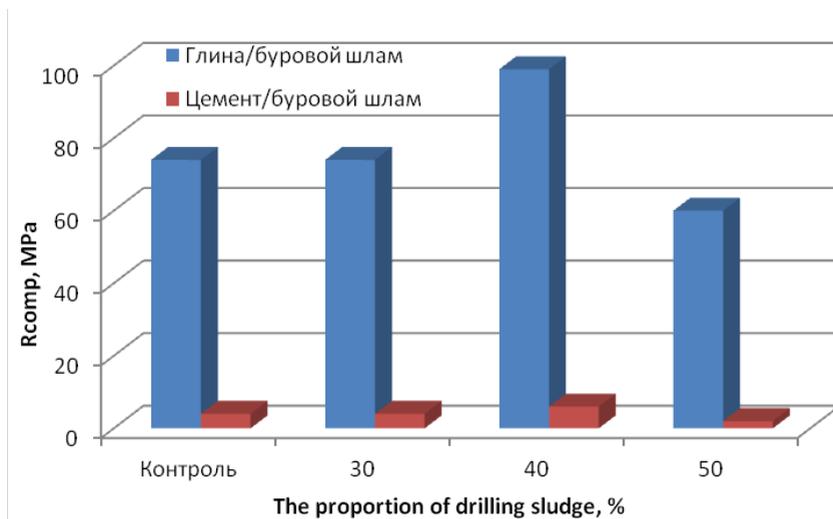


Fig. 4. Dependence of the compressive strength of samples on the composition of composites

The dependence of the attenuation coefficient of ionizing radiation on the mass fraction of drilling sludge in the clay/drilling sludge composite is shown in Fig. 5

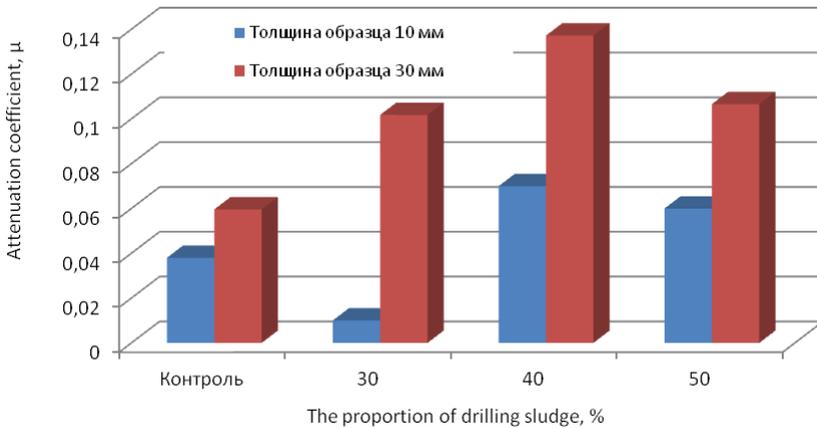


Fig. 5. The dependence of the attenuation coefficient on the mass fraction of drilling sludge in the composite

The data presented in fig. 4, 5 show that when the content of drilling sludge in the composite is 40%, the maximum values of the compressive strength of the composite are ensured. These results correlate with the data on the coefficient of half attenuation of the dose rate of ionizing radiation, which makes it possible to consider the ratio between clay raw materials and drilling sludge 60/40 as the optimal composition of a composite material with increased mechanical strength and the ability to attenuate the dose rate of ionizing radiation.

Nowadays, more complex and sophisticated methods for handling waste in the form of drilling sludge are emerging. The priority of their use in our case - is their use of them as secondary construction material resources, which is relevant for the modern, dynamically developing world. Of the technologies known today for processing drilling sludge, let us dwell on the development of a technological scheme for the disposal of drilling sludge in the production of building material.

The recommended scheme in our case consists of the following nodes:

- Storage and dosing. The bins built into the production line are used for temporary storage and continuous supply of used material.

- Transportation. It takes place with the help of a conveyor belt - it is a mechanical continuous vehicle for moving various materials over short distances. Conveyors of various types are used in all industries for loading, unloading and transportation of materials in the manufacturing process.

- Mixing. As the mixer, a twin-shaft mixer is selected. It is intended for mixing and moistening ceramic mixtures, previously crushed and cleaned of stony inclusions, and sets the requirements for mixers manufactured for the needs of the national economy and export.

- Shaping. The necessary equipment is selected depending on the particular case of the need to obtain the desired product.

The results of the development of a technological scheme for the disposal of drilling sludge in the production of building material are presented. The technological scheme of drilling waste disposal is shown in Fig. 6.

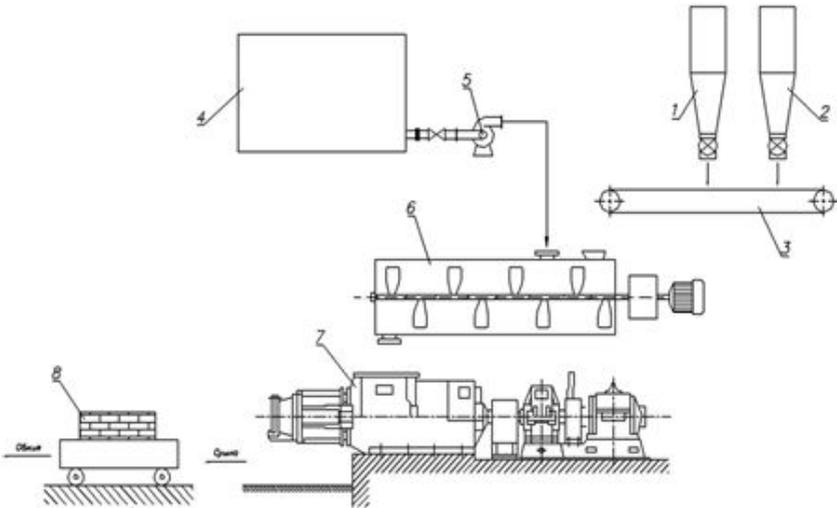


Fig. 6. The technological scheme of disposal of drilling waste

- 1- bunker with drilling sludge; 2 - a hopper with a mineral additive;
- 3 - belt conveyor; 4 - a hopper with a technological solution;
- 5- pump; 6 - paddle mixer; 7 - belt press; 8 - drying

The mixture for the fabrication building material was obtained from drilling waste, which was completely utilized.

Drilling sludge from hopper 1 enter the conveyor belt 3, where a mineral additive is fed from hopper 2 at the same time, as a sand-clay fraction was used in the ratio clay÷ drilling sludge = 60 ÷ 40 (%). Then the mixture

enters the twin-shaft mixer 6, where the technological solution with a specific gravity of 1.8 t/m³ in the amount of 20% is supplied from the hopper 4 by pump 5. The resulting mixture is fed to a belt press, where the brick is molded. Then the molded products are supplied for drying and firing.

Calculation and selection of equipment for the production line for the disposal of waste of drilling oil wells was conducted. The technological parameters of bunkers, belt conveyor, mixer (SP-32), belt press are calculated. Thus, a technological scheme has been developed that allows using the utilized waste from the drilling process in the proposed composition of the building material, namely, drilling sludge, and depleted technological solution.

Utilization of pre-treated drilling sludge can be used in the production of building materials - brick, expanded clay, small-sized building products, etc. [3].

The proposed method for the disposal of drilling waste increases environmental protection, improves the ecological situation in the territories of the fishing regions and at the same time allows the use of cheap components to obtain building material, excluding transportation costs for the delivery of these components to the place of production.

The increase in the use of such technogenic products having satisfactory technological characteristics and low cost for the needs of the construction industry will not only create a significant reserve of local mineral and energy resources, but also reduce the environmental burden.

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Scientific publication

International Conference
“Process Management and Scientific Developments”

Birmingham, United Kingdom
(Novotel Birmingham Centre, January 16, 2020)

Signed in print 22.01.2020 z. 60x84/16.
Ord. No. 82. Circulation of 500 copies.
Scientific publishing house Infinity, 2020.