



INTERNATIONAL CONFERENCE

**PROCESS  
MANAGEMENT AND  
SCIENTIFIC  
DEVELOPMENTS**



Birmingham  
United Kingdom



# **International Conference “Process Management and Scientific Developments”**

Birmingham, United Kingdom  
(Novotel Birmingham Centre, January 12, 2022)

Proceedings of the International Conference  
**"Process Management and Scientific Developments"**  
(Birmingham, United Kingdom, January 12, 2022).

M67

ISBN 978-5-905695-18-6

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

©Scientific publishing house Infinity, 2022  
©Group of authors, 2022

# CONTENTS

## ECONOMICS

What is Money Laundering and Terrorism Financing? Emelianova Ellina Sergeevna.....	9
Improvement of strategic management in the organization of primary health care Bolatkhan Nurlan Bolatkhanuly, Madraimov Nariman Bauyrzhanovich, Namazbayeva Zhanar Yertayevna.....	17

## JURISPRUDENCE

Changes to legislation in Finland in response to pandemic and transboundary emergencies in line with the Constitution and WHO guidelines Jilkine Vladimir Alekseevich.....	22
The problem of distinguishing between self-employment and labor legal relations Yyatsenko Anastasia Olegovna.....	29
The mechanism of inheritance by will with the establishment of a hereditary fund Sverdlova Yulia Valentinovna.....	37

## PEDAGOGICAL SCIENCES

Prevention of shoulder injuries by specialised exercises Barankhin Oleg Vladimirovich.....	42
---	----

## PHILOLOGICAL SCIENCES

Color perception in Russian and English on the example of linguacolor names of cars Sokolov Kirill Leonidovich.....	54
--	----

## PHILOSOPHICAL SCIENCES

The problem of the formation of new digital competencies of educational subjects in the context of digitalization Rubantcova Tamara Antonovna.....	62
---	----

## SOCIOLOGICAL SCIENCES

Creation of a media product on television - from idea to implementation Saparbekova Diana Sabyrovna.....	69
---	----

## **HISTORICAL SCIENCES**

Features of folding the ethnic map of Central Asia Syzykova Zhibek Saparbekovna, Gavrilina Elena Anatolyevna.....	74
On the issue of the legacy of the Soviet national policy in modern Central Asia Temirkhanova Ainagul Erkinovna.....	79

## **MEDICAL SCIENCES**

Correlation relationships between hemodynamic parameters and intensive care of severe burn toxemia in children under three years of age Muhitdinova Hura Nuritdinovna.....	84
Formation of a culture of balanced nutrition as a strategic direction for strengthening the health of Kazakhstan schoolchildren Baubekova Gulzakhira Juraevna, Tardzhibayeva Saule Kenesbekovna, Abdrakhmanova Damira Yerlanovna.....	93
The role of magnetic resonance imaging in the diagnosis of pleomorphic adenomas of the large salivary glands Bubnova Evgeniia Viktorovna.....	100
A new method for the treatment of schizophrenia with a composition of cytokines. As a result of a clinical experiment, a long-term 100% remission has been repeatedly obtained Voronov Alexandr Ivanovich, Mulka Siegfried Bernd.....	106
Analysis of pre-hospital drug treatment in geriatric patients with decompensation of chronic heart failure Podobed Ivan Vladimirovich, Butikova Elena Sergeevna, Rukavishnikov Aleksey Sergeevich, Prashchayeu Kirill Ivanovich.....	115

## **PHARMACEUTICAL SCIENCES**

Wound healing properties of flaxseed oil Kudryashova Nataliya Olegovna, Bogoslovskaya Olga Alexandrovna, Glushchenko Natalia Nikolayevna.....	129
---	-----

## **BIOLOGICAL SCIENCES**

Constant or periodic acoustic monitoring of the animal's body Tikhonenko Daniil Olegovich, Kalachev Aleksandr Viktorovich, Tikhonenko Zlata Olegovna.....	134
---	-----

## **EARTH SCIENCES**

Waste deposition in permafrost soils of the Arctic. Waste recycling in southern climates Sokolov Leonid Ivanovich, Sokolov Kirill Leonidovich.....	147
Waste hierarchy. Development of the world market for waste-to-energy production Sokolov Leonid Ivanovich, Sokolov Kirill Leonidovich.....	154
The current state of the small city reservoir of the Voronezh Central Park of the city of Voronezh Kaverina Natalia Viktorovna.....	163

## **AGRICULTURAL SCIENCES**

Rational use of paddlefish cutting products in combined food systems Antipova Lyudmila Vasilievna, Slobodyanik Valentina Sergeevna, Setkova Alena Yurievna.....	171
Comprehensive processing of rabbit products: new trends and prospects Antipova Lyudmila Vasilievna, Setkova Alena Yurievna, Boldyreva Marina Sergeevna.....	176

## **TECHNICAL SCIENCES**

Supercapacitor energy-accumulation system in conjunction with a traction converter for the accumulation of braking energy and its return during the acceleration of rail transport Lifshitz Mikhail Valerievich.....	182
Development of food products enriched with a complex of dietary supplements for children Vasyukova Anna Timofeevna, Krivoshtonok Konstantin Viktorovich, Akchurina Angelina Ildusovna, Bogonosova Irina Aleksandrovna, Bondarenko Yuri Viktorovich, Alekseeva Anna Alekseevna.....	192
The influence of heat treatment of meat products in a combi oven on their quality Vasyukova Anna Timofeevna, Edvars Rostislav Anatolyevich, Vasyukov Maksim Viktorovich, Lyubimova Kristina Vladimirovna, Shagarov Stanislav Nurievich.....	200
The study of beer's fullness flavor compounds Gribkova Irina Nikolayevna, Eliseev Mikhail Nikolayevich.....	207

The study of cherry wood anatomical structure to use it in the alcoholic beverages production Zakharov Maxim Alexandrovich, Zakharova Varvara Alexeevna, Dubinina Elena Vasilyevna.....	215
Analysis of spatio-temporal multidimensional vibration signals Ismailov Bahram Israfil.....	225
Quantitative and qualitative analysis of the terminological dictionary of automation of construction and production processes, lexical units included in it Lozhkin Nikolay Dmitrievich.....	233



DOI 10.34660/INF.2022.38.14.001

## WHAT IS MONEY LAUNDERING AND TERRORISM FINANCING?

**Emelianova Ellina Sergeevna**

Candidate of Economic Sciences, Senior Researcher

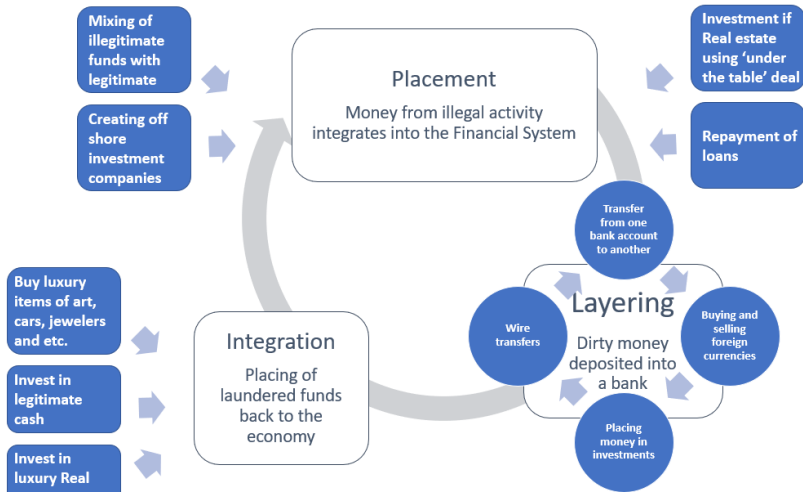
Scientific Laboratory "Research of the Monetary System and Analysis of Financial Markets",

Plekhanov Russian University of Economics

**Abstract.** The paper deals with international experience of money laundering and terrorist financing regulation. The purpose of the analysis was to identify products and services that are potentially vulnerable to money laundering and terrorist financing risks. To achieve this goal, it was necessary to analyze the best practices of regulators and considering virtual currencies as a potential source of disruption anti-money laundering. The article concludes with preventive measures to respond to the risks of money laundering and terrorist financing associated with virtual assets.

**Keywords:** anti-money laundering, potential penalties for money laundering, AML regulatory framework

Money laundering is the criminal practice of processing illegally obtained money by placing it into the legitimate financial system in order to make it appear that the funds were derived from legitimate activities or sources. Purpose – to channel these criminally-obtained gains into the financial system. Money launderer then can use legitimate financial devices and tools such as bank accounts, securities, cheques etc. Origin of funds for Money laundering comes from predicate crime with illegitimate funds. The stages of Money laundering are shown in Figure 1.



**Figure 1. The stages of Money laundering**

Money laundering is about trying to legitimize illegal funds, so there are patterns that indicate that money might not come from legal means:

- Large cash transactions;
- Large amount of transactions, which could indicate layering of transactions (splitting up of deposits to fall below reporting thresholds);
- Transactions connected with cash-heavy businesses, such as gambling;
- Transactions connected with jurisdictions that have a history of money laundering;
- Transactions connected with individuals or businesses that are potential money launderers.

What is terrorist financing? Central Bank of Ireland defined it as 'The offense of terrorist financing involves the provision, collection or receipt of funds with the intent or knowledge that the funds will be used to carry out an act of terrorism or any act intended to cause death or serious bodily injury' [1]. It also includes collecting or receiving funds intending that they be used or knowing that they will be used for the benefit of a terrorist group.

A set of Special Recommendations on terrorist financing was issued by Financial Action Task Force (FATF) in October 2001 (After the terrorist attacks of September 11, 2001).

The difference between money laundering and terrorist financing is presented in table 1.

**Table 1.**  
**Differences between money laundering and terrorist financing**

	<b>Money Laundering</b>	<b>Terrorist Financing</b>
Origin of Funds	Use of money derived from illicit proceeds and its purpose being to use dirty money to perform legitimate activities	Use of clean legal funds to commit a crime with a political background; hence such funds are not necessarily illegally obtained
Motive	Gain of profit	Ideological beliefs
Money trail	Process eventually ends up with the person(s) who initiated the proceedings (circular process)	Money is used to commit terrorist attacks and terrorist group activities (linear process) by many and in many cases unrelated to the initiator
Amount of Money	Involves large amounts of money which are usually structured	Uses small amounts which are unstructured

Similarities of money laundering and terrorist financing:

- The terrorists use methods similar to those of criminal organizations: structuring and purchase of monetary instruments, wire transfers, and use of debit or credit cards.
- Terrorists do not have a consistent and fixed way of performing their illegal activities, they keep an eye on the deficiencies of a country's controls in order to decide how and where to move their funds so as to avoid detection and investigation.
- Terrorists are attracted to countries with insufficient and weak Anti-Money Laundering/Combating the Financing of Terrorism controls since it is easier to move assets to finance terrorism through the financial system (i. e. banks) without being noticed.

European Union Level Policies and Regulations applicable to all EU MSs: Directive (EU) 2015/849 [2] and Directive (EU) of the European Parliament and of the Council on the prevention of the use of the financial system for the purposes of money laundering or terrorist financing (4 AMLD and 5 AMLD) [3], with upcoming 6 AMLD.

International Level – standards imposed by 39 countries – FATF Members. Financial Action Task Force (FATF) is an intergovernmental body established in 1989 by the Group of Seven nations. Objectives to ‘set standards and promote effective implementation of legal, regulatory and operational measures for combating money laundering, terrorist financing and other related threats to the integrity of the international financial system’ [4]. Role is a ‘policy making body’ which works to generate the neces-

sary political will to bring about national legislative and regulatory reforms in these areas [4]. Actions are monitoring countries' progress in implementing the FATF recommendations, identifying national level vulnerabilities, promoting the adoption and implementation of the FATF recommendations globally.

As per money laundering and terrorist financing law any person who knows or ought to have known that a property is the result of illegal activities and carries out activities to conceal or disguise the illicit origin of the funds, is committing a money laundering offence.

A person is subject to the following penalties:

- Person who knows: both penalties 14 years imprisonment and penalty up to 500 000 EUR
- Person who ought to have known: both penalties 5 years imprisonment and penalty up to 50 000 EUR
- Tipping-off: both penalties 2 years imprisonment and penalty up to 50 000 EUR
- Provision of false evidence: both penalties 2 years imprisonment and penalty up to 100 000 EUR

The European Commission (EC) published its most recent Supranational Risk Assessment in July 2019. This covers risk across the entire European Union. The Commission identified 47 products and services that are potentially vulnerable to money laundering and terrorist financing risks. These products and services fall under 11 sectors, including the 10 sectors or products identified by the 4th Anti-Money Laundering Directive [2]. The EC Supranational Risk Assessment also identified an additional category of products and services relevant for the risk assessment which includes virtual currencies. With regard to virtual currencies, the EC Supranational Risk Assessment took particular note of risks relating to anonymity as follows:

- Virtual Currencies - Risk to Financial Sector due to the use of new technologies (FinTech) that enable speedy and anonymous transactions with increasingly non-face-to-face business relationships, while bringing considerable benefits, may pose a higher risk if customer due diligence and transaction monitoring are not conducted efficiently across the delivery channel [5];
- Virtual Currencies – Horizontal Vulnerabilities Common to All Sectors – where there is potential to achieve anonymity in financial transactions through virtual currencies;
- Risks and Inherent Vulnerabilities.

The definition of Virtual asset service provider (VASP) was introduced

by FATF in 2018 [6], and initially included the following types of activities: VASP means any natural or legal person who is not covered elsewhere under the Recommendations, and as a business conducts one or more of the following activities or operations for or on behalf of another natural or legal person:

- i. exchange between virtual assets and fiat currencies;
- ii. exchange between one or more forms of virtual assets;
- iii. transfer<sup>1</sup> of virtual assets;
- iv. safekeeping and/or administration of virtual assets or instruments enabling control over virtual assets; and
- v. participation in and provision of financial services related to an issuer's offer and/or sale of a virtual asset.

The overall inherent risk for the VASP sector is high, although individual VASPs may have lesser or greater degrees of risk based on

- Specific products
- Specific activities and services
- Size and scope of operation
- Customer base
- Methods of transmission or delivery
- Risk control framework

Products – the range of Virtual asset products that a VASP's business encompasses will have significant impact – the risks above may have less applicability depending whether for example the VASP's products include privacy enhanced Virtual asset.

Activities and services – there are a wide range of VASP activities. Typically, VASPs operate on a non-face to face basis thus enabling non face to face business relationships. Where VASPs interact with fiat currencies, there are typically greater controls in light of the intersection with the more regulated financial system, and it is believed that the point of intersection or convertibility may tend to expose attempted bad actors. VASPs have also been shown to be susceptible to hacking or cybersecurity weaknesses around the world, and have also been used by operators to exploit customers of the VASPs by stealing and misappropriating their funds. VASPs may also engage in substantial off-chain transactions – that is, they receive and hold customer Virtual asset in commingled accounts as a result of which individual transactions and movements are not visible and transparent on the blockchain.

Size and scope of operation – VASPs can range from a small OTC brokerage serving institutional buyers and sellers or a single or small number of Virtual asset kiosk "ATMs" to a global exchange or trading platform

## Process Management and Scientific Developments

---

servicing millions of customers around the world, sending and receiving Virtual asset to and from numerous Virtual asset addresses, only some of which may be other VASPs. Some exchanges – most recently Binance and FTX – have acquired explosive numbers of customers in relatively short periods.

Customer base – VASP customer bases vary. These tend to be non face to face and involve large numbers of retail customers in multiple jurisdictions, many of which may not have imposed substantial regulation or supervision of Virtual asset and VASPs. However other VASPs may have smaller number of more targeted institutional customers. There has been well documented use of VASP exchanges by criminals associated with Silk Road, Liberty Reserve and ransomware, for example.

Method of Transmission and Delivery - VASPs may be exposed to money laundering and terrorist financing risk during the placement, layering or integration steps of money laundering and terrorist financing activities and schemes. Some VASPs may accept payment for Virtual asset in fiat currency, and may be exposed to risks associated with transmission of small or substantial amounts of fiat, depending on their policies. Operators of Virtual asset kiosks have exposure associated with receiving fiat cash in a physical transmission without staff present. Other VASPs may not accept fiat and may be involved in receiving or sending Virtual asset which is being transmitted or converted into other forms of Virtual asset. This may allow Virtual asset to move across blockchains, potentially obfuscating their path.

Risk control framework – VASPs are a relatively new form of entity and there are limited personnel with training, skills and experience in safeguarding against money laundering and terrorist financing risks. VASPs are subject to a wide range of regulatory frameworks and supervision, and in many jurisdictions the FATF 2019 Guidance and Travel Rule have not yet been implemented.

Preventive measures by VASPs are critical to responding to the money laundering and terrorist financing risks of Virtual asset as well as the VASP sector. The role of VASP supervisors is likewise critical in ensuring that VASPs are applying the controls and measures within their capabilities in proportion to the risks introduced by their activities. Preventive measures available to VASPs include:

- Customer due diligence proportionate to the risks at all stages of the relationship, including at time of customer onboarding, ongoing due diligence throughout the customer relationship lifecycle and of course transaction monitoring as well as wallet and Virtual asset source monitoring

utilising the transparency of the blockchain and the availability of professional crypto anti-money laundering database intelligence and transaction monitoring tools. In monitoring customers, market behaviors and risks, VASPs can avail themselves of the indicators set forth in the FATF Virtual Assets Red Flags report.

- Compliance with the Travel Rule. It should be noted however that in July 2021 FATF issued a Second Twelve Month Review report looking back on the previous year's progress with respect to the Travel Rule and other measures introduced for Virtual asset and VASPs under the 2018-2019 revisions to the FATF definitions and guidance in relation to virtual assets. This report found that the majority of reporting jurisdictions had not yet implemented key provisions of the 2019 amendments, most notably the Travel Rule, nor had they achieved the desired speed of progress in implementing VASP registration or licensing schemes.

- Awareness of regulatory differences or regulatory arbitrage – VASPs should be aware that VASPs in other jurisdictions may be subject to differing or lesser requirements, which may be due to differences in timing of implementation of FATF requirements as noted in the July 2021 FATF Second Twelve Month Review Report cited above. VASPs' policies and risk assessment of counterparties should take these differences into account.

- Utilization of commercially available technology tools for transaction monitoring, risk scoring and monitoring of wallet addresses and behaviors, and automated application of the FATF red flags per the FATF 2020 Red Flags report and other indicia of suspicious activity. Seven providers of such tools were identified.

- Filing of STRs and SARs is a critical element of VASP money laundering and terrorist financing compliance programs.

- Cooperation with competent authorities including supervisors, and where applicable Police and prosecutors.

### References

1. <https://www.centralbank.ie/regulation/anti-money-laundering-and-counteracting-the-financing-of-terrorism>
2. Directive (EU) 2015/849 of the European Parliament and of the Council of 20 May 2015

## Process Management and Scientific Developments

---

3. Directive (EU) 2018/843 of the European Parliament and of the Council of 30 May 2018 amending Directive (EU) 2015/849 on the prevention of the use of the financial system for the purposes of money laundering or terrorist financing, and amending Directives 2009/138/EC and 2013/36/EU

4. Guide for the Legislative Incorporation and Implementation of the Universal Anti-Terrorism Instruments. UNITED NATIONS OFFICE ON DRUGS AND CRIME. Vienna. New York, 2006, [https://www.unodc.org/documents/terrorism/Publications/Guide\\_Legislative\\_Incorporation\\_Implementation/English.pdf](https://www.unodc.org/documents/terrorism/Publications/Guide_Legislative_Incorporation_Implementation/English.pdf)

5. REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL on the assessment of the risk of money laundering and terrorist financing affecting the internal market and relating to cross-border activities, Brussels, 24.7.2019 [https://ec.europa.eu/info/sites/default/files/supranational\\_risk\\_assessment\\_of\\_the\\_money\\_laundering\\_and\\_terrorist\\_financing\\_risks\\_affecting\\_the\\_union.pdf](https://ec.europa.eu/info/sites/default/files/supranational_risk_assessment_of_the_money_laundering_and_terrorist_financing_risks_affecting_the_union.pdf)

6. U-Z - Financial Action Task Force (FATF) ([fatf-gafi.org](http://fatf-gafi.org))



DOI 10.34660/INF.2022.16.45.002

## IMPROVEMENT OF STRATEGIC MANAGEMENT IN THE ORGANIZATION OF PRIMARY HEALTH CARE

### **Bolatkhhan Nurlan Bolatkhanuly**

DBA doctoral student, MBA Master, healthcare organizer doctor  
Al-Farabi Kazakh National University, Almaty, Kazakhstan

### **Madraimov Nariman Bauyrzhanovich**

Master of Public Health, Doctoral student of Public Health, Maxillofacial surgeon  
Kazakh Medical University "KSPH" Almaty, Kazakhstan

### **Namazbayeva Zhanar Yertayevna**

Manager of economics and business, Doctoral student of Public Health,  
general practitioner  
Kazakh Medical University "KSPH" Almaty, Kazakhstan

**Annotation.** The transition to a market economy and the reform of the existing healthcare system have determined the importance of providing the population with affordable and high-quality medical care as an urgent medical, social, economic and political task.

Family medicine is a form of organization of primary health care (PHC), which is provided by a general practitioner (family doctor), providing individual primary and continuous care for individuals, families and the population, regardless of age, gender or type of disease.

**Keywords:** family medicine, primary health care (PHC), healthcare system, district pediatricians and therapists, general practitioner (GP).

Studies by foreign authors and the WHO global strategy "Health for All - the 21st Century" adopted show that one of the main directions of improving the health system, which makes it possible to increase the medical, social, and economic efficiency of the functioning of the public health system, is the creation of primary health care (PHC) based on the principles of general medical practice/family medicine [1]

Not a little time has passed since the beginning of the reform of the primary health care system. Nowadays, a sufficient number of family doctors have been trained in the system of postgraduate medical education, but the number of really working specialists cannot fully meet the needs of primary health care.

## Process Management and Scientific Developments

---

At the same time, despite the fact that the effectiveness of the work of a family doctor is gaining more and more evidence, the reform of primary health care in most territories of the republic is proceeding very slowly.

For example, in most polyclinics, district therapists continue to provide assistance to patients, and the family doctor's service does not fully function, outpatient counseling at the inpatient level is slowly developing, as well as the restructuring of the hospital network [2].

The slow pace of the introduction of family medicine observed in the development of healthcare at the regional level is caused by a number of reasons of a political, economic, legal, financial, organizational and psychological nature, among which it should be noted the imperfection of the legislative framework, undifferentiated remuneration, defects in training for family medicine, insufficient financing of the industry and therefore today in modern conditions of our republic the further development of the family doctor's service in the primary health care system has objective prerequisites.

Firstly, they are related to internal processes in our country, where the reform of the social sphere is at the forefront of economic and political processes;

Secondly, the introduction of the Institute of family Medicine into the healthcare system reflects the processes taking place in developed countries, where the so-called lifestyle diseases are rapidly growing and often already dominate, in the prevention and treatment of which family doctors, who are actively supported by the state, are achieving the greatest success [3].

The lack of accurate data on human resources, their placement, attrition, staff productivity, and the need for their services determined the first important step towards effective planning of human resources: the development of a comprehensive analysis of the situation with human resources [4].

**Table 1.**  
**Provision of primary health care doctors**

<i>Indicators of</i>	<b>Kazakhstan</b>	<b>Canada</b>	<b>England</b>	<b>USA</b>
<i>Availability of doctors GP for 10,000 us</i>	4 (including district therapists, pediatricians)	10	9	10
<i>Share of doctors working in primary care</i>	16%	51%	30%	32%

An important aspect is the ratio of personnel between individual units and medical care services, as well as between individual categories of medical workers. Thus, in the G10 countries (Canada, Germany, France, the USA, the UK, etc.), at first glance, the lower availability of medical personnel is "compensated" by a large proportion of HRH at the level of primary health care, i.e. a more pronounced preventive orientation of national health systems (in the USA - 40%, in the European Union - 50-57%, against 16% - in Kazakhstan).

The strategic Plan of the Ministry of Health provides for a gradual increase in the share of general practitioners in the structure of doctors working in PHC organizations. So, if in 2018 this figure was about 30% (2,456 people), then in 2020 the share of general practitioners will be 50%. This indicator is planned to be achieved both through the involvement of young specialists at this level, and through the re-profiling of district pediatricians and therapists. The share of the latter categories of workers in the primary sector will decrease to 24% by 2020 [5].

**Table 2.**  
**Dynamics of the number of GP, taking into account the target indicator until 2020**

Job titles	2018			2019			2020		
	Number of doctors per 10,000 Population	% of the ratio	Abs.	Number of doctors per 10,000 Population	% of the ratio	Abs.	Number of doctors per 10,000 Population	% of the ratio	Abs.
GP	1,66	29,72%	2456	2,59	46,19	4556	2,82	50,40	4976
District therapist	2,13	37,99	3139	1,50	26,76	2639	1,38	24,70	2439
District pediatrician	1,81	32,24	2668	1,51	27,05	2668	1,39	24,90	2458
<b>Total</b>	<b>4,8</b>	<b>100,0</b>	<b>8263</b>	<b>5,6</b>	<b>100,0</b>	<b>9863</b>	<b>5,6</b>	<b>100,0</b>	<b>9873</b>

### **Goal**

Development of theoretical foundations and a set of practical recommendations for the formation of infrastructural, organizational and managerial components of the SSM RK.

### **The practical significance is as follows:**

Primary health care is the basis of any health care system.

General (family) medicine is a long-term medical care for healthy and sick people, regardless of age and gender, in which special attention is paid to a comprehensive study of the individual, his family and social environment (German Society of General Practitioners).

General (family) medicine includes extensive servicing of all aspects of the patient's ill health, taking into account his living conditions, his ideas about illness and health, as well as his attitude to the treatment process: the desire to participate in it, passivity or avoidance of treatment [6].

The concept of the development of domestic healthcare approved by the Government of the Republic of Kazakhstan (the State Program for the Development of Healthcare of the Republic of Kazakhstan for 2020-2025", the Code of the Republic of Kazakhstan on the Health of the People and the Healthcare system) provides for the transformation of outpatient healthcare based on the introduction of general medical practice/family medicine at the level of primary health care [7].

### **Conclusions**

Based on the above, I suppose that in Kazakhstan there is a social need and a practical opportunity to develop an effective system of family medicine. Moreover, the development of this direction can become the main link in the search for the optimal model of Kazakhstan's healthcare, providing a variety of services provided on the basis of competition, expanding the choice for patients. As well as the improvement of personnel policy issues in the healthcare system is directly one of the factors affecting the quality management of medical services and the development of the healthcare system. It will contribute to the standardization of diagnostic and therapeutic procedures in outpatient therapeutic practice, will increase popularity among students at medical universities in the profession of a family doctor, a district doctor and a therapist in connection with the emergence of career and intellectual growth opportunities.

### References

1. J.Fry, 2000; B.Starfield, 1998; B.Abel-Smith, 2015.
2. Boerma I.G., Fleming D.M. The role of general practice in primary health care.-Copenhagen: WHO, EUROPE.-2016.-p.186.
3. McCallum A., Brommels M., Robinson R., Bergman S., Palu T. The impact of primary care our chasing in Europe, 2018.p.107-112.
4. Health Manager of the Republic of Kazakhstan - No. 4 (12) 2019.-pp. 22-24.
5. Boerma W.G., Dubois K.A. Mapping primary care across Europe // Saltman et.al., 2017. P. 25-29.
6. Stephen J. Zyzanski, Martha M. Gonzalez, Jonathan P. O'Neal, Rebecca S. Etz, Sarah R. Reves and Kurt C. Stange. The Annals of Family Medicine November 2021, 19 (6) 547-552; DOI: <https://doi.org/10.1370/afm.2697>
7. The State program of healthcare development of the Republic of Kazakhstan for 2020-2025".

**CHANGES TO LEGISLATION IN FINLAND IN RESPONSE TO  
PANDEMIC AND TRANSBOUNDARY EMERGENCIES IN LINE WITH  
THE CONSTITUTION AND WHO GUIDELINES**

**Jilkinen Vladimir Alekseevich**

Doctor of Law  
Kari Korhonen Law Company  
Helsinki, Finland

**Abstract.** The rapid spread of the number of cases of coronavirus infection in Finland, including the new omicron strain, required urgent measures and new amendments to the legislation. This article examines new legislative amendments, including an interim amendment to the Infectious Diseases Act, which aims to protect the life and health of clients and patients using social and medical services. Finland's desire to comply with the global integration processes in the context of the persisting risks of the spread of coronavirus infection has led to the digital harmonization of legislation and legal norms in accordance with the principles of international law. The amendments to Finnish legislation were based on the enshrined provisions of the Constitution and the existing international legal framework, taking into account the possibilities for responding to pandemic and transboundary emergencies in accordance with WHO guidelines.

The restrictive measures and powers to ensure the functioning of the social and health care system in Finland were based on the Emergency Situations Act and the Provisional Law in accordance with article 23 of the Constitution on Emergencies.

A major new reform of the Infectious Diseases Law is planned for 2022 and 2023, based on amendments to section 48 and discussions with medical and social departments.

**Keywords:** priority of the Constitution, EU legislation, coronavirus, new omicron strain, pandemic, emergency powers law.

The sharp increase in the number of diseases and the fight against the coronavirus in Finland required the introduction of urgent emergency measures. Thus, in March 2020, the Government of Finland adopted several decrees introducing the powers provided for by the Emergency Pre-

paredness Act. Additionally, on March 27, 2020, the Government issued a decree implementing amendments in accordance with section 118 of the Emergency Preparedness Act.

In the draft law HE 22/2021 submitted by the Government on March 8, 2021, the restrictions were intended to protect the right to life and freedom guaranteed by Article 7 (1) of the Constitution, as well as to ensure and promote the health of the population, enshrined in Article 19 of the Constitution<sup>1</sup>. The deliberations in the plenary session of Parliament were based on the reports of the Constitutional Committee regarding amendments to Articles 86, 88, 106 (1) and 107 of the Law and Emergencies.

On 28 May 2021, the Finnish Parliament approved a government proposal (HE 73/2021 vp) to amend section 58 d of the Infectious Diseases Act (1227/016)<sup>2</sup> and to temporarily amend the Infectious Diseases Act.

But despite the exceptional measures introduced by the Government in accordance with Article 3 (5) of the Emergency Situations Act, the number of cases in Finland increased rapidly and reached 1,024 COVID-19 cases on August 12, 2021. Almost all infections are attributed to the Indian "Delta" strain of the SARS-CoV-2 coronavirus, included by WHO in the group with the highest threat assessment Variants of Concern.

According to the Finnish Ministry of Health and Social Affairs, as of 15 August 2021, there were 116,996 cases and 1,002 reported coronavirus-related deaths<sup>3</sup>.

On October 13, 2021, a new bill was introduced to Parliament to introduce temporary amendments to the Infectious Diseases Act<sup>4</sup>. The explanatory note to the draft law, containing the subject of legislative regulation and outlining the concept of the proposed draft law, contained references to articles of the Finnish Constitution, including article 6 - on equality, the right to life and personal security guaranteed by article 7, freedom of movement guaranteed by article 9, protection of privacy protected by article 10, protection of property protected by article 15, cultural rights guaranteed by article 17, linguistic and Sami rights guaranteed by article 17, rights to work and freedom of doing business guaranteed by article 18, and obligations to protect fundamental rights stipulated in article 22 of the Constitution, as well as some international human rights obligations and provisions of the Law on Self-Government of the Aland Islands.

---

<sup>1</sup>The Constitution of Finland. 731/1999 English. URL: <https://oikeusministerio.fi/en/constitution-of-finland>.

<sup>2</sup>Tartuntatautilaki. 21.12.2016/1227.

<sup>3</sup>Department of Health and Human Development and Johns Hopkins University Indicators.

<sup>4</sup>HE 131/2021.

12.16.2021 The Department of Health and Social Development (THL) announced the detection of 34 cases of infection with the new omicron coronavirus strain in Finland. On December 15, 2021, a new maximum for coronavirus infections in Finland was set at 2,225 people, and on December 3, 2022, 17,047 infected people were recorded.

It is important to note that more than a third of those vaccinated with the Pfizer vaccine were twice vaccinated in Finland<sup>5</sup>.

According to a risk assessment published by the European Agency for Disease Prevention and Control (ECDC) on November 24, 2021, the rapid spread of the delta virus in the EU could lead to a significant increase in the spread of the disease at the turn of 2021-2022 if restrictive measures are not taken immediately<sup>6</sup>.

A new increase in reported cases of SARS-CoV-2 infected and admissions to intensive care units was observed in October and early November in most EU/EEA countries and was caused by the spread of Delta variant of COVID-19, B.1.617.2.

The rapid spread of the number of cases of coronavirus infection in Finland required urgent action and the introduction of new temporary amendments to the legislation.

So, on December 8, 2021, the Government submitted to the Parliament a bill on the adoption of a law on temporary amendments to the Law on Infectious Diseases, the purpose of which is to protect the life and health of clients and patients using social and medical services<sup>7</sup>. The bill provided for mandatory vaccination of healthcare workers, as well as the right of an employer in the field of social and medical services to access information from their employees about vaccinations or COVID-19 disease. The amendments were aimed at protecting the health and safety of social and medical workers, as well as improving the quality and accessibility of social and medical services. Under the bill, employers can require all doctors, nurses and service personnel to provide a certificate of vaccination or previous illness, or confirmation of PCR testing 2-3 times a week.

Note that in 2020, according to Statistics Finland, 402,000 people were

---

<sup>5</sup>Jyrki Hara. Jo yli kolmannes koronatartunnan saavista on täysin rokotettuja, mutta THL ei suunnittele rokotettujen ohjeistuksen muuttamista. 9.12.2021. <https://yle.fi/uutiset/3-12220922>.

<sup>6</sup>Assessment of the current SARS-CoV-2 epidemiological situation in the EU/EEA, projections for the end-of-year festive season and strategies for response, 17th update. <https://www.ecdc.europa.eu/en/publications-data/rapid-risk-assessment-sars-cov-2-situation-november-2021>.

<sup>7</sup>Hallituksen esitys HE 230/2021 vp. Hallituksen esitys eduskunnalle laiksi tartuntatautilain väliaikaisesta muuttamisesta.



employed in the social and health services sector, of which 132,000 were in the private sector and 268,000 in the public sector. Of these, 174,000 worked in health care, 95,000 in social welfare institutions and 133,000 in outpatient social services. The number of employees in these sectors in 2020 was 381,000. According to employment statistics in 2019, there were about 42,000 childcare workers, almost all of whom were employees. The statistics also include workers in preschool education, the number of employed also includes persons in positions that do not require social and health education.

According to the THL Department of Health and Social Development, about 55,000 health workers were not vaccinated against COVID-19 in the fall of 2021. In practice, patients at risk are treated in close contact in any social and medical institution, especially in nursing homes and in intensive care units. Therefore, the employer must assess, on a case-by-case basis, the risks of infection as a result of direct contact with persons infected with COVID-19 or who have previously been in close contact with an infected person.

The employer should ensure that work shifts are planned in a timely manner and that a sufficient number of qualified personnel are available in health departments. According to the explanatory note to the draft law, the employer must in all cases ensure that the safety of clients and patients is not jeopardized by the insufficient number of staff in the department.

The draft law regulation on the processing of personal data refers to the provision of section 5 of the Privacy Law, however the proposed amendment will differ in that the employer's right to process the employee's vaccine data does not require the employee's consent.

All costs associated with testing and health care at health facilities and vaccination points will be fully charged to extrabudgetary costs in 2021-2023.

The vaccination against COVID-19 in Finland is carried out in accordance with a government decree issued on the basis of section 45 of the Infectious Diseases Act. That is, the application of section 48 (1) of the Law on Infectious Diseases requires a separate interpretation of the mandatory vaccination against COVID-19 for medical and social personnel, as well as an assessment of the need for other possible legislative changes and a revision of the definition of persons responsible for vaccination against covid-19.

Simulations carried out by the Department of Health and Human Services have shown the effectiveness of pre-shift testing of social and health workers, which could be one way to reduce the risk of infection for clients and patients in health care or elderly care units.

Based on these studies, vaccination and regular 48- or 72-hour PCR tests are approximately equally effective in preventing the spread of infections.

During the preparation of the Draft Law, it was found that the proposed regulatory model in general provides better and more complete protection of fundamental human rights than the model based on vaccination and testing. The chosen model of vaccination of medical personnel and social workers will also be able to better protect the health of staff and increase their safety.

These legislative amendments will ensure the obligation of public authorities to take care of the protection of the labor force, as stipulated in Article 18 (1) of the Constitution<sup>8</sup> and fully comply with EU law.

For example, a COVID passport or testing is required for everyone applying to work in Italy, Greece, Cyprus, Latvia, Lithuania, France, Slovakia, Slovenia, and from 1.2.2022 in Austria. In Germany, on November 18, 2021, Bundestag approved amendments to the Law on Infectious Diseases, which allow you to go to the workplace vaccinated or with a negative test result no later than 24 hours. Bulgaria and Switzerland oblige unvaccinated workers to wear face masks. In many countries, unvaccinated workers are required to be tested regularly.

Belgium and Estonia have passed legislation requiring nurses and nurses to be vaccinated against COVID-19.

The leaders of the countries at a meeting of the European Council agreed to reduce the validity of vaccination certificates in the European Union from 12 to nine months.

On December 28, 2021, the Finnish Parliament approved an interim amendment to the infectious diseases law. The opposition "True Finns" and "Christian Democrats" voted against the adoption of the law. The interim amendment was approved with 107 votes "in favor" and 32 "against".

Deputies of the opposition "True Finns" and "Christian Democrats" voted against the law with a proposal to expand the use of rapid tests. At the same time, representatives of the ruling parties and the opposition Coalition Party stressed that this is not about forced vaccination.

Article 48 a § (30.12.2021/1378) "Protection of social and medical workers and patients from Covid-19" entered into force on 30.12.2021 and is temporarily valid in the period 1.1.2022 – 31.12.2022<sup>9</sup>. In the field of

<sup>8</sup>Finnish Constitution. § 18. Right to work and freedom of choice of occupation. Everyone has the right, in accordance with the law, to support himself on the income from his chosen work, profession or occupation. Public authorities are obliged to ensure labor protection.

<sup>9</sup>Tartuntatautilaki 21.12.2016/1227, lisätty 48 a § on väliaikaisesti voimassa 1.1.2022–31.12.2022.

social and medical services, only medical workers associated with the risk of close contact with Covid-19 patients, only vaccinated or with a previous illness for a period of not more than 6 months, can work.

A healthcare professional who is medically unable to get vaccinated may present a negative covid-19 test taken up to 72 hours before going to work.

With reference to section 5 (2) of the Labor Confidentiality Act, the employer has the right to receive and process information about the health status of an employee or student undergoing an internship in relation to compliance in the performance of the tasks specified in subsection 1 of section 1 of the Act.

The constitutional aspect of the issue was considered during the consideration of the draft law by the Government of Finland. The principle of equality before the law, enshrined in the Chapter of Fundamental Rights of the Constitution, is also applicable to legal entities, in particular, when regulation may indirectly affect the legal status of individuals. According to article 18 of the Constitution, everyone has the right to work and freedom to choose their occupation.

The amendments to the Law are based on the provisions of the articles of the Finnish Constitution and the existing international legal framework in terms of the ability to respond to pandemic and transboundary emergencies, as well as in accordance with WHO guidelines.

A major new reform of the Infectious Diseases Law is planned for 2022 and 2023, based on amendments to section 48 and discussions with medical and social departments.

According to the THL Department of Health and Social Development, on 24.12.2021, a record high number of new infections was registered in Finland - 3.223, and on 31.12.2021, THL already reported 9.616 new cases of coronavirus infection<sup>10</sup>.

On January 10, 2022, there were 328,847 cases and 1,656 deaths in Finland and a record 23,325 new cases with 18 deaths.

It is also important to note the special role of government assistance in supporting small and medium-sized businesses in Finland during a pandemic and restrictive measures. So, on 6.5.2021, the Government of Finland considered a draft law of amendments to the Law on temporary financial support for companies caught in a difficult economic situation caused by the COVID-19 pandemic, and within the framework of the norms approved by the European Commission on April 24, 2020<sup>11</sup>.

---

<sup>10</sup>Johns Hopkins University. <https://coronavirus.jhu.edu/region/finland>.

<sup>11</sup>European Commission decision SA.56995 is based on Article 107 (3) (b) of the Treaty

## **Process Management and Scientific Developments**

---

On December 20, 2021, the European Commission announced that the changes requested by Finland in the coronavirus support program are compatible with the EU internal market to support companies in the interest rate crisis. The amount of compensation was increased to 2.3 million euros.

The total amount paid by the Finnish Treasury to 40,011 companies from 7 July 2020 to 10 January 2022 amounted to 783,700,533 euros.

### **References**

1. The Constitution of Finland. 731/1999 English.
2. Tartuntatautilaki. 21.12.2016/1227.
3. Jyrki Hara. Jo yli kolmannes koronatartunnan saavista on täysin rokotettuja, mutta THL ei suunnittele rokotettujen ohjeistuksen muuttamista. 9.12.2021.
4. Hallituksen esitys HE 230/2021 vp. Hallituksen esitys eduskunnalle laiksi tartuntatautilain väliaikaisesta muuttamisesta.

DOI 10.34660/INF.2022.42.97.004

## THE PROBLEM OF DISTINGUISHING BETWEEN SELF-EMPLOYMENT AND LABOR RELATIONS

**Yyatsenko Anastasia Olegovna**

Candidate of Juridical Sciences, Associate Professor,  
Russian State University of Justice (Crimean Branch)  
Simferopol

**Abstract.** The article analyzes the legal nature of labor relations, and also names their features. A range of issues related to the legal status and characteristics of the self-employed person is outlined. The advantages and disadvantages of labor relations in comparison with the status of a self-employed person are considered. It is argued that today, in practice, the formal endowment of an individual with the status of a business entity is used to circumvent labor legislation. In addition, examples of disputes are given based on the generalization of judicial practice.

**Keywords:** self-employment, activities regulated by agreements of a civil nature, entrepreneurial activity, labor relations, employment contract.

The possibility was introduced for citizens to switch to a special tax regime, which is often called self-employment by Federal Law No. 422-FZ dated November 27, 2018 "On the experiment to establish a special tax regime "Professional income tax" in the Russian Federation. By October 1, 2020 this regime was introduced by all 85 constituent entities of the Russian Federation, including in the Republic of Crimea by the Law of the Republic of Crimea dated April 17, 2020 N 67-3PK/2020.

The specified tax regime allows to carry out taxation of the income of citizens from their independent professional activities by paying a single tax on professional income at a reduced rate, without the need to deduct income tax or income tax and without acquiring the status of an individual entrepreneur. Acquiring the status of self-employed provides citizens with the opportunity to "legalize" their income from self-employment and simplify the payment of taxes. In addition, this tool allows you to contribute automatically to the Compulsory Medical Insurance Fund. It is important to note that contributions to the Pension Fund of Russia are transferred only at will. If you do not write an application to the PFRF and do not pay

the due yourself, then the insurance period and pension points will not accumulate for a person.

Certain categories of persons who are not entitled to apply a special tax regime were established by the aforementioned Federal Law, as well as income that is not subject to taxation in this regime. Among the latter, incomes received in the framework of labor relations are also indicated. This is explained by the fact that the status of a self-employed person does not imply the emergence of labor relations, since there are no subjects of such a relationship - an employee and an employer, and the organization of the work of a self-employed person is carried out by him/her independently. In fact, it is possible to work simultaneously within the framework of an employment relationship and carry out activities as a self-employed person.

At the same time, the Russian Federation has developed a practice of concealing labor relations by registering them as civil law. It allows the employer to ignore the provisions of the Labor Code, in particular the provisions on the regulation of working hours, vacations, sick leave pay for a period of temporary disability, as well as a number of guarantees employee at the conclusion and termination of employment contracts. The introduction of the status of self-employed as a variant of the legal registration of the labor activity of individuals allowed legal entities to register new employees as self-employed and conclude civil law contracts with them, within the framework of which they can implement the labor function.

However, how to distinguish civil law relations from labor relations?

First, one should refer to the Recommendations of the International Labor Organization (ILO) on the employment relationship. Thus, in paragraph 9 of the said act, it is determined that an individual employment relationship should be determined on the basis of facts confirming the performance of work and the payment of remuneration to the employee, regardless of how this employment relationship is characterized in any other agreement to the contrary, of a contractual or other nature, which could be concluded between the parties<sup>1</sup>. The list of signs that are proposed by the ILO to determine the relationship as labor is indicated in paragraph 13 of this act and provides for<sup>2</sup>:

- performance of work in accordance with the instructions and under the control of the other party;
- integration of the employee into the organizational structure of the enterprise;

---

<sup>1</sup>Clause 9 of the Recommendation of the International Labor Organization "On labor relations" N 198 dated June 15, 2006 // Electronic resource, URL: <http://docs.cntd.ru/document/499076405>

<sup>2</sup>Art.13, Id.

- performance of work solely or mainly for the benefit of another person;
- personal performance of work;
- availability of an agreed schedule and workplace;
- the work has a certain duration and continuity;
- work requires the presence of an employee;
- work involves the provision of tools, materials and mechanisms by the party that ordered the work.

The ILO proposes to establish a presumption of the existence of an individual employment relationship as a tool for determining the existence of an employment relationship, in the event that the presence of one or more of its features is determined<sup>3</sup>.

These ILO recommendations define the main criteria for recognizing a relationship as an employment relationship. On their basis, states develop their own approaches to the definition of labor relations.

At the level of Russian national law, the most complete description of the signs of an employment relationship was given in the Resolution of the Plenum of the Supreme Court of the Russian Federation N 15 dated May 29, 2018. The Supreme Court singled out as characteristic signs of an employment relationship in this Resolution<sup>4</sup>:

- achievement by the parties of an agreement on the personal performance by the employee of a certain, predetermined labor function in the interests, under the control and management of the employer;
- subordination of the employee to the employer's internal labor regulations, work schedule (shift schedule);
- provision of working conditions by the employer;
- performance by an employee of a labor function for a fee;
- sustainable and stable nature of these relations;
- subordination and dependence of labor, the performance of work by an employee only on a certain specialty;
- qualifications or positions, the presence of additional guarantees to the employee, established by laws, other regulatory legal acts regulating labor relations;
- performance by the employee of work in accordance with the instructions of the employer;

---

<sup>3</sup>pp. "b" p. 11 of the Recommendation of the International Labor Organization "On labor relations" N 198 dated June 15, 2006 // Electronic resource, URL: <http://docs.cntd.ru/document/499076405>

<sup>4</sup>Paragraph 17 of the Decree of the Plenum of the Supreme Court of the Russian Federation N 15 dated May 29, 2018 "On the application by the courts of legislation regulating the labor of employees working for employers - individuals and employers - small businesses that are classified as micro-enterprises" // "Rossiyskaya Gazeta" N 121 dated June 6, 2018

## Process Management and Scientific Developments

---

- the integration of the employee into the organizational structure of the employer;
- recognition by the employer of such employee rights as weekly days off and annual leave;
- implementation of periodic payments to the employee, which are for him the only and (or) main source of income;
- provision of tools, materials and mechanisms by the employer.

Moreover, as the Supreme Court points out, in order to recognize the relationship as labor, the conclusion of an employment contract is not necessary. The Court may recognize an employment contract as concluded if the employee has started work with the knowledge or on behalf of the employer or his/her authorized representative. The date of conclusion of the employment contract in this case will be the date of the actual admission of the employee to work.<sup>5</sup>

It is also important to note the provision of Art. 19.1 of the Labor Code of the Russian Federation, which establishes that fatal doubts when considering by the Court disputes on the recognition of relations arising on the basis of a civil law contract as labor relations are interpreted in favor of the existence of labor relations.<sup>6</sup> This provision is in fact the presumption of an employment relationship, which was recommended in the ILO recommendations. Thus, there is a theoretical base that allows you to recognize any civil law relations as labor relations if they contain the signs established by the Supreme Court of the Russian Federation in Russian law now.

Let's consider how the courts approach to the issue of determining the nature of legal relations in practice. The easiest cases to prove are where the signs of an employment relationship are obvious. For example, in the decision in case No. 8-KG18-9 dated February 18, 2019, issued by the Supreme Court of the Russian Federation, employees indicate that they were actually allowed to work, an agreement was reached between them and the employer on the conditions and schedule of work and periodic cash payments. At the same time, an order was issued with respect to them, by which they were appointed to work and an agreement on liability was concluded. They were also issued work permits and passes. However, the courts of first instance and appellate instance dismissed their claim. At

---

<sup>5</sup>Clause 20 of the Decree of the Plenum of the Supreme Court of the Russian Federation N 15 dated May 29, 2018 "On the application by the courts of legislation regulating the labor of employees working for employers - individuals and employers - small businesses that are classified as micro-enterprises"// "Rossiyskaya Gazeta" N 121 dated June 6, 2018

<sup>6</sup>Art. 19.1 of the Labor Code of the Russian Federation of December 30, 2001 N 197-FZ // "Rossiyskaya Gazeta" N 256 dated December 31, 2001



the same time, the trial court, referring to the provision of Art. 5 of the Civil Procedure Code considered that the obligation to prove the fact of labor relations between the plaintiffs and the defendant lies with the plaintiffs. And due to the fact that there is no information about the adoption of personnel decisions by the organization in relation to the plaintiffs, no contracts were actually concluded, there were no entries in the work book, and there were no labor relations. In its decision, the Supreme Court refuted that position, pointing out that the formal absence of documents indicating labor relations does not mean their absence. The court pointed out that in order to protect the rights and legitimate interests of an employee as an economically weaker party in an employment relationship, when resolving labor disputes at the request of employees, the court should establish the existence or absence of an employment relationship between the employee and the employer. In this case, the Supreme Court of the Russian Federation sent the case back for a new trial. It is obvious that such a court decision is justified, because in the situation under consideration there are multiple signs identified in the Decree of the Plenum of the Armed Forces of the Russian Federation as indicating the existence of an employment relationship.

In another case No. 2-3213/2020, in which the decision was made on July 29, 2020<sup>7</sup>, the plaintiff got a job as a lawyer for the defendant and actually started working. He reported on the work done in a journal signed by the head. Subsequently, he was fired without concluding an employment contract due to the insufficient professional level of the plaintiff. At the same time, the defendant pointed out that, in accordance with the staff list, this organization does not have a position of a lawyer, their interests are represented by a third-party organization under a civil law contract. The plaintiff, according to their version, was invited to provide a one-time legal service, on which an oral agreement was reached. The plaintiff was issued a power of attorney to represent the interests of the defendant in court and the keys to one of the office premises. Subsequently, taking into account the fact that the plaintiff had insufficient experience in participating in arbitration courts, the defendant decided to "terminate cooperation". The defendant also pointed out that the plaintiff was registered with the tax authority as "self-employed", which excludes the possibility of drawing up an employment contract. Since in this case a person with the status of self-employed independently organizes his/her own labor activity, during which he/she does not have an employer, does not attract employees under employment contracts, as well as income from the use of property.

---

<sup>7</sup>The decision of the Promyshlenny District Court of Samara on case No. 2-3213/2020 dated 29.06.2020

The court pointed out that the position of a lawyer was not provided for in the defendant's organization, no personnel decisions were made in relation to the plaintiff, he/she was not familiar with LSI and internal labor regulations, there were no entries in the work book, there was no evidence of payroll or payment of insurance premiums. The court also took into account the fact that the plaintiff did not apply for the conclusion of an employment contract. In addition, the court points out that the power of attorney issued to the plaintiff, the rulings of the Arbitration Court indicating the participation of the plaintiff on behalf of the defendant. Moreover, the work log do not indicate that the plaintiff performed labor functions in the organization.

The court also considered that the fact that the plaintiff has the status of "self-employed" indicates that he/she conducts activities without an employer, is independently responsible for ensuring his/her working conditions and provides himself/herself with the tools, materials and equipment necessary for doing business. Accordingly, the Court of First Instance dismissed the claim. This decision raises questions, since the court mainly limited itself to the analysis of the formal features of the case, without analyzing the actual legal relations that have developed between the plaintiff and the defendant and without characterizing the features identified in the previously mentioned Plenum of the Supreme Court. Separately, it should be noted the position of the court that the status of self-employed may in any way prevent the conclusion of an employment contract and the emergence of labor relations. The status of self-employed is only a special tax regime for certain types of activities and does not prevent the emergence of labor relations. Moreover, as noted earlier, income from labor activities is not subject to this tax regime, so self-employment and labor activity should not contradict each other.

In addition, in certain areas of labor activity, employers began to abuse the status of self-employed by presenting themselves as only intermediaries between employees and clients. So the Tushinsky District Court of Moscow on June 26, 2019 ruled in case 2-2238/19<sup>8</sup>. It examined a case in which the plaintiff, who works as a taxi driver, entered into a civil contract with the defendant. At the same time, within the framework of the concluded agreement, the plaintiff agreed to work "with confirmation of the special tax regime" and acquired the status of self-employed, after which the defendant entered into a civil law contract with him, according to which

---

<sup>8</sup>Decision of the Tushinsky District Court of Moscow dated June 26, 2019. on case No. 2-2238/19 // Electronic resource, URL: <https://mos-gorsud.ru/mgs/cases/docs/content/544ee6c6-0a4c-41e3-a083-825f719f1a99>

the latter provides the plaintiff with access to the customer selection service. The court responded to the claims that the subject of the concluded contract was not the performance of a labor function. The subject of the agreement was access to the service for selecting clients and fulfillment by the defendant of the plaintiff's order to accept funds paid by third parties in favor of the plaintiff for services rendered by the plaintiff to such third parties. Under the terms of the contract, the defendant provides only information and information technology services and, on behalf of the plaintiff, accepts non-cash payments. The court noted that the funds transferred by the defendant to the plaintiff did not belong to the defendant, but were transferred directly from clients under an agency agreement. Thus, the court concluded that the parties did not reach an agreement on the personal performance by the plaintiff of a certain, predetermined labor function, and the contract does not at all imply the provision of any services to the defendant either free of charge or for a fee. It is also noted that the defendant does not determine the time of work of the plaintiff and did not provide him with material resources. Obviously, with such formulations, the court refused to satisfy the claims.

It is extremely important to note that such "agency" contracts, in theory, can be concluded in any enterprises engaged in the provision of services. De jure, the enterprise does not carry out labor activities, but only provides clients to self-employed "partners". And if before the introduction of the status of self-employed for such legal structures, a citizen had to open an individual entrepreneur, now anyone can become self-employed by submitting one application to the tax authority, or confirming consent with such an application under a civil contract.

Thus, the institution of self-employment is an innovative tool that made it possible to "legalize" income from small business activities of citizens without the need to open an individual entrepreneur. At the same time, due to the imperfection of labor legislation, it opens up access to dubious legal constructions, where the formal granting of the status of a business entity to an individual is used to ignore labor legislation.

### References

1. The Constitution of the Russian Federation (adopted at a national vote on December 12, 1993) (as amended) // "Rossiyskaya Gazeta" N 237 dated December 25, 1993.

2. Recommendation of the International Labor Organization "On labor relations" N 198 dated June 15, 2006 // Electronic resource, URL: <http://docs.cntd.ru/document/499076405>.

3. Labor Code of the Russian Federation N 197-FZ dated December 30, 2001 // "Rossiyskaya Gazeta" N 256 dated December 31, 2001.

4. Decrees of the Plenum of the Supreme Court of the Russian Federation N 15 dated May 29, 2018 "On the application by the courts of legislation regulating the labor of employees working for employers - individuals and employers - small businesses that are classified as micro-enterprises" // "Rossiyskaya Gazeta" N 121 dated June 6, 2018.

5. Determination of the Judicial Collegium for Civil Cases of the Supreme Court of the Russian Federation N 8-KG18-9 dated February 18, 2019 // Electronic resource, URL: <https://legalacts.ru/sud/opredelenie-sudebnoi-kollegii-po-grazhdanskim-delam-verkhovnogo-suda-rossiiskoi-federatsii-ot-18022019-n-8-kg18-9/>

6. Decision of the Promyshlenny District Court of Samara in case No. 2-3213/2020 dated June 29, 2020.

7. Decision of the Tushinsky District Court of Moscow dated June 26, 2019. on case No. 2-2238/19 // Electronic resource, URL: <https://mos-gorsud.ru/mgs/cases/docs/content/544ee6c6-0a4c-41e3-a083-825f719f1a99>

DOI 10.34660/INF.2022.56.51.005

## THE MECHANISM OF INHERITANCE OF ASSETS BY WILL WITH THE ESTABLISHMENT OF A HEREDITARY FUND

**Sverdlova Yulia Valentinovna**

Postgraduate

Rostov State University of Economics

**Abstract.** The article analyzes the state of the issue with the inheritance of assets by will with the establishment of a hereditary fund. The indicated fund is established by a notary upon the opening of the inheritance. The need for review is determined by the recent adoption of changes in legislation designed to introduce personal and inheritance funds into practice. The genesis of inheritance law is considered. Scientific publications of famous scientists on this topic are analyzed: B. M. Gongalo, O. E. Blinkova, V.P. Krashennikov, V. A. Kanashevsky, D. N. Karkhalev, A. N. Levushkin, N. Rasskazova, Yu. G. Tolstoy, T. V. Shatkovskaya, Yu. S. Kharitonova and others. in terms of guarantees for the execution of the will of the testator, subject to the preservation of the estate.

**Keywords:** Inheritance law, will, inheritance fund, beneficiary, testator.

### Introduction

The testator certainly evaluates the fate of his property after it falls into the hands of the heirs. Will they be able to continue the work of their parents, or will the property accumulated by labor and entrepreneurial talent go, as they say, to ashes. The answer to this question has long been in Western inheritance law. You don't have to look far for an example. For example, the Alfred Nobel Foundation. Or the inheritance fund of the province of Alberta in Canada, which accumulates income from the sale of hydrocarbons to support future generations. Both continental and insular law know such legal structures as inheritance fund and trust. The testator may, during his lifetime, bequeath his estate to be transferred to an inheritance fund or trust, both under a will and under an inheritance contract. In our country in Soviet times, this issue was not relevant. There were practically no citizens who had the means to create designated funds. At present, the issue of inheritance is constantly discussed in scientific articles by domestic experts in inheritance law. An appropriate legislative framework has been

created for the establishment of hereditary funds, which, however, caused a lively discussion. In May 2014, norms on funds were introduced into the Civil Code of Russia. In the current legislation, the Fund is recognized as a unitary non-profit organization that does not have membership of citizens or legal entities. It pursues charitable, cultural and other socially useful goals of its work. The Fund is established by individuals and (or) legal entities [article 123.17, 1]. It is interesting to note that the fund is not subject to reorganization, unless it is a pension fund [clauses 3 and 4 of article 123.17, 1]. A subspecies of the fund is an inheritance fund. It is created in pursuance of the testator's will. The fund is created from the property of the testator after his death [123.20-1, 1]. Legislative changes are coming this year. They are about funds. The article mentioned has been modified. It is now called: "Basic Provisions on the Public Benefit Fund". It is currently referred to as the Fund's Fundamental Provisions. Similar articles of the current Code [articles 123.20-1, 123.20-2 and 123.20-3, 1] will lose their force from 2022.03.01. A new version of the Code and its articles 123.20-4 - 123.20-7 will be put into effect. These articles will put into effect personal funds. The hereditary fund will be regulated by the article "Creation of the hereditary fund and its management" [article 123.20-8, 1]. The relevance of this topic is emphasized by the attention paid to it by leading lawyers, Doctors of Law B. M. Gongalo, O. E. Blinkov, V.P. Krashennikov, V. A. Kanashevsky, D. N. Karkhalev, A. N. Levushkin, N. Rasskazova, Yu. G. Tolstoy, T. V. Shatkovskaya, Yu. S. Kharitonova and others. What the authors of scientific works argue about, we will try to analyze in this article.

Research methods. Comparative legal analysis. The materials of the article are based on the works of leading scientists in the field of inheritance law.

Information base. Legal computer reference systems, scientific libraries, international Scopus and WoS databases.

### **Results**

As a result of a search for scientific papers on the topic, it was found that articles on a legal topic in the international Scopus and WoS databases occupy only about 2%. Some well-known universities do not index their collections of scientific papers in the IB, for example, Yale University. For this reason, there are few articles in these databases on the topic of inheritance. Another thing is domestic scientific libraries, which provide extensive databases of articles and monographs on the topic of interest to us. According to the results achieved in research on inheritance law, MSU, Kutafin MSLU, RLI MIA, RAL, SFU, RANEPa, RSUE, etc. are singled out. It is interesting to note the contradiction in inheritance: large fortunes ap-

peared in the Russian Federation back in the nineties, during the period called "seven bankers", and inheritance through the establishment of a fund appeared only from the date of 2018.09.01, when the corresponding law was adopted. The mission of the mentioned law is to ensure the functioning of assets without interruption [2]. This law was preceded by scientific discussion and discussion of shortcomings and gaps in the legislation. Professor M. A. Kartashev noted the shortcomings: "The legislator actually leaves the founder no choice but to rely on the conscientiousness of the notary and the highest executive body, which independently create the fund and manage it. Thus, the hereditary fund exists apart from the will of a particular founder" [4, p. 83]. There may be abuses in the activities of the executive body, since it is not accountable to the beneficiary.

A number of gaps in the legislative acts on hereditary funds were identified by Professor T. V. Shatkovskaya. She proposed to amend the legislation [5, p. 83].

Professor P. V. Krasheninnikov called for caution in borrowing foreign experience and warned that a will written in advance with the establishment of a fund could be in conflict with due to changes in legislation at the time of the testator's death [6, p. 26, 30]. The scientific thought did not stop there. P.V. Krasheninnikov stated the following fact the following year. Positive changes in inheritance law, initiated by well-known lawyers, have increased the legal field of testators in terms of drawing up testamentary dispositions with the creation of inheritance funds. A bill on lifetime inheritance funds was introduced.

The bill was adopted and is valid from 2021.07.01. [2], [3]. It should be noted that the draft of the new law takes into account the results of scientific discussion.

### **Discussion of the results**

Lawyer D. N. Karkalev, reflecting on the new realities that the law brought [2], shared his thoughts that "The undoubted advantage of the hereditary fund is the ability of wealthy people to save capital and develop their business". However, the fund "does not quite fit into the model of an ordinary non-profit organization that pursues generally useful and social goals" and the hereditary fund "...has the right to engage in entrepreneurial activity only in so far as it serves to achieve the goals for which it was created" [7]. Having considered judicial practice, Associate Professor Kazantseva A.E. came to the conclusion that the establishment of a hereditary fund avoids the bankruptcy of firms after the death of their founders [8]. Professor O.A. Makarova studied the new regulations in search of an answer to the question: can an inheritance fund become a shareholder in

companies owned by the testator, in the light of considering this fund as a potential shareholder. It turned out that it is necessary to clarify the legal status of the hereditary fund from the point of view of shareholders, equity holders, shareholders [9].

Professor Yu. S. Kharitonova noted the following. Individuals allegedly listed as fund managers must be notified. The notification must be made before the death of the testator, at the stage of agreeing on the details of the registration of the fund. The prospective manager must give his consent. The search for beneficiaries should be carried out by the hereditary fund. The notary should not look for them [10, p. 69].

Professor Yu. S. Kharitonova believes that inheritance law modernized by law [2] is characterized by dualism. On the one hand, this is the will of the founder to create a non-profit organization, on the other hand, it is a testamentary disposition. Therefore, the decision of the testator is subject to legitimation in the form of state registration [10].

### Conclusion

The mechanism of hereditary succession for the case of a will with the establishment of a hereditary fund has a number of problems in its implementation. Firstly, the testator bequeaths to create an inheritance fund not only for generally useful purposes, but also for the material support of the heirs. Their material support is provided by the profit from the commercial activities of the enterprises of the testator after his death. By law, the inheritance fund is a non-profit organization. Secondly, the testator cannot be sure of an adequate mechanism for the implementation of his will. The mechanism for the implementation of hereditary succession in this case has legislative gaps. Thirdly, the secrecy of the will does not allow obtaining the consent of the prospective fund managers. As a result of the study of the state of the regulatory framework of hereditary funds and publications on this topic, a conclusion was made about the need to improve it in terms of guarantees for the fulfillment of the will of the testator while unconditionally preserving and increasing the assets that make up the life of an entrepreneur and businessman.

### References

1. "Civil Code of the Russian Federation (part one)" dated 30.11.1994 N 51-FZ (06.28.2021 ed., as amended on 10.26.2021)
2. Federal Law N 287-FZ dated 01.07.2021 "On Amendments to Parts One and Three of the Civil Code of the Russian Federation".



3. Legal results of 2018 // Krashennikov P. V., Tolstoy Yu. G., Rasskazova et al. // Law.2019. №1.
4. Kartashov M.A. Inheritance fund: new Russian legislation and foreign experience // Modern law. 2017. № 10 (15). P.83-90.
5. Shatkovskaya, T.V. Hereditary funds in Russia: gaps in legislative regulation //T. V. Shatkovskaya, A. A. Zhukovskaya, P.V. Kochergin // Science and education: economy and economy; entrepreneurship; law and management. 2019. № 11 (114).
6. Krashennikov P., Mikheeva L., Rasskazova N. et al. Inheritance fund: an alternative to trusts in Russian law? // Law. 2018. № 9.
7. Karkhalev D. N. Inheritance fund in civil law // Agrarian and land law. 2020. №10 (190). P. 58-61.
8. Kazantseva A.E. Legal status of the beneficiaries of the hereditary fund // Notary. 2020. №7.
9. Makarova O. A. Inheritance of a business "on the go": how an inheritance fund can manage shares // Consultant
10. Kharitonova Yu.S. Inheritance fund in Russian law. – Moscow: Moscow State University, 2019. – 102 P.

## PREVENTION OF SHOULDER INJURIES BY SPECIALISED EXERCISES

**Barankhin Oleg Vladimirovich**

Postgraduate

Tyumen State University,

Tyumen, Russia

**Abstract.** In this paper, the problem of traumatism of the shoulder joint is consecrated, the main injuries of this segment among many sports are presented. Statistical data on the incidence of shoulder joint injuries in many sports are given. The instability of the glenohumoral muscles of the shoulder joint was the main reason for the high frequency of injuries in this segment among athletes in many sports. An argument is given about the relevance of the preparatory part of the lesson as a preventive measure. The effectiveness in reducing the number of injuries and pain syndromes when using mobilization exercises on the upper shoulder girdle, stabilization exercises, stretching exercises, and massage has been shown. Taking into account the main causes of injuries, practical recommendations have been developed and presented in the form of accessible specialized exercises.

**Keywords:** injury prevention, shoulder joint, specialized exercises.

### Relevance

The shoulder joint is a complex anatomical segment with a complex structure and no less complex diagnostic principles. In sports, the shoulder joint is certainly one of the most injured, on a par with the lumbar and knee joint.

The leading problems of the ligament-tendon apparatus are presented in the literature. The main options for diagnosing injuries of the glenohumoral muscles of the shoulder joint are also given.

Analyzing the topic of the shoulder joint from the point of view of sports injuries, representatives of team sports can be identified as frequent injuries. Referring to the work of Doyscher 2014, one can signal a large number of injuries of the shoulder joint among such sports as: rowing (33.9% among 13 respondents), gymnastics (35% among 48 respondents), martial arts (27% among 12 respondents), weightlifting (21% among 47 respondents) [2. 3-5p.] The percentages of injuries given by the author describe all

possible injuries of the shoulder joint.

However, the literature emphasizes the point that injuries in different sports are quite different from each other. Doyscher et al state that dislocations of the shoulder joint, dislocations of the acromioclavicular joint are the most common among contact sports (rugby, karate, judo, handball). There is also a high incidence of problems with injuries such as Bankart injury (anterior part of the glenoid labrum) and associated Hill-Sachs injury (with posterolateral depression of the humeral head). Shoulder rotator cuff tear, according to the authors, is a common manifestation among older athletes. When considering individual sports, with a constant load on the shoulder (strength sports, gymnastics, swimming), injuries of the rotator cuff of the shoulder, bursitis, impingement syndrome, are common [2. 3-5p.]

Referring to the work of Cheng 2020, one can trace a similar dynamics of shoulder joint injuries in relation to the movements used in crossfit: weightlifting lifts (30 cases out of 244 respondents), classical movements from powerlifting (22 cases out of 244 respondents), gymnastic exercises (24 cases out of 244 respondents ) and other crossfit movements (14 cases out of 244 respondents) [1. 3-4p.]

Also, an important fact sounds in the conclusions of the authors. To prevent injuries, the authors call for the use of the preparatory part of the lesson as one of the leading possible ways to prevent injuries. This emphasizes the relevance of this topic and creates prerequisites for further research.

**Target:** to develop practical recommendations in the form of affordable specialized exercises for the prevention of common shoulder joint injuries.

### **Materials and methods**

Studies with a high representativeness of the sample were taken for analysis. The studies included in the review had statistics in terms of the number of injuries per thousand hours of training, the total number of injuries presented in most sports. The works showing the effectiveness of the proposed methods of prevention had a period of conducting and monitoring the experimental group for more than 6 months. When analyzing biomedical and pedagogical literature, such important aspects of specialized exercises and preventive programs as total volume and intensity were taken into account. When drawing up practical recommendations, such criteria as the availability of specialized exercises, practical significance, volume and intensity, and the expediency of performing in one or another part of the lesson were taken into account.

### **Results and discussion**

Classifying injuries of the shoulder joint, one can cite the work of Kolber

M. J. 2010. The authors describe common problems among power sports, such as soft tissue damage, damage to the acromioclavicular joint, instability of the glenohumoral muscles of the joint [6. 1697-1698p.]

Authors involved in the prevention of problems with the shoulder joint closely study this segment, developing and testing the effectiveness of manual therapies and joint stability exercises. In [3. 5-6p.] it was found that a combined approach in rehabilitation, consisting of manual therapy (stretching exercises aimed at increasing the range of motion in adduction, abduction, external, internal rotation) and stabilization exercises (strength and stretching exercises aimed at strengthening the rotator cuff of the shoulder, levator scapula, abductor muscles) have a positive effect in reducing pain. After six weeks of the study, the respondents had a decrease in the number of pain syndromes and improved mobility in the shoulder joint (greater angles of movement in the joint).

Reviewing the work of Lanzi J. T. Et. al. The authors bring us to the general problem of glenohumoral muscle instability among athletes in most sports. The data of a large number of athletes involved in various sports (wrestling, basketball, football, lacrosse, rugby, tennis) were studied. Among all 1348 injuries, 633 of them were associated with instability of the glenohumoral muscles. Injury of the anterior surface of the shoulder is the most common, 457 cases among all cases associated with instability in the anterior surface of the shoulder joint. Of the 633 injuries, posterior shoulder instability was also a common injury among 113 athletes (18%).

The authors distinguish single combat athletes (34.15 injuries per 1000 cases per year), women's and men's rugby teams (14.35 per 1000; 10.31 per 1000, respectively), as one of the most traumatic sports with instability of the shoulder joint among intercollegiate sports. Having studied separately intra-school sports, such as: grappling, American football, basketball, football. The most frequently injured sport in this category was football (2.79 per 1000).

Men who participate in intercollegiate sports are at an increased risk of developing posterior shoulder instability. Wrestling, rugby and football are the sports that pose the greatest risk of injury according to the authors [7. 6p.]

The authors put forward the thesis that there is a very high probability that in order to return to the previous functional level of the shoulder joint, athletes need surgical treatment.

We agree with the opinion of the authors that for more complex and irreversible cases, surgical intervention is necessary. However, we note that many athletes are at an early level of development of the disease. Thus, reducing the number of relapses, reducing pain syndromes, reliev-

ing inflammation and increasing mobility are important measures to prevent future problems.

Analyzing works on such a modern sport as CrossFit, Weisenthal et al. provide injury statistics among those involved in CrossFit. The number of injuries of the shoulder joints in gymnastic movements (pull-ups on the bar, grouping socks to the bar, power outs on the rings, walking on hands, push-ups in the handstand) according to this work has a high percentage [8. 5-6p.]

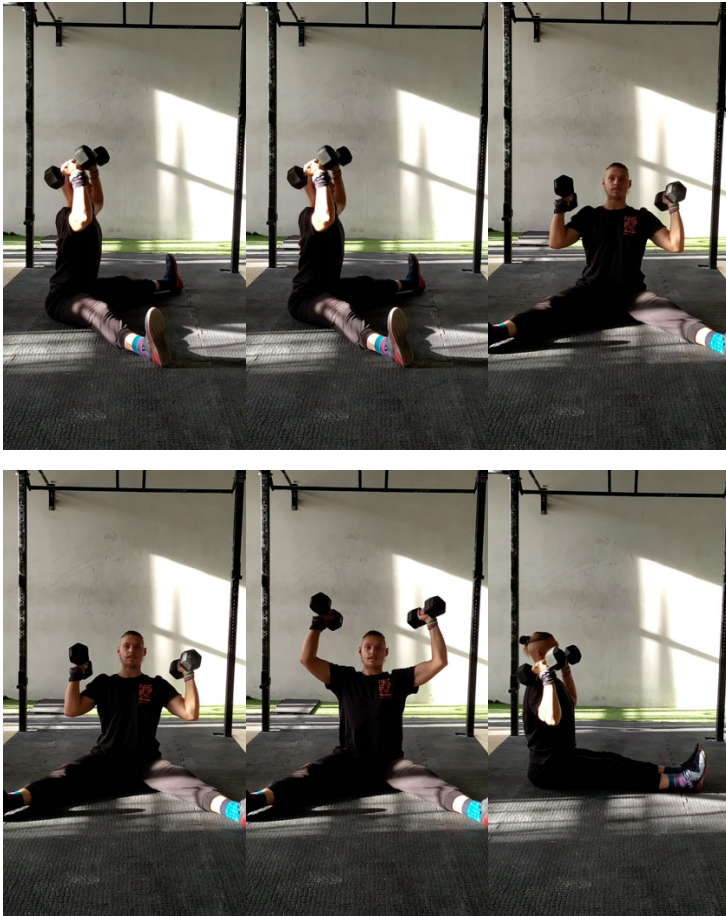
Hak et al, who studied the topic of injury prevalence, recorded that 73.5% of 132 respondents were injured while exercising in the CrossFit program. The authors also cite the similarity of injuries between crossfit and weightlifting (3.3 injuries per 1000 hours of training), gymnastics (3.1 injuries per 1000 hours of training), rugby (3 injuries per 1000 hours of training). The authors identified more traumatic sports, in their opinion: American football (140 injuries per 1000 hours of training), ice hockey (78.4 injuries per 1000 hours of training), football had a higher injury rate than weightlifting and crossfit (4.22 injuries per 1000 hours of training) [4. 7-9p.]

Note that both authors, Weisenthal (25%) and Hak (31.8%) in their studies point to a high percentage of injuries of the shoulder joint. The authors point to one of the main reasons: the performance of exercises from weightlifting, gymnastics against the background of muscle fatigue. Accordingly, the glenohumeral muscles take a high load when performing the above-described gymnastic movements, exercises with a barbell above the head. Thus, Hak et al use the term "CrossFit shoulder" to describe the high degree of overload of the glenohumeral muscles of the shoulder joint from the high range of motion in the CrossFit training program.

Looking at preventive techniques for the shoulder joint, we can highlight the work of Jurdado-García 2021 et al., who are studying the effects of massage, stretching exercises on the soft tissues of the shoulder joint. Massage aids were used in the form of metal massage scrapers on the muscular apparatus of the upper, lower spine of the scapula, back of the shoulder, trapezius muscles, rhomboid muscles, and a number of stretching post-isometric exercises for the shoulder joint were also used. The use of this massage and a set of stretching exercises in the horizontal axis of joint movement showed effectiveness relative to the control group. However, we note that both groups (control and experimental) had a small sample (10 and 11 people, respectively). It is important to note that these techniques were performed before each training session, in the preparatory part of the session, which makes it relevant for studying injury prevention in the preparatory part of the training [5. 6-8p.].

We can highlight the clear problem of the high frequency of shoulder injuries. Many authors characterize this problem as "chronic instability of the glenohumeral muscles of the shoulder joint". Data analysis showed that the problem has its place both among contact and non-contact sports. We offer practical recommendations for most sports. Specialized exercises are aimed at activating the glenohumeral muscles, increasing mobility, and improving the stability of the shoulder joint.

Presses sitting on the floor in a wide setting of legs with dumbbells.



**Figure 1. Wide stance dumbbell floor presses**

Performing this exercise can have a positive effect on the stability and mobility of the thoracic region during extreme reverse shoulder abduction in strength sports. This exercise is also possible to activate the muscles of the shoulder blades, rhomboid, trapezius muscles. It is necessary to perform the exercise with low weight, controlling the concentric and eccentric phase of the movement by squeezing the dumbbells to the extreme reverse position of the shoulder. Volume and intensity: 2-3 sets, 8-10 reps. Rest between sets for at least 90 seconds. If it is impossible to perform this movement due to lack of mobility in the thoracic, lumbar, lower limbs, it is possible to perform it while sitting on a hill, with the knee joints fully extended.

Presses sitting on the floor in a narrow setting of legs with dumbbells.



**Figure 2. Presses sitting on the floor with dumbbells in a narrow setting of the legs**

## Process Management and Scientific Developments

---

Unlike bench presses while sitting in a wide setting of the legs, this option loads the thoracic and lumbar region more during the extreme reverse abduction. This exercise requires a slightly greater mobility of the thoracic region, the shoulder joint. It is necessary to perform the exercise with low weight, controlling the concentric and eccentric phase of the movement. Volume and intensity: 2-3 sets, 8-10 reps. Rest between sets for at least 90 seconds.

Shoulder rotations can also be effective in activating the glenohumoral muscles of the shoulder joint. An example of an exercise that engages the abductor muscles of the shoulder joint, we offer a rotation of the body, with a shoulder lift up back with a rubber band.





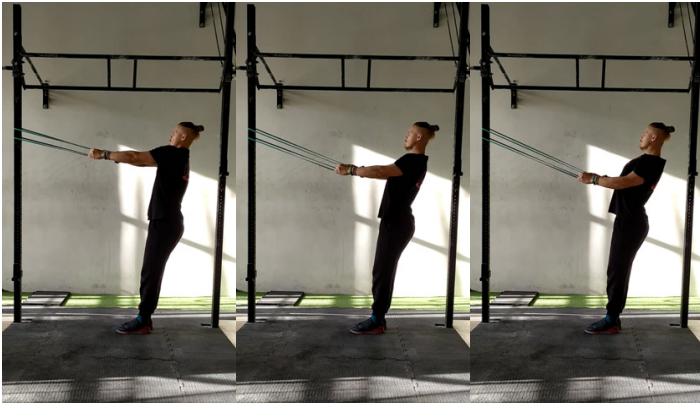


**Figure 3. Abduction with pronation of the shoulder joint with a rubber band**

This exercise can be performed in three different planes, influencing with varying degrees on a larger number of stabilizer muscles, abducting and stabilizing muscles of the shoulder joint. Volume and intensity: perform 2-3 sets of 12-15 repetitions per shoulder with a light or medium tourniquet without sudden movements, with a rest of at least 90 seconds.

Another of the most important skills that characterizes the stability of the shoulder joint is the control of the position of the shoulder blades.





**Figure 4. Reduction of the shoulder blades with a neutral position of the shoulder with a rubber band**

The reduction of the shoulder blades with the rubber band will have the positive effect of improving the control of the movement of the shoulder blades in the neutral position of the shoulder joint. It is necessary to monitor the minimum flexion in the shoulder joint and the full symmetrical work of the shoulder blades. Volume and intensity: perform 2-3 sets of 12-15 repetitions with a light or medium tourniquet without sudden movements, with a rest of at least 90 seconds.

With extreme reverse shoulder abduction, the control of the shoulder blades is also important, which is realized when working with rubber bands in this movement.



**Figure 5. Extreme reverse lead with a rubber band**

This exercise activates the abductor scapular muscles. The movement occurs on straight arms mainly due to shoulder abduction, which activates the trapezius muscles, neck muscles, muscles that lift the scapula, complexly affecting the stabilizers in this position. Pay attention to the full and symmetrical work of the shoulder blades in the extreme reverse position of the shoulder. Volume and intensity: perform 2-3 sets of 8-10 repetitions with a tourniquet that is light in rigidity without sudden movements, with a pause at the top of the movement with a rest of at least 90 seconds.



**Figure 6. Extreme reverse abduction with a rubber band (one hand)**

This exercise is similar to the one above, performed with both hands at the same time. However, shoulder abduction occurs with one hand, which allows the movement to be performed in a more controlled manner. When performing a movement with one hand, it is possible to register possible imbalances in the work of the muscles that take the shoulder up and back (the top of the trapezius muscles, the supraspinatus muscles of the scapula, the rhomboid muscles of the back). It is important to monitor the full range of motion in the extreme reverse abduction, the symmetry of the movements of both shoulders. Volume and intensity: perform 2-3 sets of 8-10 repetitions for each shoulder with a tourniquet that is light in rigidity without sudden movements, with a rest of at least 90 seconds.

### **Conclusions**

1. The problem of a high frequency of shoulder joint injuries among those involved in various sports is shown. The high frequency of injuries

is associated with instability of the glenohumoral muscles of the shoulder joint, according to many authors.

2. The effectiveness of reducing the number of injuries, reducing pain syndromes when using mobilization exercises on the upper shoulder girdle, stabilization exercises, stretching exercises, massage is shown.

3. Practical recommendations are presented to improve mobility, stability of the shoulder joint in extreme reverse abduction. We can recommend these exercises for many sports, both as a preparatory part of the lesson, and in a separate training session as a recreational tool.

### References

1. Cheng T. T. J. Injury Incidence, Patterns, and Risk Factors in Functional Training Athletes in an Asian Population. / T. T. J. Cheng, A. Mansor, Yi. Z. Lim, M. T. H. Parash // *The Orthopaedic Journal of Sports Medicine*. - 2020. – V. 8, Iss. 10. DOI: 10.1177/2325967120957412.

2. Doyscher R. Acute and overuse injuries of the shoulder in sports. / R. Doyscher, K. Kraus, B. Finke, M. Scheibel // *Der Orthopäde*. V. 43, Iss. 3. 202–208p. doi:10.1007/s00132-013-2141-x

3. Fathollahnejad K. The effect of manual therapy and stabilizing exercises on forward head and rounded shoulder postures: a six-week intervention with a one-month follow-up study. / K. Fathollahnejad, A. Letafatkar, M. Hadadnezhad // *BMC Musculoskeletal Disorders*. 2019. V. 20, Iss. 1. <https://doi.org/10.1186/s12891-019-2438-y>.

4. Hak P. T. The nature and prevalence of injury during CrossFit training / P. T. Hak, E. Hodzovic, B. Hickey // [published online ahead of print November 22, 2013]. *J Strength Cond Res*. PubMed doi:10.1519/JSC.0000000000000318

5. Jurdado-García M. Soft Tissue Mobilization and Stretching for Shoulder in CrossFitters: A Randomized Pilot Study. / M. Jurdado-García, R. Cuesta-Barruso // *Int. J. Environ. Res. Public Health* 2021, 18, 575. <https://doi.org/10.3390/ijerph18020575>

6. Kolber M. J. et al. Shoulder injuries attributed to resistance training: a brief review. / M. J. Kolber, K. S. Beekhuizen, M. S. Cheng // *J Strength Cond Res*. 2010 V. 24, Iss. 6. 1696-704P. doi:10.1519/JSC.0b013e3181dc4330.

7. Lanzi J. T. Epidemiology of Posterior Glenohumeral Instability in a Young Athletic Population. / J. T. Lanzi, P. J. Chandler, K. L. Cameron, J. M. Bader, B. D. Owens. // *The American Journal of Sports Medicine*. V. 45, Iss. 14, 3315–3321P. doi:10.1177/0363546517725067.

8. Weisenthal B. M. Injury rate and patterns among CrossFit athletes. / B. M. Weisenthal, C. A. Beck, M. D. Maloney, K. E. DeHave, B. D. Giordano // Am J Sports Med. 2014 – 2 - 4 doi:2325967114531177. PubMed doi:10.1177/ 2325967114531177

## COLOR PERCEPTION IN RUSSIAN AND ENGLISH ON THE EXAMPLE OF LINGUACOLOR NAMES OF CARS

**Sokolov Kirill Leonidovich**

Student

Vologda State University

**Abstract.** The similarities and differences are revealed on the basis of the structural-semantic analysis of the functioning of the color designation of cars in the phraseological units of the two languages. The characteristics of the obtained color designations are given, the structure and semantics of the analyzed object color names are determined. The most typical ways of interpreting English color names of cars into Russian, based on the use of lexicographic sources, are described.

**Keywords:** semantics, lingua color, perception.

The study of the lexical-semantic group of color designations using the example of color names of cars using lexicographic sources and technical texts in English and Russian leads to the use of a comparative methodology and, thus, enriches our knowledge about this lexical-semantic group and reveals the peculiarities of the linguistic and national character. The names of colors and their meanings in various languages are original and symbolic. For example, in Russian, gray is associated with mediocrity and everyday life. Russian people, speaking of "gray days", mean unremarkable days. There is also a saying "Such grayness!", which denotes the emotional assessment of narrow-minded people. In Great Britain, however, gray is the color of nobility, elegance, and, therefore, it has completely different connotations.

In stylistics, attention is often paid to the role of color units, since they are one of the elements of his style and perception of the world in a work of art of any writer. It should be noted that the material of color names is used very productively in the analysis of the artistic means of the language of writers, since the vocabulary denoting color is one of the essential components of imagery in fiction.

Each poet has his own color scheme, combinations of colors and shades. Linguacolor units perform nominative-illustrative, aesthetic and

symbolic functions in a literary text. For example, A.A. Blok very often used the adjectives white and black in his work, S.A. Yesenin used the symbolic meanings of the adjectives blue and blue, K.G. Paustovsky, revealing the dynamics of the life of nature, used synonymous series: red – scarlet, crimson, magenta, fiery; yellow – citric, ginger, bronze, gold; gray – grizzled, ashen, smoky, dove, mercury, silver, lead.

The linguistic problem of color naming developed along with linguistics as a science.

White in the English language picture of the world is often associated with honesty, virtue, kindness, joy - this is largely due to the influence of Christian culture. When speaking of a crystal-clear person who acts in accordance with moral norms, they use (sometimes ironically) the expression "whiter than white." The bride at the wedding, most often, is dressed in white "white wedding", since the white color traditionally symbolizes the purity and purity of the newlywed. For the same reason, a still unmarried girl, the bride is sometimes buried in a white "white funeral" dress. "A lie to save", that is, a lie told in order not to hurt, is called a "white lie" in English. The same traditions of color designation are observed in Russian culture, however, they are not reflected in the language.

The ancient Greek scientist Ptolemy in his writings called Britain Albion: the name, presumably, goes back to the Celtic word for "mountains" (compare - Alps), but possibly associated with the Latin word "albus". The first thing that travelers see when crossing the English Channel are the white chalk cliffs around Dover.

Snow melts quickly in England, but once a year everyone hopes that the snow that has fallen will last for several days - at Christmas, which in this case is called "White Christmas". It is believed that snow creates a joyful, magical and at the same time traditional atmosphere, so characteristic of this holiday. A person who should bring good luck or success is called "white hope". And a person (or even an organization) investing money in a company so that it does not pass into the hands of another owner is known as the "white knight".

English black comes from Old English *blæc* (dark, black, ink). In Slavic languages there is a completely different root - *chern*. Black is associated with darkness, the end of life (burnt tree), mourning, misfortune, sin, evil spirits, that is, it has a negative connotation that appeared in the Middle Ages. The words "black/cherny" are also present in phrases that are not directly related to the original meaning "burnt, charred." In comparisons, they resort to standards from the animal world and inanimate nature: "black as a crow's/raven's wing; black as a crow/raven", "coal black; black as coals".

The plague epidemic that devastated Europe in the XIV century, two hundred years later was described in the Scandinavian chronicles as a "black" (gloomy, terrible) event. But the expression "The Black Death" appeared only in the XIX century as a result of inaccurate interpretation of *atra mors* (lat. - terrible death) as "black death". After this incident, the expression "The Black Death" began to be actively used to describe the epidemic of the XIV century. In both Russian and English, "black/cherny" is associated with misfortune, trouble, anger, darkness: "black mark", "black-list", "black humor". When talking about a person experiencing grief or anger, the British say that he has a "black look" and "black mood". In the expressions "black day", "black ingratitude" there is a meaning "very bad".

In the Middle Ages, England was Europe's largest producer and exporter of wool. The presence of a black sheep in the herd meant that its wool was substandard - such raw materials did not lend themselves to dyeing in different colors. Therefore, a dysfunctional family member, society is still called "a black sheep", while in the Russian language a similar expression "scabby sheep" is accepted. In both languages, there is a connection with agricultural activities, but in Russian there is no mention of color. At the same time, men (and sometimes even women) in English portraits of the Middle Ages and Renaissance are often depicted in black clothes. There is a completely different association here - with prosperity and well-being, high social status. The fact is that for a deep and even dyeing of the cloth, a lot of paint was required, so only wealthy people could wear clothes made of high-quality expensive cloth with a white collar made of bleached linen or lace - lawyers, doctors, government officials, wealthy townspeople. The clothes of the courtiers were usually colored. Since then, the black suit has also been associated with a formal business environment. "Deep darkness" in English is associated with hell - "black as hell", and black magic in both languages - with dark forces (sorcerers, witches, Satan).

Thus, in everyday communication, white and black are certainly mentioned. In Russian and English, there are practically no differences in the perception of primary colors (white, black, blue, green and some others). But they show up in the designation of color shades, for example, cars based on blue and green. An analysis of the etymology of words denoting the main colors of the spectrum in Russian and English, and the historical influence of sociocultural factors, allows us to determine the associative fields associated with the perception of color in various contexts, in particular, in the formation of color designations in the automotive industry.

The main group of car color names has blue-green tints. The English "blue" comes, via French, from the proto-Indo-European root *bhle-was*



(light, blue, blonde, yellow). In the Ukrainian language there is a word "blakitny" (blue), in Russian a light gray horse is called "bulany". In English culture since the days of J. Chaucer, blue has symbolized fidelity. Some researchers suggest that this is due to a simple rhyme - "true blue". Blue ribbons on the clothes of the bride and groom are one of the manifestations of this belief. Anglo-American wedding tradition instructs the bride to wear "something old, something new, something borrowed, something blue." At the same time, blue clothing was usually worn by servants.

The British are a nation of sailors, so in English, navy blue is called "navy blue". As a powerful colonial power, England was actively developing a new color for itself - "indigo", which is located between dark blue and purple. The name comes from a plant found in India. Locals made a dye that was used to dye clothes and the body and to depict mandala - complex drawings that carry certain information encoded in color and shape. It should be noted that the color "indigo" (Indian blue) is traditionally more frequent in Great Britain, which had vast colonies on the Asian subcontinent, than in Russia.

It is believed that blue depersonalizes, unifies, while red stands out from the crowd. For various reasons, the word "blue" for a long time retained a negative connotation in Russian: "Burn everything with a blue flame." In terms of its physiological effect, blue is the most depressing color: it lowers blood pressure and, at the same time, lowers the pulse and respiratory rate. Therefore, it is no coincidence that in the English language there are expressions "to feel blue" (to be sad), music "blues". The word "blue" (goluboy) conveys a group of shades of blue with a bias towards green, or lighter shades of blue. Probably derived from "dove" (golub'), which means the plumage on the pigeon's neck. If the blue color was associated with water, especially with dark water, then blue - with the sky: "sky blue". "Blue" has a strong positive connotation. We are talking about "blue dream", "blue distance". However, even in the XIX century, the word "cerulean", "azure" was more frequent: "the sky azure is pure" (A.N. Pleshcheev), "and ships appeared in the azure distance" (A.S. Pushkin).

Some researchers believe that, in both Russian and English, the word "green" comes from the verb *grōwan* (to grow, to become green). The connection with the reviving nature and green plants is clearly visible here. A person is also compared with young green shoots when they talk about his youth, immaturity: "still green", "the green years" (young years). The English say about a good gardener that he has "green fingers". If a person is not feeling well (feeling nauseous), we sometimes say that they are "green". When talking about feeling unwell, in English they use the

expression "to feel/to turn green". But you can turn green from melancholy, envy, jealousy: "green melancholy", "green with envy", "the green-eyed monster".

Thus, green is associated with physical or mental illness, a feeling of unhappiness, and dissatisfaction with life. In combination with gold, green symbolizes the outgoing youth. A green car, a green wedding dress or bridesmaids' dresses, even green theatrical costumes are considered bad omens. There was, however, the famous green garment that has not been lost through the ages - "Lincoln green" - garments that were produced in the city of Lincoln, famous for its weavers and dyers. It was in such clothes that Robin Hood and his comrades wore. And in Russia the "local" green shade was "malachite green" (Ural).

One of the most important components of the linguistic picture of the world is the color picture of the world. The concept of the color picture of the world is closely related to such a concept as the symbolism of color, which is widely used, including in the names of cars. It is important to consider adjectives of color in terms of comparison, to study the peculiarities of their functioning in the names of cars of manufacturers from different countries. The color naming system has its own characteristics in different languages. The color names of cars in different languages differ from each other in many ways. This is due, first of all, to the fact that the coloristic language reflects the color associations of a particular culture, which is formed in various historical, geographical, production conditions.

Color perception and color comprehension include all the main areas of life of an ethnic group. The color picture of the world of the English people has its own specifics. So, the English basic adjective of the color blue is undifferentiated in comparison with the Russian language and is reflected in two color meanings: blue and blue. As for the object automobile color names, their meanings are also vague, for example, in English and Russian, there is a lack of distinction between the "meanings" contained in the English color designations sea blue and sea green. They are "covered" with one "meaning" - enclosed in the words blue-green and aqua.

FORD offers the following blue-green color coding: Outrageous Green, Green Gern, Blue Candy, Nitrous Blue, Blue Jeans, Blue Metallic, Lightning Blue, Dark Blue, Deep Impact Blue, Kona Blue.

Automotive color names included in the color picture of the world of the English language are widely represented in advertising texts, reference books, catalogs, where they acquire the ability to participate in the formation of the image of a car, the image of a particular manufacturer.

Color is the most important means of emotional impact on a pedestrian

and a driver: often, color designations of cars acquire a leitmotiv character, become cross-cutting images that are significant for design in the automotive industry, as well as an individual author's worldview. The inclusion of proper names (onyms) in the color designation assumes, firstly, the specification of a certain color shade (inherent, for example, in the clothes of a literary hero, shades of water in the Adriatic or Baltic Sea, the color of a favorite drink), and secondly, an advertising "pretty" name. Probably, this is a method of psychological influence on the buyer: each person has an inherent desire to have an individually made thing, maybe a rare thing, different from everyone else. And color plays an important role in this.

The use of car color coding plays an important role in international contacts between motorists and designers of new car models. When using color designations, the technique of superimposing "one's own color picture of the world" on "someone else's" is used. As a result, the mastering of the "alien" color picture of the world is carried out by means of one's own conceptual system. An example of this kind of development can be the English color designations of cars, which owe their origin to the stable characteristic color of the corresponding car parts, for example: lemon-yellow, chocolate-colored, coal-black, straw (lemon, chocolate, coal, straw) and the like. A distinctive characteristic of this kind of color designation is that, unlike the main adjectives of color, they have a pronounced etymology and imagery.

English object color names for cars have characteristic structural features and are divided into: simple; derivatives (golden, leaden, rusty, silvery); two-part (grass-green, snow-white-, earth-colored; golden vermilion, fallow gold); word combinations (the color of cream, the color of old bricks, the color of pale leather) and color designations with modifiers (pale sea-green silk, dark gold ringlets, a dusky orange).

After analyzing the website of the FORD MOTOR company, 142 color names of cars were found, among them there are 11 color names belonging to the main group, 10 with shades of the blue-green group. From the entire large list of color names, we give a list of the most popular FORD color designations: Shadow Black, Magnetic, Lead Foot, Lead Foot Gray, Smoke, Ingot Silver, Moondust Silver, Diamond White, White Platinum, Frozen White, Oxford White, Race Red, Ruby Red, Magma Red, Burgundy Velvet, Cinnamon Glaze, Hot Pepper Red, Canyon Ridge, Orange Spice, Tangier Orange, Orange Fury, Stone Gray, Bold Yellow, Platinum Dune, School Bus Yellow, White Gold, Solar, Triple Yellow, Outrageous Green, Green Gern, Bohai Bay Mint, Guard, Blue Candy, Nitrous Blue, Blue Jeans, Blue Metallic, Lightning Blue, Dark Blue, Deep Impact Blue,

Kona Blue. For comparison, the catalog of colors of cars of the "Avtovaz" plant contains 180 designations of cars, while the names do not always contain the names of the colors. Most of the names of the color of the car are borrowed words: 108 (60%): currency (Ital.), defile (Fren.), cappuccino (Eng.), tornado (Span.), etc.), which indicates the desire of manufacturers to influence potential car buyers using figurative expressions. Borrowing comes mainly from French (21.3%), Italian (9.3%), English (7.4%), Spanish (6.5%) and German (6.5%) languages (see fig. one). The words of Japanese (Tsunami), Slovenian (Pirano), Hungarian (Paprika) languages are represented by isolated cases. For FORD cars, which we analyzed by the number of color names, borrowing from Italian - 30%, Latvian - 10%, Dutch - 9%. As for the structure of names, the first component of the combination is necessarily the noun "color", and the second component, as a rule, is a proper or common noun, sometimes a combination of an adjective and a noun being defined. In this case, proper names cease to play their role (the color of the Adriatic, the color of medeo, the color of the electron). Further, there is a loss of the main function of such nouns: the loss of individualization of the object of the name, since the main thing for the studied lexical units is the determination of the color of the car. The names, in the structure of which the word "color" appears, acquire the character of stable combinations. Of the total number of analyzed color terms, 125 names belong to the morphological group of nouns (amethyst, antelope, basalt, bergamot, geyser, pomegranate, jam, duchess, iris, spark, cedar, cosmos, lavender, lagoon, almond, nutmeg, daffodil, opal, paprika, rhapsody, safari, triumph, tsunami, electron), 22 names are adjectives (beige, blue, green, azure blue, honey, olive, light green, silver), 30 names are stable phrases of an adjective and a definable noun (Bronze Age, Cherry Orchard, Stardust, Moonlight, Shimmering Blue, Milky Way, Diamond Silver, Midnight Blue, Tea Rose, Black Pearl) and only in three phrases both words are nouns (gold of the Incas, Lake Tahoe, pole of the world).

### Conclusions

1. The analysis of vocabulary in this work was carried out with the use of common automobile color names of the English language and their Russian equivalents, while the frequency of English color designations was determined by the occurrence in the established sample.

2. The analysis of the reference material made it possible to establish the frequency of the use of one or another color designation of the car. The following colors are widely compatible: jet-black, coal-black, hazel, flaxen, chestnut, sallow, straw-colored. In English, a set of 11 basic color names

includes the following: white, black, gray, red, green, yellow, blue, brown, pink, purple, orange.

3. The most numerous color designations of cars in English and Russian are groups of color adjectives formed from the names of flora (58 units) and from the names of precious stones, metals and minerals (39 units).

4. English object color names for cars have characteristic structural features and are divided into: simple; derivatives (golden, leaden, rusty, silvery), two-part (grass-green, snow-white-, earth-colored; golden vermilion, fallow gold); word combinations (the color of cream, the color of old bricks, the color of pale leather) and color designations with modifiers (pale sea-green silk, dark gold ringlets, a dusky orange).

5. It has been established that associative fields are largely determined by the proto-Indo-European etymology of adjectives - color designations, although historical development has given them specific features within the framework of national linguistic cultures. It is impossible to single out associative fields without defining the etymology of color-forming words, since associations are historically and culturally determined.

### References

1. Sokolov, K.L. Color perception in Russian and English on the example of lingua-color names of cars. Materials of the interuniversity scientific congress "Higher school: scientific research". Moscow, 2020 - P. 64-67.

**THE PROBLEM OF THE FORMATION OF NEW DIGITAL  
COMPETENCIES OF EDUCATIONAL SUBJECTS IN THE CONTEXT  
OF DIGITALIZATION**

**Rubantcova Tamara Antonovna**

Doctor of Philosophical Sciences, Full Professor  
Siberian State University of Geosystems and Technologies

**Abstract.** The development of modern science, new technologies form a digital and interactive space at the university. The modern education system faces the challenge of creating a new digital and interactive space using modern technological methods and building a multifactor educational environment. In the learning process, the need arose for the formation of new research skills and reception, new professional competencies, independent development of an array of modern knowledge by students. The study analyzes the digital transformation of the educational space and the problem of the formation of new professional competencies of educational subjects in the context of the digital transformation of the learning process. The article analyzes the role of new information technologies in the modern digital educational environment of the university in the formation of professional competencies of a specialist. The education system is considered from the point of view of the formation of the digital environment of the university. The paper notes that the main role in the formation of the digital environment is played by modern technologies and technical means, however, the role of constructivism methodology in the formation of a new interactive educational environment is great, and analysis of the role of innovative methods of education in the formation of a new educational digital space. The article examines the contradictions between traditional and innovative education, shows the ways to solve this problem in technical education. The paper deals with the problems of modern university education that arise in the learning process when using traditional and innovative teaching methods.

**Keywords:** digital educational space, constructivism as a methodological basis, innovative technologies.

### Introduction

Education as a social institution is a complex systemic phenomenon that reflects all the contradictions and problems and social development [1. p. 56]. In the XXI century, it became necessary to restructure the entire system of modern education, since the traditional model of university education in many ways does not correspond to the new technological digital development trends. New scientific discoveries, the formation of artificial intelligence entailed social changes and the restructuring of the entire education system. Recently, modern education has been built on the basis of a digital learning model, and the interactive way of organizing the educational space has become a mass phenomenon in higher education. All these processes require the development of new digital professional competencies in the process of studying at the university.

**The purpose of the study** is to analyze the problems of the formation of new digital competencies of educational subjects in the context of a new interactive educational space.

**Research methods:** the work uses the systemic method, as well as general scientific methods from the abstract to the concrete and the method, from the simple to the complex.

### Research and results

The need for digital learning in modern education sets the system for the formation of new research skills and techniques in students, the ability to independently master an array of modern technical knowledge and form new professional competencies. That is why teachers and students have to master innovative research techniques and methods in the process of learning in a university educational environment in the formation of new professional competencies.

It is necessary to highlight the problems of modern university education from the point of view of the ratio of traditional and innovative teaching. The traditional approach at a technical university is based on the fact that a student in four years of study will not be able to independently study a huge array of knowledge. The modern educational space of the university was formed in modern times, it is based on behaviorism, which presupposes the concept of ready-made, objectified knowledge. This knowledge is fixed, permanent, universal and invariable, does not depend on the carrier, therefore the teacher must simply transfer this knowledge to the subject of the educational process, who must understand and learn it [3, p. 34].

The traditional system is based on the translation of ready-made knowledge, the teacher transmits it in a finished form, which is necessary for the student to memorize and repeat in the process of education in a particu-

lar specialty. With traditional training methods, the teacher forms a linear learning environment in which the process of developing technical skills and assimilation of knowledge is directed from him to the student. It is the teacher who is the source of knowledge, controls the process of its formation and evaluates the result on the exam. The process of mastering the sciences is strictly ranged and dosed, the student teaches the finished product of knowledge, prepared by the teacher.

The teacher in this educational space is the main subject of the educational process, he is the main carrier of knowledge, his translator and expert [3, p. 80]. In modern university classrooms, traditional methods take the main place in the educational process. The traditional educational space, formed in the era of the Enlightenment, does not meet the main tasks of the digital educational space. It does not form value-based, exploratory thinking in the student, therefore, does not meet the new goals of technical education in the modern era [4, p. 75]. D. Searl believes that the rationalism of the traditional educational paradigm has a drawback in the form of a lack of analysis and criticism [10, p. 58].

However, the new social digital reality dictates different requirements for the learning process, and the interest of teachers in innovative technologies and methods is growing everywhere. Professional skills and competencies must be learned by students in the process of studying at the university, and not in the workplace in the process of adaptation.

To do this, it is necessary for teachers to master new techniques and introduce them into the educational process. Strategies for the development of modern university digital education, which are based on constructivism as a methodology and research curriculum, are called innovative [2, p. 25]. One of the problems in the field of education is the processes of its democratization and mass character, they contradict the principle of student selection based on the results of mastering the curriculum. Innovative teaching contributes to the leveling of this negative process, with the help of new research programs, it helps to reduce the negative effect and form new professional competencies in the student.

In modern society, the architecture of a new digital educational space has been formed, which in its content differs significantly from the methodology of traditional education. For him, the characters are new remote ways of transmitting information, a different methodology for organizing the educational process arose. Group forms of education appear: trainings, discussions, business games, the use of videos that are held in an online format in the learning process, for this, the subjects of the educational process need knowledge, skills and abilities of technological professional competencies.



The organization of educational material has also changed, it has become more technically informative, at seminars and lectures they are actively used: interactive training, graphic design of the material in the form of tables, diagrams and clusters, all these forms contribute to the formation of creative thinking and deeper assimilation of educational material. Innovations in the education system create and disseminate new digital learning models that lead to significant changes in the educational process. In the process of studying academic disciplines, students develop a new type of activity, style of thinking and understanding of educational material. In this case, "novelty" as a category will lead to a change in the qualitative characteristics of the studied object itself.

Social constructivism is the main research methodology that defines innovative teaching methods. Recently, constructivism as a methodology of innovative education in the modern educational space of the university is gradually taking the leading positions. This theory entered pedagogical scientific thought from social philosophy and culture. Constructivism is based on the relativity of human cognition and the constant change in the results of this knowledge [8, p. 120].

The research approach based on constructivism allows students to shape their scientific program in the learning process based on the individual learning process in the new digital social reality. The constructivist approach will allow the student to create their new experience in the process of digital learning at the university, which will be based on their own achievements and will allow them to form the necessary skills to solve subsequent educational problems. Constructivism in education develops a deep understanding of educational material through the formulation of research problems and the development of new ways of solving and analyzing them. As a result, the teacher and the student form their own research digital educational educational space in interactive lessons [5, p. 48]. This methodology orients the student towards a deep understanding of the problem, he becomes an equal subject of his research program, as a result of which creative thinking and research skills are also developed.

R. Ayresan and M. Walsh believe that the diversity of constructivist ideas in education allows the teacher to express his individuality in the process of learning and teaching. Scientists, analyzing constructivism in the social sciences, come to the conclusion that a teacher, working in research programs of constructivism, can choose one of four ways of teaching at the university. [6, p. 44]. He can become a teacher - a transmitter of knowledge, organizer, assistant and accomplice, it all depends on the research tasks facing him [7. p. 445].

Recently, in scientific research on this issue, the process of education is increasingly viewed as creative. Teachers from different countries are searching for the design of a new educational space by the main subjects of education through innovation. An exploratory research approach transforms traditional teaching based on the productive activities of students, determines the development of learning models, which contributes to the development of new experiences by students [9, p. 120]. For teachers seeking to give their students as much knowledge as possible, the main problem is to develop their cognitive activity.

Innovative methods contribute to the formation of a new research, search educational space in the process of digital learning. The subjects of the educational process work together on a research project, they design a research program and receive a new research product. The knowledge that a student receives in a joint search with a teacher at a seminar becomes interesting, multidimensional, diverse and scientific. Within this approach, the goal of the learning process is to develop new opportunities for students to independently search and master new experiences. In the process of communication between the teacher and the student, new guidelines are formed, which serve not only to search for new knowledge and a way to achieve goals, but also personal meanings.

One more aspect of innovative education should be noted, in the learning process, the student begins to actively experiment, participate in discussions, analyze and discuss problems, ask questions, he learns to defend his point of view, find arguments, freely and openly express his thoughts, compare different points of view on the same problem. It should be noted that this process should take place when organizing and adjusting the teacher.

In the learning process, when using innovative methods, new connections arise between the subjects of the educational process, both between the teacher and between the students themselves. In the process of active communication in discussion group forms, the line is erased according to the property criterion, class belonging, equality and trust are formed between all subjects of the educational process, which allows the teacher to experiment and creatively approach the problems studied.

### **Conclusion**

In the modern educational space, there are different types of educational space and different types of knowledge that are formed in them. The digitalization of higher education forms a completely new educational space at the university, which is built on completely new methods, tech-

niques for studying and analyzing information. This technically structured educational space is of a systemic, multifactorial nature, the teacher can use an unlimited number of sources and digital data in the learning process, conduct a dialogue with many subjects of education. solve many technical problems. Subjects of education, students, can solve complex problems themselves, investigate problems with the help of new technological methods and methods, however, no machine can fully convey the cultural, educational and historical experience. which professors own, the machine cannot replace the living word and human communication, which are received by the subjects of the pedagogical process.

The knowledge obtained in an active research search and the knowledge obtained as a result of studying the factual material differ from each other. However, these two types of knowledge should not be opposed, they have different tasks in the educational process, but they solve the same problem in different ways - the formation of new professional competencies of students in the context of digitalization of modern education. The fact that there are two categories of knowledge: on the one hand, actively constructed, which is the result of an exploratory search, and, on the other hand, knowledge acquired in another passive way, has important consequences for the educational process, they are both important and necessary for the learning process. Knowledge, which is exclusively the result of scientific research search, can be applied extremely widely in the new educational digital space of the university and contributes to the active formation of new professional competencies.

### References

1. Rubantsova T. A., Sokolov E. A. Philosophical and methodological problems of the formation of a specialist in higher education. Novosibirsk: SB RAS. 240 P.
2. Prouot Z.S., Floden R.E. Philosophical views on constructivist education // Psychologist – teacher. – №29. – 1994. – P. 47-49.
3. Rubantsova T.A., Zinevich O.V. Innovative methods for improving the quality of education: textbook – Novosibirsk: NSTU, 2010. – 119 P. Rubantsova T.A., Nazarova M.A. Humanitarization of natural - scientific education in the conditions of information - communicative society. Novosibirsk: NSAU, 2008. 174 P.
4. Meredict S., Steele D., Temple Ch. Teaching Together: textbook – Novosibirsk, 2002. 121 P.

5. Airasian P.W., Walsh M.E Constructivist cautions // Phi Delta Kappan. 1997. N 6. P. 444-449.

6. Cennamo K.S., Abell., S.K, Mi-Lee Chung A "layers of negotiation" model for designing constructivist learning materials // Educational technology. 1996. N 4. – P. 39-48.

7. Greening T. Building the constructivist toolbox: An exploration of cognitive technologies // Educational technology. 1998. N 2. P. 23-35.

8. Kryukov V. Communication modalities in the virtual continuum // Science and Technology. The collection includes 11th International Conference «Science and Technology». – 27-29 October, 2019. P. 119 – 125.

9. Serle J. Rationality and Realism. What is at stake? // Daedalus. Journal of American Academy of Arts and Sciences. Fall. N. Y. 1993. №5. P. 55-85.

DOI 10.34660/INF.2022.19.27.009

## CREATION OF A MEDIA PRODUCT ON TELEVISION - FROM IDEA TO IMPLEMENTATION

**Saparbekova Diana Sabyrovna**

master's student

Russian Presidential Academy of National Economy and Public Administration

**Annotation.** The article examines the process of creating a media product on television - from idea to implementation. It is emphasized that progressive technologies continue to transform the work of both traditional media and new types of media. It is noted that multimedia communication is becoming more and more firmly established, including on television. It is concluded that multimedia journalism is actively intertwined with the television specifics of work, and gives the traditional mass media new impulses.

**Keywords:** media product, idea, methods, project, information.

Any product is based on an idea, and it also plays a key role. There are many interesting examples when the founders of already well-known large companies came up with their ideas with one notebook and pen in hand. An example is the MacDonal brothers. They worked in Hollywood as set makers. Having saved up a certain amount, they opened a cinema. However, the idea was not financially successful, and in the mid-1940s the brothers built a simple roadside diner for motorists. They later installed neon-lit golden arches on the roof, which have since become one of the world's most recognizable commercial symbols. [1]

In the process of developing an idea, it is necessary to think about the name of the future TV product, the format, the target audience, the visual effects used, and the locations of filming. The technology of creating a media project on television goes the same way. The journalist can personally propose his idea, idea to the management of the TV channel. Most often, experienced journalists with proven production skills are ready for this option. Every day, even in a small village, different events take place, there are problems, the solution of which lasts for years: problems with heating, water, roads, education and many more small but important issues. A journalist comes to the rescue and covers the topic to the public. Sometimes, on the contrary, the proposal comes from the management. Annually,

monthly, a rough plan is drawn up with the topics that need to be covered in television materials. When the list is ready, the editor-in-chief proposes topics and distributes them among the correspondents. The choice of this or that question falls on the one who is better versed in a particular issue. If a journalist takes his own initiative and takes upon himself the creation of material, responsibility for the final result is placed on his shoulders. A whole world of possibilities opens up before the author, he becomes in some way an artist and can approach the preparation of the material creatively, reveal the question being raised fully and vividly. Such qualities as efficiency, mobility, communication, stress resistance should be inherent in a professional journalist. When getting involved in journalistic work, you need to avoid "burnout syndrome" - a state of demoralization, frustration and extreme fatigue. According to psychologists, this condition is typical for 5-10% of employees whose work is associated with prolonged stress. Another 50-60% of employees have individual signs of this syndrome, which can go into the acute phase at any time. Then the employee begins to do his job mechanically, carelessly, without interest and even with hatred [2].

An important role is played by the correct setting of the project goals, the formulation of tasks. If this is a team work, then each participant takes responsibility for completing the tasks assigned to him. If the planned plan is violated and the task is not completed in a timely manner, the life cycle of the media project may change. And they, in turn, have a beginning and an end and cannot function indefinitely. The scheduling of tasks included in the media project helps to control the process. On the other hand, creating a TV project is a creative process. And on the way, decisions can change, new and improved ideas can be added. The main leader must skillfully accept and discuss all stages with his team. At the initial stage, the issue of financing is also being resolved. Professionals in their field always intend to bring a project to life with a minimum waste of resources and in a limited time, but with maximum efficiency. A worthy media project skillfully uses the benefits of television to create entertainment shows, news programs, or educational materials. Thanks to technological innovations, television has transformed from a craft to an art. And today it is also a multi-billion dollar multinational business. Compared to other media, television has the most significant impact on what is happening in the world. As a synthesis of creativity and technology, television and video have become the main conductors of information [3].

The next step is collecting information. As a simple journalist, when preparing a small story, thinks over all the little things and details of his

material, so the authors of a media project should discuss and offer their ideas. In such cases, different concepts are effective on the example of brainstorming, when there is a heated discussion between team members, and as a result, a clearer work plan is drawn up. The selection of facts requires careful examination of various information. If a journalist clearly understands what kind of information, characters, locations for filming he needs, production will be faster and more productive. It is customary to consider three methods of collecting information.

1. *Communication methods.* All types of interpersonal and technical communication belong to communicative methods of obtaining information. This is, first of all, a conversation, an interview and a survey. To a certain extent, communication methods include correspondence via postal information channels, and specific methods of computer communications, such as teleconferences, e-mails, etc. [4].

2. *Non-communicative methods.* This category includes printed publications, primary documents, books, diaries, notes, business correspondence, orders, etc. Such materials can provide a very large amount of information that is important and interesting for a journalist. The journalist's own observations are another effective way of obtaining information. There is no need for special equipment, there is enough time and a lively mind of the correspondent who will be able to put together the received material and use it in his work.

3. *Analytical methods.* In the work of a journalist, there is not always ready-made data. Sometimes you need to use research skills and do the analysis yourself. There is a short classification of methods: system analysis; comparative analysis; deductive and inductive methods; modeling.

Next is the preparation of the script. Its basis is the plot - a logical sequence of actions. The main characters, the shooting location, the sequence of episodes are being considered. As R. Walter writes: "The first, last and only commandment of the screenwriter is to be worthy of the audience, cherish its opinion, attention and time. The only unbreakable rule of scriptwriting is not to be boring" [5].

The practical part of preparing a TV program includes filming, editing and preparation for the broadcast. The filming process is very complex and requires team cohesion. Those that are both "in the frame" and "for" - they are responsible for what methods, what equipment will be used to shoot. Light, focus, framing, balance, sound, foreshortening - each of these components is most important in the work and responsibility here falls on the shoulders of videographers. Basic shooting methods: asynchronous shooting; synchronous shooting; filming with a soundtrack.

Depending on the direction and format of the program being produced, shooting is divided into studio and outside. In both cases, the organization of the work process also requires a serious approach and efficiency from each member of the creative team.

Editing a TV program is a laborious process during which the footage is viewed, processed and restructured. As a result, a solid material should be obtained, close to what was conceived at the very beginning. Thanks to editing, you can correct the flaws, add missing elements, give the atmosphere and the desired rhythm. If there is a ready-made installation plan, the work of a video engineer will be facilitated. It details the scenes that are approved and those that need to be removed. Also, the work is being built with sound design. Due to the convergence and multimedia of media, at the stage of editing the video material can be filled with additional infographics, video effects, etc.

Next comes the preparation of the material for the broadcast. The editor reviews the video product for moral and ethical compliance. If there are no violations, the material is approved. The following is not allowed in the media: a) disclosure of state and commercial secrets; b) a call for violent overthrow; c) propaganda of war, violence and cruelty, national, religious exclusivity and intolerance towards other peoples and nations; d) insult to the civil honor of peoples; e) insulting the religious feelings of believers and clergymen; f) distribution of pornography; g) the use of expressions that are considered obscene; h) distribution of materials that violate the norms of civil and national ethics [6].

In addition, one of the last points that plays a significant role in the modern world is promotion. Each company develops its own product promotion plan. Commercials on TV, street billboards, Internet publications are used. It will be true that the majority of consumers of all types of media prefer the Internet. That is why it is worth considering social networks not as competitors of television channels, but as assistants in promoting TV content. A properly built SMM strategy will pave the way not only to the hearts of viewers, but also allow one or another TV channel to implement encompassing cross-media projects that are part of marketing communication. It is worth noting the importance of the formation of a media brand in modern life. In addition to promoting the brand of the TV channel, the emphasis should also be placed on the brand of a separate media project. Brand is the perception of a product that exists in the mind of the consumer. This is not a logo, trademark, or trademark; it is not an advertisement or a single product itself. A brand is the sum total of all customer experiences. And it changes from platform to platform, from environment to environment, from



context to context. There is also a downside to the brand as a collection of experiences. A brand is a collection of expectations [7].

Subsequently, when the implementation of the media project is successful and the product wins the hearts of viewers, it is important not to stop - to be in the field of view of the audience.

### References

1. MCDONALD'S. History of creation. [Electronic resource] // CEO.RU URL: <http://www.ceo.ru/news/business/brand/mcdonalds-istoria-sozdania>
2. Burnout syndrome. Doctor's summary URL: <http://health.mpei.ac.ru/sindrom.htm>
3. Tikhinya, O. V. Evich L.N. // Lecture course "Management of media projects". P.32.
4. Kasyanov V.V. Sociology of mass communication. - Rostov-on-Don: Phoenix, 2009. P. 42-44.
5. Walter R. // Scenario art. Book abstract. Moscow, 2014, p. 78.
6. Sinetskiy D. Camcorders and video filming. A Practical Guide Second Edition. - M.: International agency "A.D. & T", 1998. - 157 p.
7. Tikhinya O.V., Evich L.N. // Lecture course "Management of media projects". P.33.

## FEATURES OF FOLDING THE ETHNIC MAP OF CENTRAL ASIA

**Syzdykova Zhibek Saparbekovna**

Doctor of Historical Sciences, Full Professor  
Lomonosov Moscow State University

**Gavrilina Elena Anatolyevna**

General manager  
PACIFIC PARTNERS TOKYO CO., LTD

**Annotation.** This article discusses the process of formation and folding of the ethnic map of the states of Central Asia. It is noted that the process took place mainly in the 20s of the twentieth century during the formation of Soviet power. It is emphasized that the formation of new Soviet republics took place without taking into account the historically established territorial settlement of ethnic groups before the formation of the USSR. It is concluded that it was this approach that laid the foundations for conflicts in the formation of the borders of modern states after the collapse of the Soviet Union. Attention is focused on the fact that unresolved issues can serve as an impetus for the emergence of new hot spots in the Central Asian region.

**Keywords:** Central Asia, states, ethnic groups, territory.

Central Asia is a multinational region where five sovereign states are located: Kazakhstan, Uzbekistan, Tajikistan, Kyrgyzstan, and Turkmenistan. In each of the countries, in addition to the titular nation, representatives of many nationalities live "... when studying the Central Asian region (CAR), it is necessary to take into account not only the new geopolitical situation and the conditions of the transition period, but also the role of historical heritage, the features and nature of the civilizational development of the peoples of the region" [5].

Since ancient times, the territory of Central Asia has been a place where interactions of various ethnic groups took place, which belonged to different economic and cultural types: settled agricultural and pastoral (nomadic and semi-nomadic) farms. "The development of the territorial boundaries of future peoples and states was not originally associated with the settlement of a single ethnic group" [5]. The arrival of the Arabs in the

7th century took a long time, and its consequences turned out to be much deeper than previous foreign penetrations. After the conquest of Maverannkhr (Interfluve between the Amur Darya and the Syr Darya) became part of the Arab Caliphate. With the advent of the Arabs, the establishment of a new religion, Islam, began here. As a result, the penetration of the Arabs and the emergence of a new religion marked the beginning of the formation of a new identity based on religious affiliation and faith. As a result, to the former economic division of the population into settled and nomads according to ethnic differences (Persians, Turks), a new dividing line was superimposed: a Muslim and a pagan[3]. The Samanid state (875-999) was freed from the Arab Caliphate and a centralized state is being formed on its territory. There is also a process of consolidation of the Turkic-speaking groups of the population, which settle down and accept the norms of behavior, lifestyle, culture, as well as the religion of the local population. The state of the Karakhanids appears (942-1212), where in 960 Islam becomes the state religion. Integration processes receive a new impetus. In ethnic processes, the formation of a common Turkic ethnic group with tribal division took place. Later, the ethnonyms Uzbek, Kirghiz, Turkmen, Kazakh appear. The more or less established situation is diluted by the arrival, or rather, the invasion of the region by the troops of Genghis Khan. The Mongolian army was heterogeneous in ethnic composition. A significant number of Turks were part of the Mongol army and the Mongols themselves mixed with the Turks.

Serious changes appeared in the development of interethnic relations in the region of Central Asia in the second half of the 19th century. And this is connected with the geopolitics of the "Great Game" when the territory of Central Asia is in the zone of interests of the British and Russian empires. After becoming part of Russia, a European population appeared here in the person of the Russian colonial administration, officials, entrepreneurs, military men, workers, resettled peasants, and with them a new religion, Christianity. Most of the arrivals are ethnic Russians, but there are other peoples: Ukrainians, Tatars, Jews, etc. Under these conditions, religious identity played a significant role. Residents of the Emirate of Bukhara, the Khanate of Kokand and Khiva, and then the Turkestan Governor-General considered themselves Muslims. Such identification was an important component of the self-awareness of the local population. However, it is worth noting that the place of origin, as well as belonging to one or another ethnic group, was recognized as an identity. And this situation practically remained until the October Revolution.

According to the "Declaration of the Rights of the Peoples of Russia" - a

document adopted by the Council of People's Commissars of the RSFSR on November 2 (15), 1917, the main principles of national policy were proclaimed: equality, sovereignty, the right to self-determination up to secession, the abolition of national-religious privileges and restrictions. Considering that most of the modern part of Central Asia was part of the Russian Empire and the RSFSR, which became the successor to the USSR, this document played a significant role in determining the future of the peoples of the Central Asian region after the collapse of the Soviet Union. The differences between the tsarist and Soviet resettlement course consisted in the fact that the tsarist government sought to solve the agrarian problem of the European part of the country through resettlement, while the Soviets tried to eliminate inequality in land use, eliminate economic, legal and other forms of inequality[4].

As a result of the demarcation carried out by the Soviet authorities in 1924 (still corrected in 1936), the boundaries of the compact residence of certain peoples were determined and new state formations were created[1]. It was then when the artificial demarcation of the new Soviet socialist republics took place that the Bolsheviks planted a "time bomb", which to this day is making itself felt with interethnic conflicts and border incidents on the territory of the Central Asian region. The aggravation of interethnic relations began to occur after the collapse of the Soviet Union. In territorial terms, the issues of demarcation turned out to be not simple, especially in the south of the Fergana Valley, where there are disputed areas between Tajikistan, Kyrgyzstan and Uzbekistan. Disputes over delimitation and demarcation of borders often lead to armed conflicts in border areas. When defining the boundaries, the specifics of the way of life were not taken into account, for example, nomads, being the majority in a particular area, became a minority among the settled population, for example, territories inhabited by the Kyrgyz became part of Uzbekistan, forming an ethnic enclave. As a result, this led to the fact that border territorial claims became acute and the issue of borders became one of the most acute issues at the interstate level.

Among the difficult sections of Central Asia, the Ferghana Valley stands out, which has become the epicenter of the conflict, where the Sughd region (Tajikistan), Osh, Jalal-Abad, Batkent regions (Kyrgyzstan), Ferghana, Namangan, Andijan (Uzbekistan) are located.

The most complex processes are taking place on the border with Kyrgyzstan, where there are two disputed points, one point in Uzbekistan and three in Tajikistan, and in total there are eight enclaves in the Ferghana Valley. Often, conflicts arise due to various reasons, including the lack of

water, pastures, agricultural land, and tightening of border crossing rules. There are more than 70 disputed areas on the border between Tajikistan and Kyrgyzstan. The most difficult two Tajik enclaves are Vorukh, Western Kalach-Isfra region. Khujand region and on the territory of the Batkent region of Kyrgyzstan. Tajik-Uzbek relations complicate the contradictions associated with the actual stratification of ethnic Tajiks and Uzbeks, which does not correspond to the borders and geographical location of national states[2].

In the period of the USSR, if problems of an interethnic nature arose, then their authorities often bypassed them, we can say that the problem was simply hushed up. And finally, in the 80s. there were conflicts on ethnic grounds in Kazakhstan, in the Caucasus, in the Baltic states. The conflict in Isfara, the Ferghana events became harbingers of the collapse of the USSR into national "apartments"[4]. conflicts between representatives of different nationalities in a particular republic. The aggravation of relations between representatives of different nationalities was primarily due to the growing claims of national elites for control over their republics. Despite this, all the republics, with the exception of the Baltic states and Transcaucasia, were ready to coexist in a single state. However, the USSR was dissolved in December 1991 and all the former republics of the USSR faced a new geopolitical reality.

Thus, it can be stated that over the course of millennia, a complex ethnic map of Central Asia has evolved and the process of formation at each stage had its own characteristics. Any conflicts have a negative impact on the lives of people living in the region, and on this basis, it is necessary to closely study the causes of a particular conflict. Taking into account the fact that conflicts are in a latent form in many places, it is important to preempt them, and for this it is necessary to apply active preventive measures to relieve tension in order to avoid an open inter-ethnic conflict. And in order to resolve acute issues of this nature, it is necessary to pay attention to the historical past, which in many respects can contribute to the fact that the key will be found taking into account the experience of the past.

### References

1. Almanov S.K. Enclaves in Central Asia: background and current problems // Post-Soviet studies. - M., 2018. Vol. 1 No. 5. P. 451-460.
2. Bushkov V. Interethnic conflicts in Central Asia. - M., 1993.

3. Vinogradova N.M., Kuzmina E.E. Contacts of the steppe and agricultural tribes of Central Asia in the Bronze Age / East Turkestan and Central Asia in the system of cultures of the ancient and medieval East, M., 1986.

4. Kizhikhov A. Territorial issue in Central Asia. <https://cyberleninka.ru/article/n/territorialnaya-samoidentifikatsiya-natsii-postanovka-problemy-na-osnove-issledovaniya-materialov-po-razgranicheniyu-postsovetskih>

4. Saprynskaya D.V., Syzdykova Zh.S. National policy of the councils and the resettlement issue in Kazakhstan // Questions of national and federal relations issue 10 (67). – 2020. - volume 10. P. 2405

5. Syzdykova Zh.S. The main stages of the civilizational development of the peoples of Central Asia before joining the Russian Empire .// Army and Society. №2 <https://cyberleninka.ru/article/n/osnovnye-etapy-tsivilizatsionnogo-razvitiya-narodov-tsentralnoy-azii-do-vhozhdeniya-v-sostav-rossiyskoy-imperii>

DOI 10.34660/INF.2022.80.62.011

**ON THE ISSUE OF THE LEGACY OF THE SOVIET NATIONAL  
POLICY IN MODERN CENTRAL ASIA**

**Temirkhanova Ainagul Erkinovna**

lecturer

Karaganda University named after A. Buketova

**Annotation.** The article deals with issues related to the legacy of the Soviet Union in the implementation of national policy, which still affects the socio-political processes taking place in the states of Central Asia (CA). It is emphasized that today there are so-called "enclaves" on the territory of Uzbekistan, Kyrgyzstan, Tajikistan. It is noted that the stable development of the Central Asian region (CAR) largely depends on the solution of a number of controversial border issues between the CA countries.

**Keywords:** state, national policy, Central Asia, perestroika.

The crisis of Soviet society in the second half of the twentieth century. exacerbated the problems of interethnic relations. The impetus was the course towards perestroika, taken at the April Plenum of the Central Committee of the CPSU in 1985, when cardinal transformations began and the word "perestroika" was first used. Perestroika affected all spheres of life of Soviet society without exception. A number of experts believe that it was perestroika that dealt a crushing blow to Soviet identity. Political and statesman of that time E.K. Likhachev: "Political accents were shifted, conservatism was declared the main danger for perestroika, and a wide road was opened to anti-communism, separatism and nationalism. I want to repeat again: if in 1987-88 the main danger of perestroika, the growing separatism, had been correctly identified, the country would have been able to avoid bloody conflicts and upheavals" [5, p.134]. In the USSR, such a system was formed in education when recruitment was carried out on an ethnic basis a) upon receipt of higher education b) holding leadership positions c) joining the ranks of the CPSU d) in presentation for awards. After the death of Brezhnev L.I. the central leadership of the USSR made an attempt to take control of all aspects related to domestic politics, the driving factor was the campaign against corruption and nepotism. After the collapse of the USSR, M.S. Gorbachev, touching upon issues related to

the aggravation of interethnic relations and the emergence of open conflicts during the years of perestroika, noted that they (conflicts) were laid down by Stalin's national policy, that is, several decades earlier before Gorbachev came to power. Speaking about the heavy legacy, Gorbachev said that "when national disputes and claims arose, Stalin considered them as a manifestation of anti-Sovietism ..." [7, 210]. Gorbachev's assistant A.S. Chernyaev noted that his boss in national politics relied on "old methods" and underestimation of the consequences of unilateral support for certain lobbying ethnic groups [7, 210].

Change of the first secretary of the Central Committee of the Communist Party of Kazakhstan Kunaev D.A. in December 1986, Kolbin G.V. was appointed, which led to the performance of Kazakh youth. The speech was brutally suppressed by the forces of the Ministry of Internal Affairs and the KGB of the USSR.

Even before these events, in November 1986, Kunaev D.A. agreeing to resign, he asked who would take his place, to which Gorbachev replied that he would decide without him. Thus, the beginning of the struggle against "Kazakh nationalism" was laid. The accusation of nationalism of an entire people who were loyal to the Soviet state, which caused a feeling of resentment and discontent among a significant part of the population of Kazakhstan. The performance of the youth of Kazakhstan in 1986 had the following consequence: the allied leadership abandoned its attempt to create the Virgin Land with its subsequent withdrawal from the Kazakh SSR.

The countries of Central Asia have long been of interest to both East and West since the time of the Great Silk Road. The region has significant natural resources, including uranium, gold, natural gas, oil, rare earth and non-ferrous metals. The CAR states are located far from the maritime borders, such a kind of Eurasian rear - a "soft underbelly" for large countries. CA is a strategic foothold. They have such landscapes: plains (steppes and deserts), floodplains, foothills and mountains. Plain Kazakhstan, Uzbekistan, Turkmenistan, mountainous Kyrgyzstan and Tajikistan.

*"Hot spots" of Central Asia.* In the south of Kyrgyzstan, the Kyrgyz and Uzbeks live side by side, in a neighborhood, but each side considers itself a local, indigenous population, and the other a newcomer. As a rule, the Uzbek part of the population has been leading a sedentary lifestyle for centuries, being mainly engaged in trade and agriculture, is in no hurry to leave for the city and enter higher educational institutions, and does not show any zeal to go to public service. And the Kyrgyz part of the population of the cities of Osh and Jalal-Abad, most of whom are migrants from mountain villages, tend to the city in order to get a higher education and



then get a job in the public service. As a result, this leads to social and property division, which is expressed in the following:

- the Uzbek part of the population, not always having a higher education, controls business and trade, shows a desire to live in their mahals (quarters), mainly in their well-equipped houses;
- The Kyrgyz part of the population occupies administrative posts, as a rule, they are represented at almost all levels, from the heads of the village council to law enforcement agencies and above.

But, despite their administrative positions where they had a clear advantage, but still this did not affect their financial condition, that is, they had lower incomes than the Uzbeks. Thus, the stratification of property has become one of the key irritants of representatives of both sides. The Fergana Valley is the most densely populated region of Central Asia. In the Osh region, the Uzbek population is about 30%, Jalal-Abad - 25%, Batkent - 15%, the average for the country is about 15%. In those places where Uzbeks live, the Uzbek language is compactly used.

The Uzbek population of the Osh region lives in the city of Osh and further in such areas as Uzgen, Karasu, Aravan, Nookat; In Jalal-Abad and further to Nooken, Bazarkorgon, Suzak. And in the Batkent region: the city of Isfan, Kyzy-Kiya[<sup>452</sup>]. The problem of non-coincidence of state borders with the residence of ethnic groups (titular nationalities) was laid back in 1924-1915, when the process of national-state delimitation took place. As a result, large communities of other titular ethnic groups of Central Asia live in all three states. In Uzbekistan, Tajiks, Kazakhs, Kirghiz, Turkmens;

There is a large diaspora of Uzbeks in Tajikistan, Kyrgyzstan, and Turkmenistan. In Uzbekistan, the largest diaspora is Tajiks, while in other republics, the largest diaspora is Uzbeks. And besides, until now, talk about who should own such beautiful cities as Bukhara and Samarkand remains a subject that excites many. The aggravation of this issue occurred after the end of the civil war in Tajikistan in 1992-1997 and turned this dispute into one of the difficult problems of Uzbek-Tajik relations. Kyrgyzstan considers the most vulnerable territories in the southern part of the republic, where Uzbeks live compactly (about 28% of the population) and where the border between Kyrgyzstan and Uzbekistan passes. Note that the indicator of the specific weight of the growth of the Uzbek population is higher than that of the Kyrgyz. Based on this, the authorities of Kyrgyzstan constantly have a threat, or rather fears about the territorial integrity of the country. The factor of the presence of a large Uzbek diaspora is especially evident at the moments of the revolution in Kyrgyzstan, when there is a seizure of power either by representatives of the "South" or the "North". As you know,

Kyrgyzstan is geographically divided into north and south, and these two parts are separated by mountain ranges, and only one road has become connecting both parts. Large ethnic enclaves: in Kyrgyzstan, where Uzbeks live, these are Sokh and Shakhimardan; in Uzbekistan, the village of Barak; in Kyrgyzstan, the Tajik enclave Vorukh, it administratively belongs to the Isfara district of the Sughd region. From the Uzbek side, a proposal was put forward to connect Sokh (with 19 settlements where Tajiks live) with a wide strip of land with Uzbekistan and exchange it for the transfer of the southern part of the enclave. This proposal was rejected by the Kyrgyz side, which believes that these lands have no agrotechnical value, and the Leilek and Batkent regions will be completely cut off from the rest [2]. The dispute over water and land resources between the Kyrgyz and Tajiks led to clashes in the Batkent region in the 1980s. Clashes took place in the villages of Vorukhe-Tangi in 1982 and Matche-Aktatyr in 1988. A year later, all the contradictions escalated into a large interethnic conflict in 1989. In 1991, the conflict resumed, as the Tajiks demanded that 10 thousand ha of land. The conflict took a sharp turn, that even the presidents made mutual accusations and thus the conflict rose to the interstate level between the two countries of Kyrgyzstan and Tajikistan [4, 378].

With a demarcation in the 20s. 20th century the most important factor - the specifics of farming - was not taken into account. Nomads at one time of the year lived in one place, and then, for example, with the onset of winter in another. And they were simply, without looking, attached to the settled population. For these reasons, a number of regions with a Kyrgyz population ended up as part of Uzbekistan. The distribution of land took into account the agricultural population and this was the decisive principle of allocating land, and the interests of the peoples leading a nomadic lifestyle were ignored and this eventually led to such a demarcation, which still responds to conflicts. Another reason is cotton growing. The Soviet Union, in order to overcome dependence on other supplier countries, emphasized the cultivation of this particular industrial crop.

So, the epicenter of the conflict remains the Ferghana Valley, which has a high level of population density, the predominant ethnic group in the valley are the Uzbeks. Among the countries of Central Asia, the situation between Uzbekistan, Kyrgyzstan and Tajikistan remains the most difficult. This situation is connected, first of all, with ethnic striping, lack of land resources, and even more water resources in an arid climate, which periodically leads to interethnic conflicts. "It is quite possible, having settled into power and having established a medieval way of life in the country, the Taliban will establish cooperation with any terrorist organization and may

begin to expand into border countries. Earlier there were many reports that militants who fought in Syria and Iraq returned to the countries of Central Asia. Extremists who have received combat experience in the Middle East can take on the tasks of the Taliban or take up playing their own card. The Ferghana Valley is called the "powder keg" of Central Asia. This part of the region is distinguished from others by a high population density, a high level of Islamization, a large number of issues and problems of a domestic and socio-economic nature. And this is where the borders of the three countries meet.

Thus, the origins of the complexities of interethnic relations were laid during the construction of the Soviet state, when instead of the "state of nations" it was supposed to create nation-states, which laid the foundation for future conflicts.

### References

1. Almanov S.K. Enclaves in Central Asia: background and current problems // Post-Soviet studies. - M., 2018. Vol. 1 No. 5. P. 451-460.
2. I.V. Bushkov, D.V. Mikulsky Anatomy of the civil war in Tajikistan (ethno-social processes and political struggle 1992-1995). [http://yakov.works/libr\\_min/02\\_b/ush/kov\\_09.htm](http://yakov.works/libr_min/02_b/ush/kov_09.htm)
3. Gorbachev M.S. Life and reforms: in 2 kn.M., News. 1995 Book 1. p.404.
4. History of the Tajik people.V.5. Recent History (1917-1941) Ed. Academician of the Academy of Sciences of the Republic of Tatarstan R.M. Masova-Dushanbe, 2004. P.378-380.
5. Ligachev E.K. The riddle of Gorbachev / E.K. Ligachev.-Novosibirsk, 1992.
6. Syzdykova Zh.S. Taliban: new image with old content political science issues • Issue 8(72). - Volume 11. - 2021. p. 2307.
7. Chernyaev A.S. 1991 Diary of an assistant to the President of the USSR. - M.: TERRA, Respublika, 1997. P. 215.

## **CORRELATION RELATIONSHIPS BETWEEN HEMODYNAMIC PARAMETERS AND INTENSIVE CARE OF SEVERE BURN TOXEMIA IN CHILDREN UNDER THREE YEARS OF AGE**

**Muhitdinova Hura Nuritdinovna**

Doctor of Medical Sciences, Full Professor

Center for the Development of Professional Qualifications of Medical Workers

**Abstract.** Thermal burns 2-3A degree with an area of  $46.7 \pm 8.3\%$ , 3B degree  $17.2 \pm 7.2\%$ , IF  $73.4 \pm 9.6$  units. on the first day of the burn injury caused, despite the clinical efficacy of complex intensive therapy, a tendency to increase the mesor of circadian rhythms SBP, PBP and mean BP, with a slight tendency to decrease DBP. In the first wave of the inflammatory reaction (first 9 days), an increase in SBP, DBP, PBP, MBP was observed. A more pronounced increase in the deviations of the SBP, DBP, MBP mesor was found in the later periods of toxemia (on days 21-24), due to insufficiently effective antibiotic therapy. The correlations between treatment and the studied hemodynamic parameters in general characterized the stress-protective result of the complex therapy for burn toxemia in infants under 3 years of age.

**Keywords:** hemodynamics, intensive care of severe burn toxemia, children under three years of age.

### **Relevance**

The period of toxemia in severe burns occurs within a few hours or during the first days after receiving a burn. Along with the pain factor during this period, the phenomena of systemic inflammatory reaction and intoxication of the body come to the fore. Despite the large number of studies in combustiology, recommendations for intensive care during the period of burn toxemia are predominantly general in nature, do not take into account age characteristics, the severity of the patient's condition [1-5].

### **Purpose of the work**

To assess the correlations of changes in hemodynamics and intensive care of burn toxemia at the age of up to three years.

### **Material and research methods**

The clinical material is presented by the data of hourly monitoring of

body temperature, hemodynamic parameters: systolic (SBP), diastolic (DBP), pulse (PBP), mean (MBP) pressure in 8 children admitted to the Republican Scientific Center for Emergency Medical Aid (RSCEMA) in connection with thermal burns between the ages of 9 months and 3 years. The main sign that determined the allocation of this group was the duration of intensive therapy in the conditions of the intensive care unit (ICU) for more than 20 days, due to the severity of the burn disease. In the study group, the monitoring data of the studied parameters and the volume of intensive therapy in 8 children ( $24.6 \pm 2.4$  days) were considered. This paper presents an attempt to objectively assess the effect of the volume of intensive care in children aged  $17.9 \pm 8.6$  months on hemodynamic parameters. The severity of the burn was assessed by calculating the surface area of the damaged skin and using the Frank index. The severity of the condition was due to a thermal burn of 2-3A degree with an area of  $46.7 \pm 8.3\%$ , 3B degree  $17.2 \pm 7.2\%$ , the severity of the condition averaged  $73.4 \pm 9.6$  units according to IF. (tab. 1). The studies were carried out while providing 100% of the physiological need by enteral administration throughout the study period of burn toxemia. A detailed analysis of reliably significant deviations, intergroup differences of the studied indicators was carried out. The results were obtained by monitoring the hourly registration of hemodynamic parameters, body temperature, assessment of fluid balance, analysis of drug correction. The research data were processed by the method of variation statistics using the Excel program by calculating the arithmetic mean values (M) and the errors of the means (m). To assess the significance of the differences between the two values, the parametric Student's test (t) was used. In this case, the critical level of significance was taken equal to 0.05. The interrelation of the dynamics of the studied indicators was determined by the method of paired correlations. Intensive therapy from the moment of admission was aimed at removing burn shock, adequate anesthesia, timely correction of deviations in homeostasis parameters under the control of clinical, functional and biochemical parameters and intravenous administration of crystalloids, volemic and other solutions under the control of hemodynamics, volume of urine output.

**Table 1.**  
**Characteristics of patients of group 3, aged from 7 months to 3 years**

Age, months	2-3 Degrees, %	3B degree, %	IF, units	Days at the ICU	Weight, kg	Height, cm
$17.9 \pm 8.6$	$46.7 \pm 8.3$	$17.2 \pm 7.2$	$73.4 \pm 9.6$	$24.6 \pm 2.4$	$9.1 \pm 0.9$	$68.5 \pm 3.3$

**Results and discussion**

According to the data of studies conducted by numerous authors in healthy infants (up to 3 years), the average SBP value is normally 90 mm Hg, diastolic - 60 mmHg, pulse - 30 mmHg, average BP - 70 mmHg [1,2]. On the first day of burn injury, a tendency to increase SBP, PBP and mean BP was revealed, with a slight decrease in DBP. Thus, the SBP circadian rhythm mesor was  $94.4 \pm 2.7$  mmHg, PBP -  $38.9 \pm 3.1$  mmHg., Average BP -  $72.3 \pm 3.1$  mmHg, diastolic -  $54.4 \pm 2.6$  mmHg (tab. 1). That is, on the first day, a tendency to decrease the tone of peripheral vessels was noted.

**Table 2.**  
**Dynamics of the mesor of the circadian rhythm of hemodynamic parameters**

Days	SBP, mmHg	DBP, mmHg	PBP, mmHg	MBP, mmHg
1.	$94.4 \pm 2.7$	$54.4 \pm 2.6$	$38.9 \pm 3.1$	$72.3 \pm 3.1$
2.	$96.6 \pm 1.3$	$55.8 \pm 0.9$	$40.8 \pm 1.4$	$74.6 \pm 0.9$
3.	$98.4 \pm 1.9$	$56.0 \pm 1.2$	$42.4 \pm 1.8$	$75.4 \pm 1.3$
4.	$97.5 \pm 1.1$	$55.2 \pm 1.6$	$42.4 \pm 1.8$	$74.7 \pm 1.1$
5.	$96.9 \pm 1.3$	$53.8 \pm 2.0$	$43.0 \pm 2.1$	$73.7 \pm 1.3$
6.	$99.5 \pm 1.3^*$	$55.0 \pm 1.7$	$44.4 \pm 1.4^*$	$75.2 \pm 1.1$
7.	$98.8 \pm 1.5$	$57.2 \pm 2.4$	$41.7 \pm 2.1$	$76.3 \pm 1.8$
8.	$99.0 \pm 1.0^*$	$58.0 \pm 0.8^*$	$41.0 \pm 1.2$	$77.0 \pm 0.6^*$
9.	$96.7 \pm 1.6$	$57.4 \pm 1.5$	$39.6 \pm 1.9$	$76.0 \pm 1.0$
10.	$96.3 \pm 1.6$	$56.4 \pm 1.6$	$40.4 \pm 1.4$	$74.8 \pm 1.2$
11.	$96.8 \pm 1.8$	$57.1 \pm 0.8$	$40.4 \pm 1.5$	$75.3 \pm 1.1$
12.	$99.6 \pm 1.2^*$	$57.8 \pm 0.8$	$41.8 \pm 1.6$	$77.1 \pm 0.7^*$
13.	$99.5 \pm 1.1^*$	$57.1 \pm 1.7$	$42.4 \pm 1.9$	$76.5 \pm 1.1$
14.	$97.4 \pm 1.1$	$56.8 \pm 1.2$	$40.6 \pm 1.4$	$75.5 \pm 1.1$
15.	$95.7 \pm 1.3$	$56.3 \pm 1.2$	$39.5 \pm 1.1$	$74.4 \pm 1.2$
16.	$97.2 \pm 0.8$	$58.0 \pm 1.5$	$39.4 \pm 1.8$	$76.0 \pm 1.2$
17.	$97.4 \pm 0.9$	$58.5 \pm 0.9$	$39.2 \pm 1.4$	$76.4 \pm 1.0$

18.	94.0±1.6	56.7±1.3	37.6±2.4	73.4±0.9
19.	99.8±2.1	58.6±1.4	41.7±1.7	77.6±1.4
20.	98.0±1.4	57.6±1.3	40.6±1.8	76.0±1.0
21.	100.3±1.4*	60.9±1.5*	39.4±1.8	78.9±1.3*
22.	98.8±1.5	59.4±2.1	38.8±2.1	77.3±1.0
23.	102.5±1.4*	59.6±2.2	42.4±1.5	81.4±1.3*
24.	103.4±1.5*	59.7±2.7	42.9±2.4	80.9±2.4*
25.	98.8±2.4	58.2±3.0	40.0±2.1	78.8±2.3
26.	99.7±3.2	59.5±1.5	38.2±2.5	79.5±1.9

\*- changes are reliable relative to the indicator in 1 day

There was a significantly significant increase in the mesor of the circadian rhythm SBP by 6 (5.4%), 8 (4%), 12 (5.5%), 13 (5%), 21 (6%), 23 (8.5%), 24 (9.5%) days. The mesor of the circadian rhythm DBP increased by 8 (6%), 21 days (12%). An increase in the PBP mesor was detected on day 6 (by 14%), an increase in the mesor of the circadian rhythm of MBP was detected on days 8, 12 by 6.5%, 21 (9%), 23 (12%), 24 days by 11.8%. In the first wave of the inflammatory reaction (first 9 days), an increase in SBP, DBP, PBP, MBP was observed. At the same time, attention was drawn to a more pronounced increase in the deviations of the SBP, DBP, MBP mesor in the later periods of toxemia (21-24 days) (tab. 2).

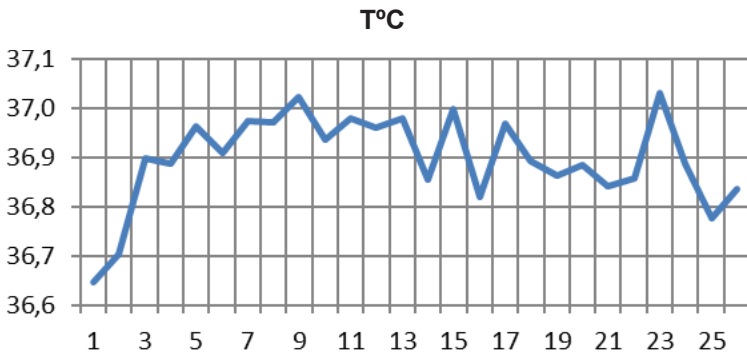
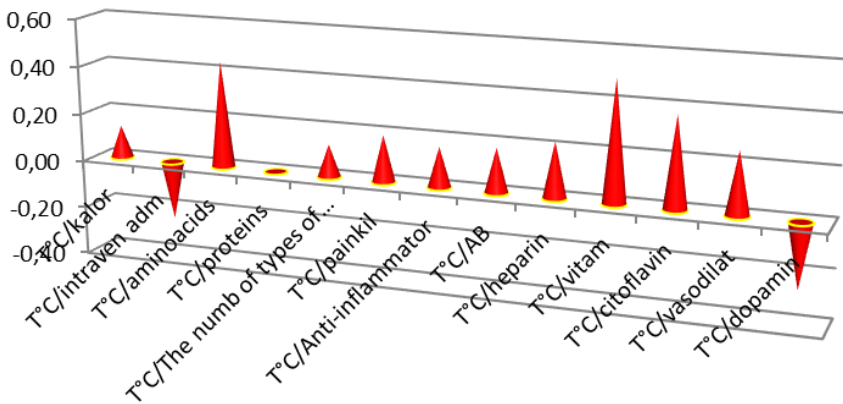


Figure 1. Dynamics of the mesors of the circadian rhythm of body temperature, T° C

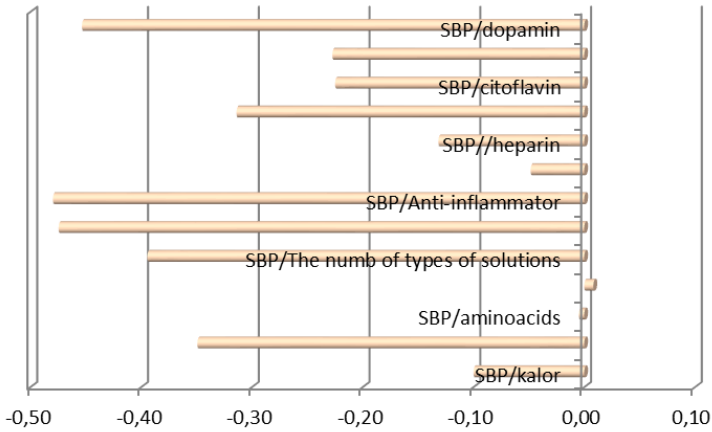
As can be seen from the data presented in Figure 1, against the background of effective intensive therapy, changes in the mesors of circadian rhythms of hemodynamic parameters correspond to a gradual increase in the temperature response up to 9 days and a repeated hyperthermic response on the 23rd day. The revealed changes in the mesor of the circadian rhythm of body temperature confirm the assumption of the inflammatory nature of the changes caused by secondary infection, the rearrangement of hemodynamics in the late stages of burn toxemia in young children.



**Figure 2. Correlation of body temperature with treatment**

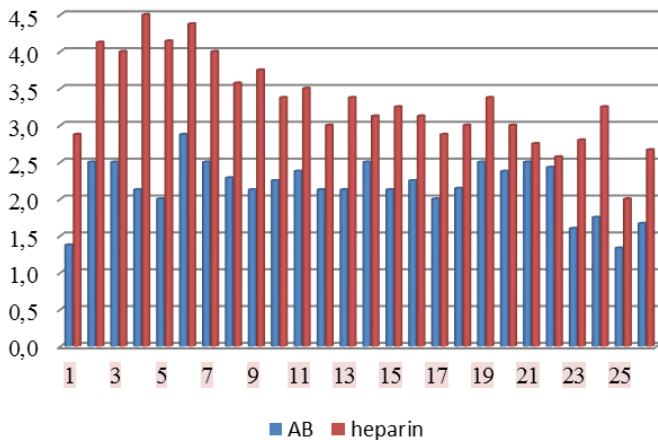
However, in the process of studying the relationship between changes in hemodynamics and the inflammatory response during toxemia (fig. 2), a moderate correlation was found between the mesor of the circadian rhythm of body temperature and the volume of intravenous infusion (0.41), and the frequency of administration of vitamins (0.48).



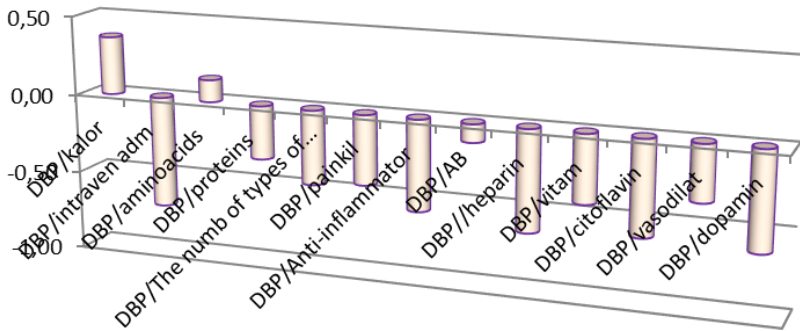


**Figure 3. Correlation of systolic blood pressure with therapeutic correction**

There was a tendency (fig. 3) to decrease the mesor of the circadian rhythm SBP with an increase in the frequency of administration of dopamine (-0.46), anti-inflammatory (-0.48) and painkillers (-0.47). Taking into account the initial tendency to arterial hypertension, the stress-limiting nature of the complex therapy can be noted. Insufficiency of the effect was revealed on days 21-23 due to a decrease in the frequency of administration of AB less than three times a day (fig. 4).

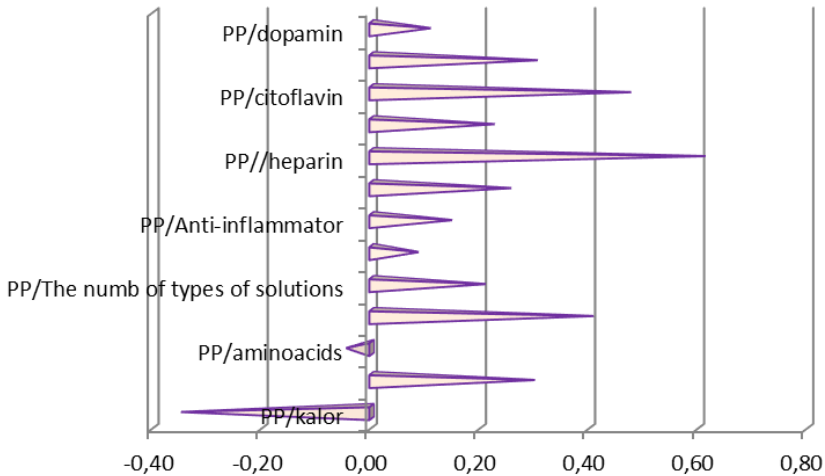


**Figure 4. The frequency of administration of antibiotics and heparin**



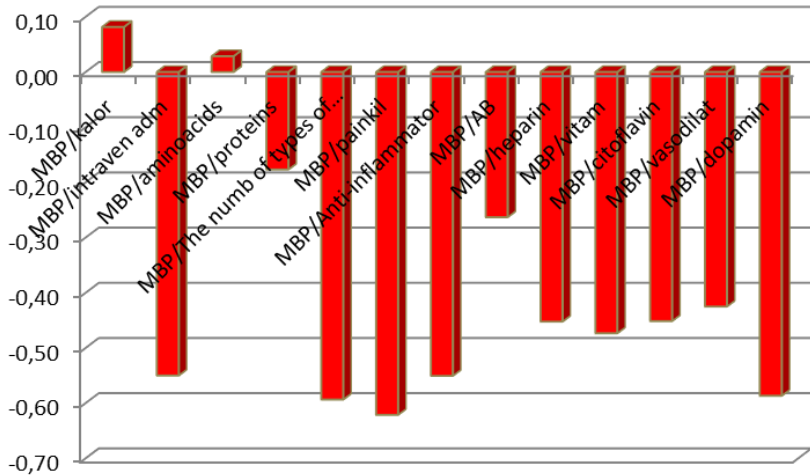
**Figure 5. Correlation of DBP with Treatment**

An inverse correlation was found between the volume of intravenous infusion (-0.7), anti-inflammatory (-0.57), heparin (-0.63), cytoflavin (-0.59), dopamine (-0.61) on the dynamics of the mesor of the circadian rhythm of DBP (fig. 5).



**Figure 6. Correlations between pulse blood pressure and drug therapy**

The introduction of heparin (0.61) had a positive effect on the PBP index (fig. 6).



**Figure 7. Correlations between mean arterial pressure and treatment**

As shown in fig. 7, the most negative effect (a decrease in the mesor of the MBP circadian rhythm) was an increase in the volume of intravenous infusion (-0.55), an increase in the types of solutions (-0.59), anesthesia (-0.62), the introduction of anti-inflammatory (-0.55), dopamine (-0.59), characterizing in general the stress-protective result of the complex therapy.

### Conclusion

Thermal burns 2-3A degree with an area of  $46.7 \pm 8.3\%$ , 3B degree  $17.2 \pm 7.2\%$ , IF  $73.4 \pm 9.6$  units on the first day of burn injury caused, despite the clinical efficacy of complex intensive therapy, tendency to increase in the mesor of circadian rhythms SBP, PBP and mean BP, with a slight tendency to decrease in DBP. In the first wave of the inflammatory reaction (first 9 days), an increase in SBP, DBP, PBP, MBP was observed. A more pronounced increase in the deviations of the SBP, DBP, MBP mesor was found in the later periods of toxemia (on days 21-24), due to insufficiently effective antibiotic therapy. The correlations between treatment and the studied hemodynamic parameters in general characterized the stress-protective result of the complex therapy for burn toxemia in infants under 3 years of age.

### References

1. <https://1serdce.pro/sistolicheskoe-i-diastolicheskoe-davlenie-norma-po-vozzrastam.html>
2. [http://vk.com/@karapuzam\\_by-norma-davleniya-u-detei](http://vk.com/@karapuzam_by-norma-davleniya-u-detei)
3. <https://hpt-kld.ru/tsirkadnyy-ritm-pod-vliyanie-stressa>
4. <https://pediatricsrus.site/prevention/detskij-son-i-cirkadnye-ritmy/>  
<https://studfile.net/preview/6159959/page:15/>
5. <https://scienceforum.ru/2016/article/2016021616>

DOI 10.34660/INF.2022.72.79.013

**FORMATION OF A CULTURE OF BALANCED NUTRITION AS A  
STRATEGIC DIRECTION FOR STRENGTHENING THE HEALTH OF  
KAZAKHSTAN SCHOOLCHILDREN**

**Baubekova Gulzakhira Juraevna**

Doctor of Pedagogic Sciences, Full Professor

**Tardzhibayeva Saule Kenesbekovna**

Candidate of Medical Sciences, Associate Professor

**Abdrakhmanova Damira Yerlanovna**

Master

National Academy of Education named after Y. Altynsarin

Nur-Sultan, Kazakhstan

This article was written as part of the program-targeted financing of the scientific and technical program "Scientific foundations for the modernization of the education and science system" (2021-2023, Reg. № OR 11465474)

**Abstract.** The article deals with modern problems and features of a balanced diet of Kazakhstani schoolchildren. The authors emphasize that the formation of a culture of balanced nutrition is a strategic direction in improving the health of Kazakhstani schoolchildren. Based on the analysis of the nutrition of schoolchildren by region and the study of problems in their nutrition within the framework of the article, the authors offer recommendations developed by them.

**Keywords:** balanced nutrition, food culture, health, schoolchildren, diet, nutrition model.

One of the leading factors determining the state of health is the lifestyle of each person. The main goal in achieving a high level of health is the formation of a healthy lifestyle and a new attitude of a citizen to his health, which should become a natural and internal need.

The overall health promotion strategy includes such elements as a healthy lifestyle policy, stereotypes of behavior, reorientation of health services, especially in working with the population, education, etc. In this regard, school-age children are one of the largest and most socially ac-

tive population groups in Kazakhstan. The number of students in daytime general education schools in our country is more than 2.5 million children. The effectiveness of education and the health of school-age children is determined by the level of catering for students in educational institutions. To maintain health and prevent various diseases, the issue of organizing proper nutrition for school students in the period from 6 to 17 years is very relevant.

Consider what is the essence of a healthy, proper diet. It is known that the human body contains approximately 60% water, 25% protein, 10% fat, 4% minerals, 1% carbohydrates. Metabolic processes are constantly taking place in the body - some substances are burned, oxidized, excreted, they must be replaced with new ones all the time. Nutrition closely connects us with the environment, and food is the very material from which the human body is built. In modern nutrition, there is the concept of "healthy nutrition", which implies, first of all, the preventive effect of food on the body [1].

Healthy eating is not about calorie control and endless diets, it is a complete diet, in which all the necessary products must be present: meat, cereals, dairy products, fruits, vegetables, nuts.

Thus, we adhere to the definition that healthy nutrition is nutrition that ensures the growth, normal development and life of a person, contributes to strengthening his health and preventing diseases.

Many researchers consider food culture as a combination of certain components: scientific achievements, skills, traditions in the field of nutrition. So, V.I. Grigoriev, D.N. Davidenko, V.A. Chistyakov define food culture as: "the level of mastering the theory and practice of optimizing the processes of preparing and consuming food products that ensure the realization of a person's genetic potential in achieving bodily harmony in a person, improving physical conditions".

Other authors (E.A. Bashmakova, A.V. Bakhmetov, O.I. Zhdanova, V.V. Onishina, O.V. Sidorenko, V.M. Shepel, in Kazakhstan - Sharmonov T.Sh., Dalenov E.D. et al.) use the concept of "healthy eating culture", characterizing it as a set of competencies that help a person to realize nutritional needs as one of the basic needs. According to researchers, a stereotype of thinking is being formed that the state of health of an adult depends on the proper organization of nutrition in childhood, which emphasizes the relevance and importance of the problem [2].

For the development of children and adolescents, the formation of a personality with high performance, the prevention of a number of diseases, and the preservation of an active life, nutrition is the most important factor.

Numerous preventive projects and health programs for children around the world have demonstrated the role and importance of nutrition in improving the quality of life, reducing morbidity and mortality. The results of large-scale epidemiological studies aimed at studying the state of physiological nutrition of the population in various regions of Kazakhstan indicate that the structure of nutrition and the nutritional status of children in our country is characterized by serious violations. Eating disorders lead to poor health and, as a result, to the development of diseases. If we take the entire population of the Republic of Kazakhstan as 100%, only 20% will be healthy, people in a state of adaptation (with reduced adaptive resistance) - 40%, and in a state of pre-illness and illness - 20% each, respectively. Among the most common alimentary-dependent diseases are the following: atherosclerosis, hypertension, hyperlipidemia, obesity, diabetes mellitus, osteoporosis, gout, and some malignant diseases [3].

Making nutrition healthier and, accordingly, improving the health of the child population is currently an urgent problem. According to most nutritionists, errors in the structure of children's nutrition have become one of the leading risk factors for the development and progression of most non-communicable diseases. Prolonged malnutrition can lead to a variety of changes, which are based on changes in cell metabolism, associated either with damage to the genetic apparatus, or with a lack of invariable food components or with their excess. The main reasons for the growth and spread of chronic non-communicable diseases, which occupy a leading place in the structure of morbidity and mortality in the population of Kazakhstan, are year-round deficiencies of essential macro- and micronutrients in the diets of all categories of Kazakhstanis, i.e. chronic non-communicable diseases can be classified as alimentary-dependent diseases, and the factors initiating their development are the constant effects on the body of a complex of environmental eco-pathogens, psycho-emotional stress, the modern food production industry, the unreasoned use of synthetic drugs, and also the recommendations of doctors to reduce energy consumption food rations against the background of hypodynamia, which affects the majority of young Kazakhstanis [4].

Food production has a direct connection with one of the global problems of mankind - the food problem.

According to the RK Statistics Agency, the gastronomic map of Kazakhstan on food consumption by the population shows amazing facts. For example, potatoes are most consumed in the Mangistay region, although they grow little there. And residents of the capital of Kazakhstan consume the least of all sweets, and also limit themselves to vegetables

that are more beneficial for the body. The leader in the consumption of fish and seafood is the Atyrau region - 5.217 kg per inhabitant, with an average in Kazakhstan of 2.573 kg. In the South Kazakhstan region and in Nur-Sultan, these products useful for the body correspond to 1.514 kg and 1.952 kg. 59.120 kg of milk and dairy products were consumed per Kazakhstan citizen. East Kazakhstan (78.605) and Pavlodar (78.222) regions were ahead in this indicator, and South Kazakhstan (41.982) and Zhambyl (42.685) regions were outsiders. Residents of Nur-Sultan did not reach the average level - in the capital, 53.867 kg per inhabitant, while in Almaty it turned out to be 62.704 kg [3].

It should be noted that obesity is getting younger from year to year, its prevalence among young children at the moment is 10 times higher than the statistics that were 40 years ago. The issue of overweight in children of the republic has acquired a social character. Nearly 20% of children aged 6 to 9 in Kazakhstan are overweight or obese, with higher rates among urban populations and non-breastfed children. For example, epidemiological monitoring of childhood obesity showed that 77.5% of all children in grades 3-4 have normal weight, and 19.1% of children are overweight, including obesity, among them 6.5% of boys and 5.5% girls are obese, 1.1% - excessive obesity [3].

Unfortunately, in Kazakhstan there is no unified service providing consultations for overweight children and adults. This is due to the fact that there are several reasons for the occurrence of overweight or obesity.

Forming the foundations of proper nutrition for a child is, first of all, mastering useful skills that will help him in everyday life.

Therefore, along with the solution of problems of an economic, technological nature, it is necessary to update the educational tasks that arise in the process of organizing children's nutrition. We need a systematic approach to all aspects of children's nutrition, from hygiene to the promotion of a healthy lifestyle. In this regard, a lot is being done in the republic:

- Improvement of the legislation continues. The new version of the Code "On the health of the people and the health care system" includes measures to form a healthy nutrition policy: teaching the population about healthy nutrition, coordinating food safety policies, conducting scientific research in the field of nutrition, developing and encouraging breastfeeding of children under one year of age and etc.

- Uniform standards for the diet of schoolchildren have been developed, which have been implemented by 53% of schools since the beginning of 2018.

- To solve a number of urgent problems in the field of nutrition and



coordinate the actions of parent committees, the project "Modernization of school canteens" is being implemented, which provides for the interaction of business and schools, the establishment of mandatory standards for school meals and public control.

- A ban on the sale of sugary and carbonated drinks in secondary schools has been introduced.

- Information and explanatory work, training among children and parents is being carried out.

- Work has begun to conduct nationwide surveys on behavioral risk factors for noncommunicable diseases, including on nutrition.

- In order to encourage healthy eating, shelves "Healthy food products" have been organized in large shopping supermarkets.

- Together with the health authorities and the Kazakh Academy of Nutrition, for the first time in the republic, a set of methodological recommendations was developed and a series of books "School Nutrition" was published.

The experience of observations of teachers has shown that students who do not consume hot food during the school day get tired faster, more often complain of headaches, fatigue, stomach pains, bad mood and decreased performance.

Teachers and psychologists note the importance of the fact that during the period of growing up a child learns to independently observe a diet, eat rationally, regardless of the guardianship of adults.

An analysis of the questionnaires we developed to determine the formation of a culture of healthy eating in children shows that one of the reasons for the prevalence of malnutrition is the lack of awareness of schoolchildren, teachers and parents about modern recommendations for healthy eating. Therefore, special attention should be paid to promoting the formation of ideas about a healthy lifestyle and proper nutrition.

An important method in the formation of the foundations of a food culture is reading fiction, which helps to enrich the vocabulary of children, introduce them to folklore, teaches children to be polite, hospitable, cultivates a culture of behavior at the table and forms cultural and hygienic skills, develops horizons. The system of work with children involves various forms of forming ideas about proper nutrition. So, the main forms of work are classes, games, leisure, entertainment, excursions.

In the main educational activity, it is important to introduce the rules and principles of nutrition through excursions, training sessions and various games. In free activities - games, productive activities to consolidate the skills and abilities acquired in the lesson.

In order for children to love healthy food, it is necessary that their parents, the older generation, eat and cook it. A child will not eat boiled beets or turnips if they are offered to him, and meat or salads are served for adults. First of all, parents should accustom themselves to proper nutrition and be an example for their children. It is necessary for the elders to abandon the "Western food model" (fast food, fries) and remember what they were fed in their parental home.

For example, the main food of the Kazakhs was milk and dairy products, boiled and fried meat. Parents and the older generation used boiled and sour milk. Koumiss was made from mare's milk, airan and katyk (yogurt) were made from cow's and sheep's milk, and camel's shubat was made from camel's milk. Various cakes and boursaks, kespe (noodles) were usually prepared from flour, from prosasok (zharma), stew (tare kozhe), oatmeal (talkan) was prepared from fried wheat.

I would like to offer teachers, parents, nutritionists the following proven recommendations:

1. Regularity – that is, the diet.

Already at preschool age, you can teach your child to independently determine the time of the main meals by the clock. Nutrition by the clock is important at any age, but its importance is especially great for children 6-7 years old, as there is an active growth and maturation of the body. The child should form the idea that daily food is necessarily tomorrow, lunch, afternoon tea and dinner.

2. Diversity – the task of teachers and parents to form a diverse taste horizon so that he likes different foods and dishes. It is necessary to help to understand that tasty, not always healthy food.

3. Adequacy – the replenishment of the body's energy costs. Children need to form an idea of how much food is enough, insufficient and excessive.

4. Safety – food safety is ensured by 3 conditions - this is personal hygiene, the ability to distinguish between fresh and stale foods, and careful handling of unfamiliar foods.

The child needs to know if there are doubts about the freshness of the products, that is, it cannot be. The same attitude must be formed towards unfamiliar foods, as new foods that are unfamiliar to our food culture may contain allergens that are hazardous to health. And acquaintance with unfamiliar products should only be in the presence of an adult.

5. Pleasure – eating should take place in a warm, cozy atmosphere, at a beautifully set table.

During the meal, you need to pay attention to how the food is deliciously

cooked, how varied it is, and discuss the merits of the dishes. Teach children to describe a dish by smell, taste and appearance.

Forming the foundations of proper nutrition for a child is, first of all, mastering useful skills that will help him in everyday life.

### References

1. Martinchik A. N. General nutrition: Textbook. — M.: MEDpress-inform, 2005. — 392 P.
2. Akhmetova, G.K. Study of nutrition of children in preschool institutions in the West Kazakhstan region // Young scientist. — 2015. — № 6.3 (86.3). — P. 14-19.
3. Sharmanov, T. Sh. Scientific foundations of the national policy of healthy nutrition of the Republic of Kazakhstan.// Health and disease. - 2007. - № 4. - P. 9-11.
4. Website of the Agency of the Republic of Kazakhstan on Statistics // [www.stat.gov.kz](http://www.stat.gov.kz)
5. Tapmaeva I.Yu. Features of the structure of nutrition at the present stage // Successes of modern natural science. - 2007. - № 3 - P. 16-17
6. Efremov A.A. Problems of healthy nutrition of the population of certain regions of Russia // Successes of modern natural sciences, - 2012. - № 9. - P. 7-9
7. Alekseeva H.B. Problems of production, processing, sale and quality control of food // New University. Series: Economics and Law. - 2013. - № 1. - P. 9-11.
8. Luchyanov V.I., Mukhoryanova O.A., Nedvizhay S.V. Theoretical Aspects of Sustainable Economic Development of the Region: Monograph / Total. ed. dr. econ. sci. V.I. Lukyanov. - Stavropol: Publishing house "AGRUS", 2013. - 120 P.

## THE ROLE OF MAGNETIC RESONANCE IMAGING IN THE DIAGNOSIS OF PLEOMORPHIC ADENOMAS OF THE LARGE SALIVARY GLANDS

**Bubnova Evgeniia Viktorovna**

Candidate of Medical Sciences, Associate Professor  
Pavlov First Saint Petersburg State Medical University

**Abstract.** Tumors of the salivary glands occur in 3-5% of all tumors of the head and neck, occur mainly in the parotid and submandibular salivary glands. The most common benign tumor of the major salivary glands is the pleomorphic adenoma. Up to 80% of pleomorphic adenomas occur in the parotid salivary glands, 10% in the submandibular salivary glands, and 10% in the minor salivary glands. In the course of our study, the number of patients with histologically verified pleomorphic adenoma of the major salivary glands among patients with confirmed tumors of the salivary glands was 48.5% ( $p < 0.001$ ), while in this group women significantly predominated - 80.4% ( $p < 0.001$ ). In 97% of cases, the tumor was localized in the parotid salivary gland and in 3% - in the submandibular salivary gland.

**Keywords:** magnetic resonance imaging, major salivary glands, pleomorphic adenomas

### **Purpose of the study**

To identify the characteristic signs of pleomorphic adenomas of the major salivary glands when performing magnetic resonance imaging.

### **Materials and methods**

In the clinic of maxillofacial surgery FSBEI HE Pavlov FSPbSMU MH RF for the period from October 2014 to December 2021, 243 patients were examined with suspicion of the presence of formations of the large salivary glands, among which the presence of a neoplastic process in the structure of the large salivary glands was confirmed in 101 patients. By gender, among patients with large salivary gland formations, women predominated (70 patients), a minority were men (31 patients), the ratio of women and men was 2.2:1. The mean age of patients with tumors of the major salivary glands was  $54.2 \pm 8.2$  years. From the moment the first symptoms appeared (in the form of an increase in the volume of soft tissues in the

projection of the parotid or submandibular region) to the patient's visit to the maxillofacial surgeon,  $4.6 \pm 2.3$  years passed. The criterion for inclusion in the study was the suspicion of a neoplasm of the salivary gland in the patient, based on the presentation of complaints of an increase in soft tissues in the projection of the parotid or submandibular regions. The exclusion criterion was the presence of an oncological history, surgical operations on the organs of the head and neck, and contraindications to magnetic resonance imaging. The final verification of the diagnosis was carried out on the basis of postoperative histological data. Magnetic resonance imaging was performed on a high-field tomograph with a magnetic field strength of 1.5 Tesla using pre- and post-contrast T1 weighted images (WI) based on spin echo (time of repetition (TR)/time of echo (TE) 32 ms, 659/12; matrix 256\*256; slice thickness - 2.5 mm; distance between slices - 2.5 mm; field of view (FOV) - 20-25 cm, images were obtained in three orthogonal planes (coronal, sagittal and axial), as well as T2 weighted images (WI), fat-suppressed programs, DWI (with  $b=0$  and  $b=1000$ , with the construction of maps of apparent diffusion coefficient (ADC)) and contrast enhancement (using the technique of image subtraction). The area of study is from the lower edge of the orbits to the collarbones with a targeted examination of the parotid and submandibular regions. The interpretation of the data of standard pulse sequences was based on the assessment of the location of the tumor, its shape and size, the characteristics of its contours, and the presence of a capsule. The intensity of the signal from the tumor was divided into hyper-, hypo- and isointense relative to the surrounding intact salivary gland tissue and adjacent muscles. Diffusion coefficient measurements were performed on an apparent diffusion coefficient (ADC) map using region of interest ROI in the parenchymal part of the tumor, avoiding the cystic-necrotic or calcified part. Statistical analysis of the obtained results was carried out using conventional parametric and nonparametric methods.

### Results

Tumors of the salivary glands occur in 3-5% of all tumors of the head and neck, occur mainly in the parotid and submandibular salivary glands, but also occur in the minor salivary glands located in the oral mucosa. According to the literature, benign tumors occupy up to 80% of salivary gland tumors. The most common benign tumor of the major salivary glands is pleomorphic adenoma, less common adenolymphoma. Up to 80% of pleomorphic adenomas occur in the parotid salivary glands, 10% in the submandibular salivary glands, and 10% in the minor salivary glands. Pleomorphic adenomas of the salivary glands are more common in patients in

the third to sixth decades of life, with a predominance in females (2:1 ratio). A feature of pleomorphic adenoma is its tendency to malignant transformation during long-term existence, which makes the task of the earliest and most accurate detection of this pathology extremely important.

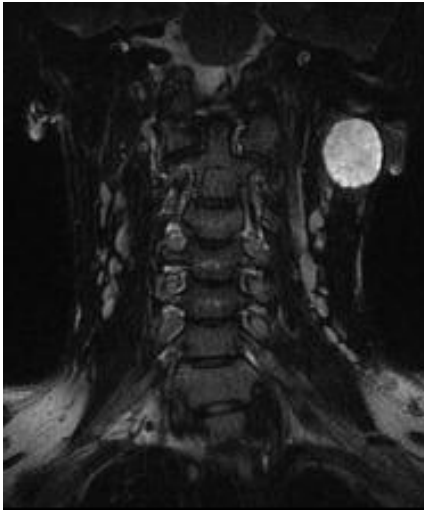
In the course of our study, the number of patients with histologically verified pleomorphic adenoma of the major salivary glands among patients with confirmed tumors of the salivary glands was 48.5% ( $p < 0.001$ ), while in this group women significantly predominated - 80.4% ( $p < 0.001$ ). In 97% of cases, the tumor was localized in the parotid salivary gland and in 3% - in the submandibular salivary gland. In addition, pleomorphic adenoma affected the left parotid salivary gland somewhat more often than the right parotid salivary gland ( $p < 0.876$ ). In the structure of the sublingual salivary glands, no histologically verified pleomorphic adenomas were found during our study. When interpreting MRI data, pleomorphic adenoma of the salivary glands had the appearance of a round or oval formation with clear and even contours, with a thin capsule in 92.8% of cases. When performing T1 weighted images, the structure of the pleomorphic adenoma in 65% of cases had a hypointense signal, and when performing T2 weighted images, in all cases it had a hyperintense signal (homogeneous in 78% of cases, heterogeneous in other cases). When performing diffusion-weighted images (DWI), the true restriction (limitation) of diffusion in the structure of the tumor, as a rule, was not determined. In most cases, qualitative analysis of diffusion-weighted images reveals false diffusion restriction ("T2 transillumination"). In quantitative analysis, the average values of the measured diffusion coefficient in pleomorphic adenomas were  $1.72 \pm 0.29 \text{ mm}^2/\text{s}$ . ( $p < 0.001$ ). In addition, significantly significant differences in the value of the measured diffusion coefficient between pleomorphic adenomas and malignant neoplasms were revealed, which allows planning an algorithm for further treatment and determining the extent of surgical intervention. When analyzing post-contrast T1-weighted images, including when using the subtraction technique (image subtraction), diffuse heterogeneous accumulation of the contrast agent by the tissue of pleomorphic adenoma was determined in all cases, which is a characteristic feature of this type of tumor process.



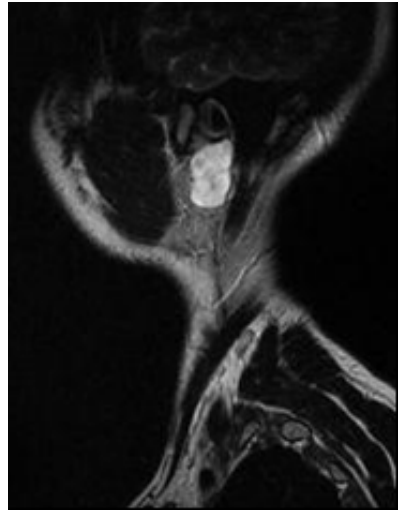
Coronal projection T2 WI



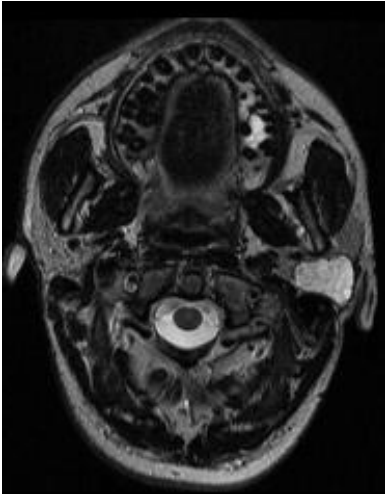
Coronal projection T1 WI



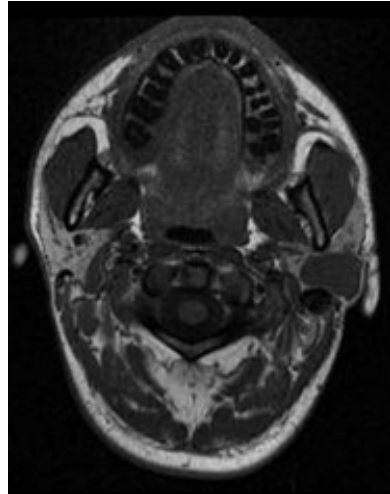
Coronal projection T2 WI FatSat



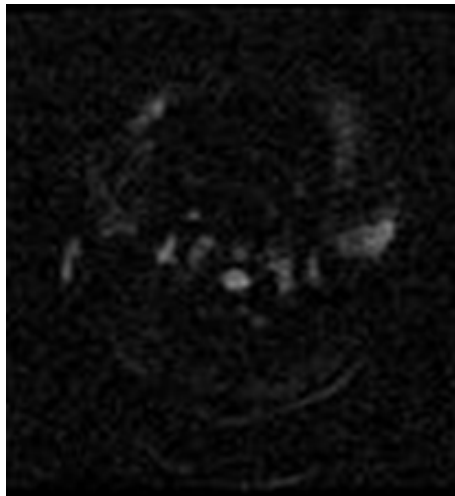
Sagittal projection T2 WI



Axial projection T2 WI



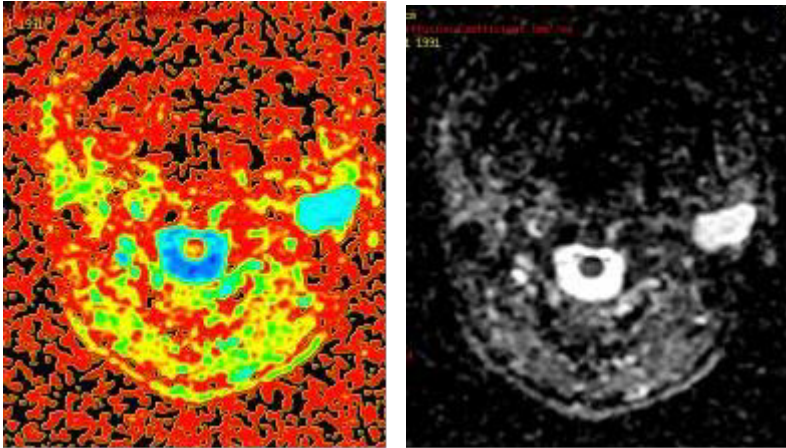
Axial projection T1 WI



Axial projection DWI with b=1000

**Figure 1. Patient D., 27 years old, neoplasm of the left parotid salivary gland (histologically - pleomorphic adenoma)**





Apparent diffusion coefficient (ADC) maps

### **Conclusions**

According to magnetic resonance imaging, preoperative prediction of the histological structure of the tumor is possible, which provides valuable information in planning further treatment and determining the extent of surgical intervention. Pleomorphic adenomas of the major salivary glands have characteristic features on magnetic resonance imaging, which allows you to determine the exact localization of the tumor in the structure of the salivary gland and identify a clear border with the surrounding unchanged tissue of the salivary gland.

**A NEW METHOD FOR THE TREATMENT OF SCHIZOPHRENIA WITH  
A COMPOSITION OF CYTOKINES. AS A RESULT OF A CLINICAL  
EXPERIMENT, A LONG-TERM 100% REMISSION HAS BEEN  
REPEATEDLY OBTAINED**

**Voronov Alexandr Ivanovich**

Candidate of Medical Sciences, Psychiatrist  
Clinic of Pathology of Higher Nervous Activity  
Novosibirsk, Russia

**Mulka Bernd Germany, Munich.**

Automation engineer, stepfather of one of the patients who took part in the clinical experiment, retired

**Abstract.** In our experiment, non-invasive cytokine monotherapy in more than half of the cases led to a long-term 100% remission in patients with an established diagnosis of "schizophrenia" (F20). The signs of the existing defect were reduced, including autism (in the understanding described by E. Bleyer). Independent physiological sleep was completely restored (according to the results of polysomnography). The ability to learn and work returned, social ties were restored. All patients taken in the experiment, prior to treatment with cytokines, were repeatedly treated with neuroleptics in psychiatric hospitals in Russia and the European Union without results.

Based on the results of the experiment, we have proposed a fundamentally new model of the pathogenesis of schizophrenia, which is based on:

1. Recognition of a defect in the astroglial network as the initiating and leading cause of the pathogenesis of all types of schizophrenia, including autism!

2. Damage to astroglia changes the sensitivity of tripartite synapses to dopamine, serotonin, and a number of other mediators. We abandoned the idea of neurocentricity in favor of the equality of astroglial and neural networks in the pathogenesis of psychosis.

3. A schizophrenic defect develops as self-poisoning of the brain due to a drop in the volume of the draining flow of cerebrospinal fluid in the glymphatic system. Delta sleep deficiency is the main cause of autointoxication. Normalization of slow sleep, in some, not neglected

cases, makes it possible to reduce the defect.

4. The CSF flow separating the dense layer of astrocyte pedicles from the cell layer of the vascular wall is an integral part of the blood-brain barrier! A multiple amplification of this flow occurs exclusively in the phase of slow sleep. The breakdown of this drainage mechanism is the main cause of the development of schizophrenia.

5. Exacerbation of F20 psychosis is always associated with a violation of the normal balance of cytokines. The goal of our therapy is to restore this balance. Psychotropic drugs bind dopamine in the synaptic cleft, artificially and temporarily stopping not the root cause, but only the consequences of this pathological process. By regulating the balance of cytokines, we gradually restore the draining mechanism of slow sleep, reduce autointoxication, so astroglia is revived. The remaining oligodendrocytes proliferate, as a result, axon myelination is restored. Astrocytes again become able to energetically support neurons. The clinical manifestations of schizophrenia gradually disappear. The genetic burden remains. This leads us to call the result obtained not a cure, but a remission, although clinically we see the regression of psychosis, often with a complete reduction of the defect.

**Keywords:** Monotherapy with cytokines gives a long-term 100% remission of F20.

The amount of non-REM sleep is an objective instrumental predictor of schizophrenia. The use of cytokines, in some cases, leads to the reduction of the schizophrenic defect.

For the first time in the history of psychiatry, we have cured schizophrenia! Of course, it would be more correct to say - to achieve a long-term 100% remission. This remission is complete, stable and lasts for many years. Our first F20 patients have already given birth to children, received education, including higher education, work successfully and live quite independently, forgetting about psychiatrists and not receiving any maintenance therapy... And it all started by chance... Not for nothing they say; "Chance is a great organizer!"

We were led to the discovery of this method of treating schizophrenia by a case of suicide that occurred in the spring of 1997 in the village of Novosibirsk Oblast. A local hunter, born in 1964, attempted suicide and was shot twice in the heart with a 12-gauge hunting rifle. The video is on our website; <https://schizophrenia8.ru/video>. On the same site you can read most of the articles to which we will refer. The patient's interview is on YouTube. <https://www.youtube.com/watch?v=BkAtq6L1jKU&t=13s>

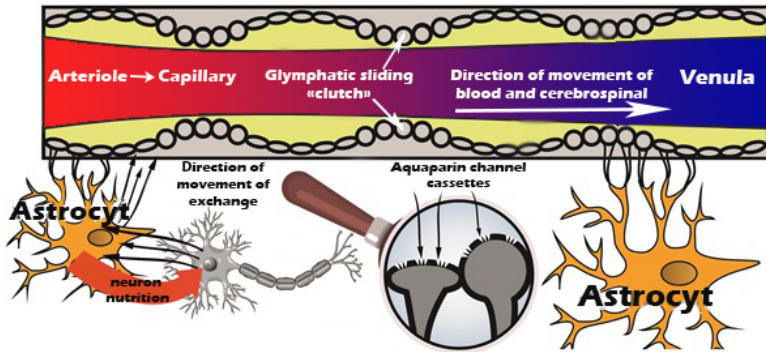
Both bullets went right through. The heart was not hurt. After the operation, a cryopreserved mixture of cytokines (CPRC) was instilled into the vein of the patient - a course (200 ml №7 each). The drug was developed at the Institute of Immunology and at that time was experimentally used in severe, often "hopeless" cases of extensive traumatic injuries, as well as after operations for resection of the lung lobes in case of tuberculosis, etc.

Among the doctors was a psychiatrist... He was delighted with the disappearance of imperative "voices from outer space" - pushing the patient to commit suicide. Antipsychotics and psychotropic drugs were not used in the described case. But! The most surprising was the complete disappearance of not only pseudo-hallucinations, but also of all productive symptoms against the background of sound independent sleep, immediately after the first droppers. Prior to the use of cytokines, this patient was observed in a psychodispensary, was repeatedly hospitalized and was discharged from the army due to paranoid schizophrenia.

For five years, no signs of psychosis occurred in the patient. Only then did the understanding of the special value of the use of cytokines in F20 arise. Subsequently, CPRC has been used to treat schizophrenia in a number of other patients. The result was excellent, but the experiments were not carried out regularly, and the film material was lost. Finally, in 2008, a real experiment was launched. As F20 monotherapy, CPRC was used in the form of a solution for a nebulizer, slowly inhaled, through the nose, or a sterile CPRC preparation was instilled into the eyes and nasal passages. Parenteral, intravenous administration of CPRC was carried out until 2017, but was discontinued after several cases of idiosyncrasy. All cases ended successfully, however, I did not want to risk the very idea, with the threat of complications. This could put an end to the entire experiment. The paradox was that patients recovered after cytokine therapy, but we did not understand the mechanism of action of cytokines. We tried to explain our results by stimulating stem cells in the olfactory zone, followed by homing of neurons to the hippocampus, etc. Now, it's ridiculous for us to remember these clumsy attempts ourselves...[2,3,5]

Finally, we noticed that shortly before the reduction of psychoproducer symptoms, our patients had a strong long sleep, continuously up to 12-15 hours. Then, in addition to MRI and prepulse inhibition, we began to conduct polysomnography for our patients without fail. As a result, we were able to link the quality and quantity of delta sleep with the dynamics of the disappearance of psychoproducer symptoms and the reduction of the defect. In 2018, we published a figure [1,3,4,5] theoretically explaining the mechanism of CSF movement through the lymphatic system. We

realized that astroglial autointoxication is directly related to the lack of non-REM sleep and is completely dependent on the balance of cytokines.



Finally, in June 2021, we sent a paper to a conference in Birmingham about the "three vicious circles of the pathogenesis of schizophrenia". In the figure for this article, we schematically outlined three pathogenetic mechanisms [1] leading to the emergence of psychoproductive symptoms and the formation of a defect. At the same time, we drew attention to the limited therapeutic effect of neuroleptics and the impossibility of curing psychosis with their help... At the same time, we by no means call for the abandonment of neuroleptics, although we ourselves cancel them, but - **"THE BEST IS THE ENEMY OF THE GOOD!"**

It is easy to find a detailed description of the patients cured by us in the articles on the website <https://schizophrenia8.ru/> so we decided not to clutter up the limited volume of publication with clinical examples, especially since in this article for the first time we called for co-authors not a doctor - a psychiatrist, but the stepfather of a participant in the experiment born in 1992, who conflicted with psychiatrists in Munich (Germany) for years about the treatment of his adopted daughter. Over the years, trying to help his daughter, he was forced to read a large amount of specialized literature on psychiatry and psychopharmacology, studied the law and gained invaluable experience in communication between psychiatrists, psychiatric institutions, police and relatives of patients with F20. The daughter has been ill since the age of 13. At the Munich University of Psychiatry and Psychotherapy, the adopted daughter of our co-author, after long ordeals, was diagnosed with hebephrenic schizophrenia (ICD-10 F20.1) in 2017. The daughter was hospitalized eight times in psychiatric institutions in Munich, and four times she was taken to psychiatrists by the police. We have

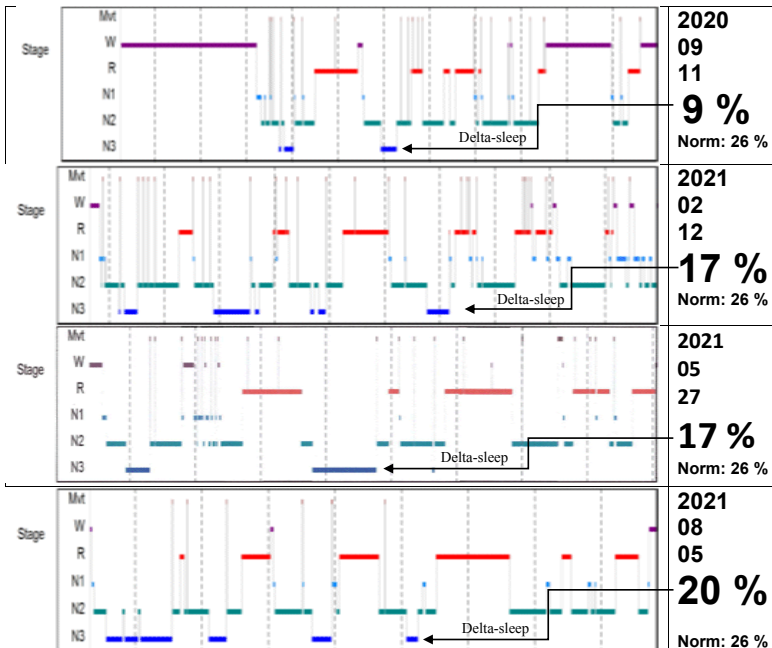
tried to preserve the style and way of presenting the thoughts of our co-author. Here is his monologue: The diagnosis of "schizophrenia" is a blow of fate for close relatives and good friends. The person feels at the mercy of the disease without any hope. Find out what I went through. As parents, you do not want to accept the truth that a son or daughter has schizophrenia. Very important: this is a special type of disease that is difficult to diagnose at the initial stage using the methods adopted by psychologists and psychiatrists. The disease may occur in outbreaks. It comes back with other symptoms and may not respond to previously effective medications. BUT: the disease progresses and cannot be stopped by antipsychotics and similar psychotropic drugs, let alone cured! Treat only the symptoms, not the causes. You cannot rely on the testimony of psychologists and psychiatrists, even if their information seems to be very reliable. It is possible to help the patient alleviate his suffering with psychotropic drugs, but only for a limited time. Unfortunately, psychiatrists, especially in psychiatric clinics, all too often give too high doses of psychotropic drugs, without taking into account the significant side effects that the patient must suffer. In addition, the abolition of these drugs is a complex process that requires unconditional attention. It is also important that close relatives are concerned about the patient's capacity. When making a diagnosis of schizophrenia, I strongly recommend that you obtain a notarized power of attorney from the patient so that he has the rights of a guardian. When a patient is seen by his actions in public, he can be placed in a closed department, and then a foreign guardian can be established by the court. And all this without information to relatives. Without a certified power of attorney, parents and friends do not receive any information from doctors and even from authorities, especially if the patient is already an adult. I first met my adopted daughter at the end of 2002-beginning of 2003. She was a quiet, reserved and kind child. But even then I noticed her shyness. I really got to know her later, after she moved to Germany, in September 2005. She really wanted to study, especially in terms of learning German. Unfortunately, as parents, we received instructions from the German class teacher that the daughter stood out from other students and avoided contact with them. In the beginning, we were looking for a child psychologist. Then, we were instructed by a doctor to see a child psychiatrist in Landshut. There, the daughter was at receptions from February 2007 to July 2010. Initially diagnosed with "childhood social anxiety disorder" (F93.2) Later: "Social phobia" (F40.1 G). Paroxetine 20 mg was prescribed. As parents, we were not well aware of the side effects of paroxetine. We later learned that "Paroxetine should not be used to treat children and adolescents under the age

of 18, it produces suicidal behavior". At the beginning of 2011, my daughter passed the 12th grade of a technical school with a degree in economics. This was the level at which in the summer of 2011 the school ended with Abitur. It was a big stress for my daughter. In the spring of 2011, the daughter expressed thoughts of suicide, after which she was first placed in a psychiatric clinic in the city of Taufkirchen (from March 08 to April 29, 2011). A diagnosis of paranoid psychosis (F20.0) was made. Quetiapine 600 mg/day was promptly given. Doctors have not tried to succeed with lower doses. For us, as parents, being diagnosed with "schizophrenia" was like a punch in the face. Especially when it was predicted that the daughter would not bathe, take a shower, wash her hair. The daughter was prescribed paroxetine 20 mg once a day in the morning and 600 mg quetiapine in the evening. Further treatment took place through the psychiatric day clinic and the Freising institute ambulatory. Until the end of 12th grade, the medicine was not changed. The daughter successfully graduated from a technical school with a degree in economics in 2012 and began teaching by profession in September 2012. From 07.11.2016 to 21.12.2016 she was treated at the Westendstrasse Psychiatric Day Clinic in Munich. The following diagnoses were made there: "Social phobia" (F40.1), "Depressive episode of moderate severity" (F32.1) "Combined personality disorder with anankastic and schizoid proportions" (F60). In a conversation with the head physician, autism was suspected and contact with an autism specialist from the Max Planck Institute of Psychiatry was recommended. In the autumn of 2017, she also suffered from delirium and was admitted to the closed ward of the Nord Psychiatric Clinic for Psychiatry and Psychotherapy (Station P3) in Munich, after she ran away from home. She was diagnosed with "hebephrenic schizophrenia". During the stay, they tried to treat her with medicines, but this failed, as she secretly spit them out. On October 31, 2017, the daughter was discharged from the hospital. In February 2018, the daughter was still being examined by a psychiatrist from the Max Planck Institute for Psychiatry. 08.23.2019. Again she was taken by the police to the psychiatric clinic in Taufkirchen. Then she was diagnosed with "paranoid schizophrenia" (F20). Severe control limitations and auditory hallucinations were found. On 10.11.2019, the daughter was again hospitalized by the police at the Taufkirchen clinic. She was now diagnosed with "hebephrenia" (F20.1). Hallucinations and various obsessions were revealed. The 600 mg dose of quetiapine was immediately increased to 700 mg. However, it didn't get any better. The daughter showed herself very tired in the morning. Switching to haloperidol started on 10/30/2019 to 6 mg/day. However, akathisia and delusional symptoms soon appeared,

with the presence of the grandmother and vision or talking with ghosts. Then, starting on 11.19.2019, she was switched to clozapine up to 250 mg/day. Then on 09.12.2019 haloperidol was cancelled. The daughter grew strong anxiety episodes, especially when she was alone in the room, the ghosts frightened her, and the deceased grandmother talked to her louder and badly assessed her. On 12.17.2019, risperidone was prescribed along with clozapine. 12.27.2019. Tiredness appeared, as well as hypersiallorrhoea. As part of this antipsychotic combination, the daughter continued to report auditory hallucinations. The condition was horrendous for us as parents at the end of 2019. In addition to severe obsessions and hallucinations, we felt that the daughter was suffering from the side effects of haloperidol and clozapine. I had to listen to the phrase from the head physician: "Yes, you are resistant to therapy." The daughter was discharged on 12.31.2019. From 02.11.2020 to 05.25.2020, the daughter was hospitalized at the Clinic for Psychiatry and Psychotherapy at the University of Munich. They continued to drop psychotropic drugs from Taufkirchen. Was started with taking abilify (aripiprazole) up to 20 mg until 03.12.2020. Starting from March 24, 60 mg/day of duloxetine was additionally administered. In an MRI study, it was found that expanded internal and external CSF spaces that exceeded the age norm appeared without specific signs of atrophy or signs of acute accumulation of CSF, which is in good agreement with the picture in paranoid schizophrenia. From 07.01.2020 to 08.28.2020, the daughter was in the day outpatient clinic for psychiatry and psychotherapy at the University of Munich. However, all this time her condition did not change. After a long journey of suffering through German psychiatric clinics and after unsuccessful treatment with statements like "You are resistant to therapy!" my wife managed to find a Russian doctor who treats schizophrenia with cytokines. His approach was not the same as usual in Western Europe. We found hope and began planning our daughter's trip and stay with her mother. As of 10.09.2020, daughter started treatment in Novosibirsk, Russia. Antipsychotics prescribed so far have been cancelled. An analysis was made of only 9% delta sleep at a rate of 26%. An MRI of the head at 3 Tesla was performed. These objective methods quickly made it clear that the daughter was, in fact, suffering from schizophrenia. Thus began the treatment with cytokines, which are inhaled through the nose and dripped into the eyes. During my first telephone conversations with my daughter, I felt that she was again suffering from hallucinations, attention disturbances and thought circles. I attributed this to the discontinuation of antipsychotics. Then at the end of 2020, the hallucinations disappeared. The daughter was also more outspoken on the



phone. She answered not only "yes" and "no", but already with whole sentences. She began to be interested in many things. In the 1st quarter of 2021, the situation improved even more. She began to show emotions. Her features were no longer petrified. She understood jokes and tales and began to laugh contagiously at the same time. She became more and more natural. However, what is left is her circle of thoughts and her trouble concentrating. In the 2nd quarter of 2021, it developed for the better. She was interested in many things in life, cooking in the kitchen and much more. You could talk to her the right way. She began to pay attention to her hair. For some time, delta sleep rose to 17%, which showed that the treatment with cytokines was successful. The cycle of thoughts, unfortunately, was still very disturbing. In the 3rd quarter, the daughter proved to be very helpful and very interested during her stay in Germany. She was much more open and easy to talk to. In later phone conversations, I got the impression that she was happy, and each time it became an interesting conversation. Only the circle of thoughts has not yet gone and greatly hinders. I know that one should never give up hope, even if it can sometimes be a deceptive hope. My daughter is recovering. This is objectively evidenced by the increase in % delta sleep over time.



### References

1. Voronov A.I. Vicious circles in the pathogenesis of schizophrenia. International conference. Process management and scientific developments juli 21. 2021 Birmingham.
2. Voronov A.I. A new look at the pathogenesis and treatment of schizophrenia // Academic Journal of Western Siberia. - 2018. - №3. - volume 14.
3. Voronov A.I. Reduction of defective symptoms as a result of long-term use of cytokines // Academic Journal of Western Siberia. - 2018. - №6. - volume 14.
4. Voronov A.I. et al. The leading role of astroglia in the pathogenesis of schizophrenia // Scientific Forum Siberia. - №2. - volume 6. - 2020.
5. Voronov A.I. Mechanisms of formation of schizophrenic defect // Scientific forum Siberia. - №1. - volume 7. - 2021.

DOI 10.34660/INF.2022.99.74.016

UDC 616-08-039.57

**ANALYSIS OF PRE-HOSPITAL DRUG TREATMENT IN GERIATRIC PATIENTS WITH DECOMPENSATION OF CHRONIC HEART FAILURE**

**Podobed Ivan Vladimirovich**

postgraduate

Belgorod State National Research University, Belgorod, Russia

ORCID ID: 0000-0001-6644-6054

**Butikova Elena Sergeevna**

postgraduate

Belgorod State National Research University, Belgorod, Russia

ORCID ID: 0000-0003-3430-2843

**Rukavishnikov Aleksey Sergeevich**

Candidate of Medical Sciences, Deputy Chief

Tosno Clinical Interdistrict Hospital, Tosno, Russia

ORCID ID: 0000-0002-7028-5406

**Prashchayeu Kirill Ivanovich**

Doctor of Medical Sciences, Full Professor

Belgorod State National Research University, Belgorod, Russia

CEO Research Medical Centre «GERONTOLOGY», Moscow, Russia

ORCID ID: 0000-0003-4207-6137

**Introduction.** The prognosis for heart failure remains poor and the mortality rate is high, regardless of the existing advances in treatment. An important component of treatment is drug therapy. The real situation of outpatient therapy for patients with CHF remains poorly understood. In this connection, the study of outpatient therapy for patients with CHF is an actual task.

**Objective:** to study the scope of prehospital drug therapy in patients with decompensated CHF.

**Materials and methods:** included 107 patients aged 46-95 years with decompensated CHF functional class III-IV (FC). 4 groups were formed: 1st - 29 people. ( $53.9 \pm 4.5$  years old) middle age (46-60 years old); 2<sup>nd</sup> - 31 people ( $68.3 \pm 5.0$  years) elderly (61-74 years); 3rd - 40 people ( $81.5 \pm 4.1$  years) old age (75-89 years). 4<sup>th</sup> - 7 people ( $92.4 \pm 1.4$  years) of the age of centenarians (> 90 years). Patients underwent: examination, electrocardiography (ECG), echocardiography (EchoCG), coagulogram with determi-

nation of the level of international normalized ratio (INR).

**Results:** there was a significant decrease in the number of patients with reduced ejection fraction (EF) ( $p = 0.03$ ) and an increase in the number with preserved EF (50% or more) ( $p = 0.02$ ) with increasing age. There was an increase in the number of patients receiving digoxin ( $<0.01$ ) with increasing age. There were no significant differences between the groups in the presence / absence of atrial fibrillation / flutter ( $p = 0.7$ ). 85.7% of patients with atrial fibrillation / flutter did not receive anticoagulant therapy prehospital. The number of patients receiving new oral anticoagulants (NOAC) significantly increased with age ( $p < 0.01$ ).

**Conclusion.** Heart failure with reduced ejection fraction is dominated by middle-aged people prevails. Patients of elderly and senile age had a high prevalence of CHF with preserved EF. All study groups showed a high prevalence of atrial fibrillation / flutter. Regardless of age, there were few patients receiving pre-hospital drug therapy. 85.7% of patients with atrial fibrillation / flutter did not receive anticoagulant therapy prehospital.

**Keywords:** chronic heart failure, outpatient drug therapy, pre-hospital drug therapy, atrial fibrillation, anticoagulant therapy.

### Background

The number of elderly people is steadily increasing every year. An increase in the age of patients is accompanied by an increase in the prevalence of CHF [1], [2], [3]. In middle-aged patients, the incidence of CHF does not exceed 1%. Among people over 80, already 10% have CHF [4]. According to the data of the EPOCH-CHF and EPOCH-O-CHF studies, the prevalence of CHF in the Russian Federation (RF) is 7%. However, among the population over 65, the proportion of such patients is 12.9% [5].

With the increasing prevalence of CHF among patients over 65 years of age, issues of prevention and treatment of this disease are of particular importance. According to the recommendations of the All-Russian Scientific Society of Cardiology (RSC), the main classes of drug products (DP) recommended for CHF are the following groups - beta-blockers, angiotensin-converting enzyme inhibitors (ACE inhibitors), diuretics, angiotensin II receptor blocker (ARB II). Additionally, the prescription of aldosterone antagonists, cardiac glycosides, as well as a relatively new class of drugs - neprilysin inhibitors / angiotensin II receptor blockers, can be considered [5].

The prognosis of patients with heart failure remains poor. According to the Framingham Heart Study (FHS), mortality within 5 years from diagnosis is 67% [6]. Currently, one of the most important prognostic factors

in heart failure is drug treatment. However, the real situation of outpatient therapy for these patients remains poorly understood. In this connection, one of the objectives of this study was to evaluate the outpatient treatment of patients with decompensated CHF.

Rhythm disturbances often accompany and aggravate the course of CHF. One of the most common atrial arrhythmias is atrial fibrillation (AF) [7], [8], [9]. In the EORP-AF study, a permanent form of atrial fibrillation was detected in 19.7% of patients with heart failure [10]. According to the Framingham Heart Study, 37% of patients (middle age 75+/-12 years old) with new-onset atrial fibrillation had heart failure [11]. The prevalence of AF among the adult population increases from 0.5% at the age of 50–59 to 9% in patients over 80 years old [7], [12].

Elderly patients with AF differ significantly from younger patients. These differences include: multiple comorbidities, a high prevalence of AF, a higher risk of thromboembolic complications and bleeding [13]. The main danger of AF is thromboembolic complications (TEO) [7], [12]. In this connection, a very urgent task is to study outpatient anticoagulant therapy in patients with atrial fibrillation/flutter.

**Objective:** to study the scope of prehospital drug therapy in patients with decompensated CHF.

**Research objectives:**

1. To conduct a comparative assessment of LV systolic function in patients with CHF decompensation
2. To assess the differences in the prevalence of atrial fibrillation/flutter in patients with decompensated CHF
3. To compare the amount of prehospital therapy in patients with CHF decompensation
4. To evaluate the volume of prehospital therapy with aldosterone antagonists, neprelisin inhibitor and type II aldosterone receptor antagonists in patients with reduced LVEF
5. To give a comparative assessment of the volume of prehospital anticoagulant therapy in patients with CHF decompensation and atrial fibrillation/flutter

**Materials and methods**

The study was carried out based on the cardiac intensive care unit of the Central Clinical Hospital of the PPMD of RF. We analyzed 107 patients aged 46-95 years with CHF III-IV functional class (FC). There was formed 4 age groups of patients: 1st group consisted of 29 people of middle age (46-60 years). Group 2 included 31 elderly patients (61-74 years old); group 3 consisted of 40 elderly patients (75-89 years old). The 4th group

consisted of 7 studied age of centenarians (over 90 years old). Taking into account the small size of the group of centenarians (only 7 people), these patients were represented only at the level of descriptive statistics and were not included in intergroup comparisons. CHF was verified according to the criteria recommended by the Russian Society of Cardiology (RSC) [14]. The presence of postinfarction sclerosis (PPS) was established according to the data of echocardiography, electrocardiograms. The presence of hypertension was assessed by taking anamnesis. The diagnosis of atrial fibrillation was established by taking anamnesis and evaluating the ECG. Exclusion criteria from the study: presence of severe liver dysfunction (Child-Pugh class C); carrying out polychemotherapy in patients with oncopathology; patients on renal replacement therapy with end-stage chronic kidney disease (CKD) (glomerular filtration rate  $<15$  ml / min); the presence of an acute period of myocardial infarction; the presence of an acute period of cerebrovascular accident; massive pulmonary embolism (PE); acute phase of inflammatory diseases. In the opinion of the physician, any clinical conditions that may interfere with the patient's participation in the study.

All patients underwent a general clinical examination. ECG on the CARDIMAX FX-8322 device with an assessment of the heart rate and heart rate, EchoCG using a portable ultrasound device "Phillips CX50" with an assessment of the presence of local contractility disorders, the state of the heart valve apparatus, left ventricular (LV) ejection fraction according to the Simpson method, coagulogram with level determination of INR. The features of prehospital drug therapy of CHF were studied. The volume and nature of drug therapy were assessed. For patients with existing atrial fibrillation / atrial flutter, prehospital anticoagulant therapy was additionally analyzed (choice of anticoagulant, INR value when taking warfarin).

### **Statistical data processing**

The analysis of the obtained data was carried out using the environment for statistical computing R 4.1.0 (R Foundation for Statistical Computing, Vienna, Austria). Differences were considered statistically significant at  $p < 0.05$ .

### **Ethics committee**

The Ethics Committee passed in the Central Design Bureau of the PPMD of RF (minutes of the meeting No. 01 of 01/22/2020). All patients signed an informed consent form.

### **Results**

The study included 107 patients admitted to the intensive care unit with a diagnosis of CHF decompensation. Depending on age, 4 groups were

formed, in which significant gender differences were noted ( $p < 0.01$ ). The first group consisted of middle-aged patients ( $n = 29$ ), 100% of whom were men. The second group was represented by elderly patients ( $n = 31$ ) and consisted of 16 (51.6%) men and 15 (48.4%) women. In the third group, consisting of elderly people ( $n = 40$ ), there was a predominance of women (67.5%). Long-liver patients ( $n = 7$ ) formed the fourth group, where the predominance of women (87.5%) was also observed (Table 1).

Echocardiography was used in all patients to assess the contractility of the left ventricle of the heart. Revealed significant intergroup differences in the level of EF. With increasing age, there was a significant trend towards a decrease in the number of patients with reduced EF (less than 40%) ( $p = 0.03$ ). In the middle-aged group, more than half of the patients (51.7%) had an EF of less than 40%. Among the elderly, the proportion of people with reduced EF was 19.4%. Among elderly patients, 1/3 (30%) showed reduced EF. From the group of centenarians, EF less than 40% had 28.6% of patients. Intergroup comparison of patients with intermediate ejection fraction (40-49%) did not reveal significant differences ( $p = 1.0$ ). With increasing age, there was a predominance of patients with preserved EF (50% or more) ( $p = 0.02$ ) (table 1).

In the middle-aged group, less than ¼ patients (13.8%) had preserved EF. 45.2% of elderly patients had an EF of 50% or more. Among elderly patients, preserved EF was verified in more than 1/3 of the group (37.5%). In centenarians, only 14.3% of individuals had preserved EF (Table 1).

There were no significant differences between the groups in heart rate ( $p = 0.7$ ) (table 1).

**Table 1.**  
**General characteristics of patients with decompensated chronic heart failure included in the study**

Indicator/ Group	Middle-aged patients N = 29 (27,1%)	Elderly patients N = 31 (29,0%)	Senile-aged patients N = 40 (37,4%)	Patients-centenarians N = 7 (6,5%)	P
Average age, years	53,9 (4,5) 55,0 (50,0–57,0)	68,3 (5,0) 68,0 (64,0–72,5)	81,5 (4,1) 81,5 (78,0–84,2)	92,4 (1,4) 92,0 (91,5–93,0)	<0,01
Men, n (%)	29 (100,0%)	16 (51,6%)	13 (32,5%)	1 (14,3%)	<0,01
Women, n (%)	–	15 (48,4%)	27 (67,5%)	6 (85,7%)	<0,01
EF less than 40%	15 (51,7%)	6 (19,4%)	12 (30,0%)	2 (28,6%)	0,03

## Process Management and Scientific Developments

EF from 40 to 49%	10 (34,5%)	11 (35,5%)	13 (32,5%)	4 (57,1%)	1,0
EF 50% or more	4 (13,8%)	14 (45,2%)	15 (37,5%)	1 (14,3%)	0,02
Rhythm: - sinal	15 (51,7%)	13 (41,9%)	20 (50,0%)	2 (28,6%)	0,7
- atrial fibrillation/ flutter	14 (48,3%)	18 (58,1%)	20 (50,0%)	5 (71,4%)	0,7

We assessed the volume of CHF before hospital drug therapy in patients of different age groups. Significant differences were found only for digoxin therapy ( $<0.01$ ). All middle-aged subjects denied taking digoxin. About  $\frac{1}{4}$  of the group of elderly patients (25.8%) were treated with cardiac glycosides. Almost  $\frac{1}{3}$  of the studied patients over 75 years old (30%) were treated digoxin. Among centenarians, there were no persons who were treated with digoxin therapy before hospitalization (Table 2).

The studied patients did not significantly differ in the intake of drugs from the group of angiotensin-converting enzyme inhibitors (ACE inhibitors) ( $p = 0.4$ ). A total of 39 (36.4%) of the total number of patients studied received an ACE inhibitor before hospitalization. There were no significant differences between treatment groups with angiotensin II receptor blockers (ARB II). ( $p = 1.0$ ). Only 26 (24.3%) patients of the entire cohort received ARB II therapy. Patients of different age groups did not significantly differ in the intake of beta-blockers ( $p = 0.8$ ). Of the total group, 58 (54.2%) studied patients were treated with beta-blockers. No significant differences were noted when comparing the loop diuretic therapy groups ( $p = 0.9$ ). Less than  $\frac{1}{2}$  of all 44 studied (41.1%) were treated with diuretic therapy (Table 2).

**Table 2.**  
**The volume of pre-hospital drug therapy in patients with decompensated chronic heart failure**

PT/Group	Middle-aged patients N = 29 (27,1%)	Elderly patients N = 31 (29,0%)	Senile-aged patients N = 40 (37,4%)	Patients-centenarians N = 7 (6,5%)	P
ACE inhibitors	9 (31,0%)	9 (29,0%)	17 (42,5%)	4 (57,1%)	0,4
Beta-blockers	14 (48,3%)	17 (54,8%)	22 (55,0%)	5 (71,4%)	0,8



Loop diuretics	11 (37,9%)	13 (41,9%)	17 (42,5%)	3 (42,9%)	0,9
Type II aldosterone receptor antagonists	7 (24,1%)	8 (25,8%)	10 (25,0%)	1 (14,3%)	1,0
Digoxin	–	8 (25,8%)	12 (30,0%)	–	<0,01

Our study analyzed prehospital therapy recommended only for patients with reduced EF (less than 40%). Comparison of prehospital therapy with aldosterone antagonists did not reveal significant differences ( $p = 0.1$ ). Only 8 (22.8%) patients of the total number of patients with reduced EF received aldosterone antagonists. Only 1 (2.8%) studied patient was treated with combination therapy with inhibitors of neprelysin and ARB II. The current study did not identify patients who were treated with dapagliflozin therapy (Table 3).

**Table 3.**  
**Scope of prehospital therapy in patients with reduced left ventricular ejection fraction**

PT/Group	Middle-aged patients N = 15 (42,9%)	Elderly patients N = 6 (17,1%)	Senile-aged patients N = 12 (34,3%)	Patients-cente-narians N = 2 (5,7%)	P
Aldosterone antagonists	4 (26,7%)	3 (50,0%)	1 (8,3%)	–	0,1

In our study, we analyzed prehospital anticoagulant therapy in patients with CHF in combination with atrial fibrillation / flutter. Significant intergroup differences were found only for NOAA therapy ( $p < 0.01$ ). With age, the number of patients were treated with NOAA increased. All middle-aged patients denied taking the NOAA. In the elderly, the 16.7% were treated with NOAA. The senile age group consisted of 25% of the subjects taking NOAA. No patient over the age of 90 was treated with NOAA (Table 4).

With increasing age, there was an unreliable tendency towards a decrease in the proportion of people take warfarin ( $p = 0.1$ ). For persons taking warfarin therapy, the values of the international normalized ratio (INR) were compared. The studied three age groups did not show significant differences ( $p = 0.1$ ) (table 4).

There were no significant differences when comparing patients who did

not receive anticoagulant therapy ( $p = 0.8$ ). More than 2/3 (85.7%) of patients with atrial fibrillation/flutter did not receive any anticoagulant (Table 4).

**Table 4.**  
**Scope of prehospital anticoagulant therapy in patients with decompensated chronic heart failure and atrial fibrillation/flutter**

PT/Group	Middle-aged patients N = 14 (48,3%)	Elderly patients N = 18 (58,1%)	Senile-aged patients N = 20 (50%)	Patients-centenarians N = 5 (71,4%)	P
Warfarin	7 (50%)	6 (33,3%)	6 (30%)	–	0,1
NOAA	–	3 (16,7%)	5 (25%)	–	<0,01
Are not taking anticoagulant therapy	7 (50%)	9 (50%)	9 (45%)	5 (100%)	0,8
INR target value (2.0-3.0)	1,0 (0,2) 1,0 (0,8–1,1)	1,1 (0,2) 1,0 (0,9–1,1)	1,2 (0,4) 1,1 (0,9–1,2)	1,2 (0,7) 0,9 (0,8–1,6)	0,1
Risk of feasibility study according to CHA2DS2-VASc: - 2 or more points	14 (100%)	18 (100%)	20 (100%)	5 (100%)	1,0
Risk of hemorrhagic complications according to HAS BLED: - less than 3 points	14 (100%)	18 (100%)	16 (80%)	2 (40%)	0,2
- 3 or more points	-	-	4 (20%)	3 (60%)	0,2

**Discussion**

107 patients took part in the study presented by us. All studied patients underwent an assessment of LV contractility. With increasing age, there was a decrease in the number of patients with reduced EF, while the proportion of patients with preserved EF increased. The studied groups were comparable in terms of the number of persons with intermediate EF. Similar results were obtained when analyzing the register of the Mayo Clinic.

More than 90% of patients with preserved EF were over 60 years old [15]. A. Teixeira et al. also noted the predominance of intact EF among people over 75 years of age with CHF [16].

We conducted a comparative assessment of the rhythm in the study cohort. Patients of three age groups had an equal distribution in terms of the presence of atrial fibrillation / flutter. Analysis of the CHARM, I-RESERVE and TOPCAT registers showed different data. With increasing age, there was an increase in the number of patients with atrial fibrillation. In patients under 55 years of age, only 15.5% had atrial fibrillation. Among the elderly, this indicator was twice as high (31%). Almost ½ of the subjects over 85 years old (46.5%) were diagnosed with arrhythmia [17]. The dynamics of the increase in the prevalence of atrial fibrillation among elderly and senile patients was also noted in the GBD study. For persons 60–64 years old, it was 1064.1; 70–74 years old - 2446.3; at the age of 80 and over - 5279.1 per 100,000 population [18].

All patients were analyzed prior to hospital medication. Statistically significant differences were found only for digoxin therapy. With age, there was a trend towards an increase in the proportion of patients taking digoxin. This value was greatest in the group of patients from 75 to 90 years old (30%). Other studies evaluating pre-hospital therapy with cardiac glycosides are limited.

Regardless of age, we found low rates of pre-hospital drug therapy in all patients. 39 (36.4%) patients out of the total number of the studied took an ACE inhibitor before hospitalization. 26 (24.3%) patients of the entire cohort took ARB II therapy. Less than ½ of all 44 studied (41.1%) took diuretic therapy. Less than 1/3 of patients 20 (18.7%) took digoxin. Of the total group, 58 (54.2%) studied patients took beta-blockers. Due to the limitations of our study, the reasons for not taking drugs have not been clarified.

Other studies show the opposite. Thus, in the Swedish register of CHF patients, 3673 (8.8%) of 41,791 patients did not receive ARB II therapy [19]. According to data from the CHARM, I-RESERVE and TOPCAT registers, the number of patients receiving beta-blockers decreased with increasing age. Among middle-aged patients 69.1% took beta-blockers, in the group from 75 to 84 years old - 57.5% patients were prescribed this therapy. In patients over 85 years of age, 50% took beta-blocker therapy [17]. The data presented by M. Matsushita et al. a significantly larger proportion of the subjects (more than 90%), regardless of age, received loop diuretics [20].

We also observed an extremely small number of patients taking drug therapy, given the reduced EF. Of 35 patients with EF less than 40%, only

8 (22.8%) patients received aldosterone antagonists. Only 1 (2.8%) patient received combination therapy with neprelisin inhibitors and ARB II. We are faced with a limited number of publications devoted to the analysis of therapy with these drugs.

For the entire group with atrial fibrillation / flutter, we assessed the risk of thromboembolic complications on the CHA2DS2-VASc scale. Each patient had a risk of 2 points or more. This result shows the need for anticoagulant therapy for all studied patients. The increase in age was accompanied by a downward trend in the number of patients receiving warfarin. In middle-aged individuals, ½ patients (50%) took warfarin before hospitalization. About 1/3 of the studied elderly (33.3%) and senile people (30%) took vitamin K antagonists.

Such dynamics can be explained by the many difficulties of therapy with vitamin K antagonists in elderly and senile patients. The narrow therapeutic window necessitates frequent monitoring of the INR level. Difficulties with visiting the clinic can lead to irregular monitoring of this indicator, which creates an increased risk of both hemorrhagic and ischemic complications. An additional difficulty is the pronounced effect of a number of drugs and food products on the metabolism of warfarin. All these factors lead to a decrease in adherence to treatment [21]. According to the Dresden register of oral anticoagulants, up to 50% of patients who have been prescribed warfarin to prevent stroke in atrial fibrillation do not even start taking warfarin due to concerns about complications [4].

The studied patients taking warfarin therapy were evaluated for INR values. All patients had non-target INR values at the time of admission. According to the Russian registers REKVAZA and REKVAZA-FP, the target INR values are achieved only in 26.3–39.5% of patients taking warfarin [22]. In the GARFIELD-AF registry, only 25% of patients treated with vitamin K antagonists achieved satisfactory blood clotting control [23], [24]. Somewhat earlier, specialists from the Japanese Circulation Society proposed a new INR range for patients over 70 years of age - 1.6 - 2.6 [25]. However, at present, the reference values from 2.0 to 3.0 are used most often.

In contrast to warfarin therapy, the number of patients taking NOAA increased with age. The largest number of patients taking NOAA was in the elderly group (25%).

The increase in the number of patients receiving NOAA among the elderly and senile age groups can be explained by the greater efficacy and safety of this class of anticoagulants. However, the decisive factor is most likely the absence of the need to control the parameters of hemostasis

[26], [27].

A significant proportion of the studied (85.7%) with atrial fibrillation / flutter did not take any anticoagulant drug before hospitalization. We found a small number of publications showing the situation with prehospital anticoagulant therapy. However, in the large outpatient clinic REKVAZA, the proportion of patients with atrial fibrillation who received an anticoagulant did not exceed 4.2% [28], [29].

### Conclusions

1. CHF with preserved EF is more common in elderly and senile patients. In middle-aged people, the prevalence of CHF with reduced EF was noted.
2. Regardless of age, there is a high prevalence of atrial fibrillation / flutter.
3. All age groups were characterized by a small number of patients receiving pre-hospital drug therapy.
4. Most of the subjects (85.7%) with atrial fibrillation / flutter did not take anticoagulant therapy before hospitalization.

### References

1. Gurevich MA. Hronicheskaya serdechnaya nedostatochnost' u bol'nyh pozhilogo vozrasta [Chronic heart failure in elderly patients]. «RMZH»: nezavisimoe izdanie dlya praktikuyushchih vrachej ["Russian Medical Journal": an independent publication for practicing doctors]. 2014;12: 874-875. (In Russian)
2. Zarudskij AA, Proshchaev KI. Starcheskaya asteniya i serdechno-sosudistye bolezni kak faktory vzaimootyagoshcheniya [Senile asthenia and cardiovascular diseases as factors of mutual aggravation]. Sovremennye problemy nauki i obrazovaniya [Modern problems of science and education]. 2014;1:2-5 (In Russian)
3. Kotovskaya YU.V., Rozanov A.V., Kurashev D.H., i dr. Serdechnyanedostatochnost' isindromstarcheskojastenii [Heart failure and frailty]. Medicinskijsovet [Medical council]. 2018;16:72-75 (In Russian)
4. Cowie M, Mosterd A, Wood D, et al. The epidemiology of heart failure. Eur Heart J. 1997;18:208-225. DOI: 10.1093/oxfordjournals.eurheartj.a015223

5. Mareev V.YU., Ageev F.T., Arutyunov G.P., i dr. Nacional'nyerekomendacii VNOK i OSSN po diagnostikeilecheniyu HSN (tretijperesmotr) [National recommendations of ANSC and AHF for the diagnosis and treatment of CHF (third revision)]. Serdechnyanedostatochnost' [Heart failure]. 2009;58:64-106 (In Russian)
6. Tsao CW, Lyass A, Enserro D, et al. Temporal trends in the incidence of and mortality associated with heart failure with preserved and reduced ejection fraction. *JACC Heart Fail* 2018;6:678-685. DOI: 10.1016/j.jchf.2018.03.006
7. Volkov VP, Nedoruba EA, Tayutina TV. Aktual'nye problemy gerontologii i geriatrii [Actual problems of gerontology and geriatrics]. Sibak. 2016:105-112. (In Russian)
8. Doshchicin VL, Fedorova MH. Lechenie fibrillyacii predserdij u komorbidnyh pacientov pozhilogo i starcheskogo vozrasta [Treatment of atrial fibrillation in elderly and senile comorbid patients]. *Konsilium Medikum [Consilium Medicum]*. 2018;20(12):47–54. (In Russian)
9. Fumagalli S, Pelagalli G, Migliorini M, et al. The complex interaction between atrial fibrillation and heart failure in elderly patients. *Monaldi Arch Chest Dis*. 2019;4:89(2). DOI: 10.4081/monaldi.2019.1050.
10. Lip G, Laroche C, Popescu MI, et al. Prognosis and treatment of atrial fibrillation patients by European cardiologists: One Year Follow-up of the EURO observational Research Programme Atrial Fibrillation General Registry Pilot Phase (EORP-AF Pilot Registry). *Eur Heart J*. 2014;35:3365-3376. DOI: 10.1093/eurheartj/ehu374
11. Benjamin EJ, Levy D, Vaziri SM, et al. Independent risk factors for atrial fibrillation in a population-based cohort. *The Framingham Heart Study*. *JAMA*. 1994;271(11):840–4
12. Kohan EV, Kiyakbaev GK, SHavarov AA. Fibrillyaciya predserdij pri hronicheskoj serdechnoj nedostatochnosti s sohrannoju frakcieju vybrosov: kliniko-prognosticheskoe znachenie i problemy lecheniya [Atrial fibrillation in chronic heart failure with intact ejection fraction: clinical and prognostic value and treatment problems]. *KLINICHESKAYA FARMAKOLOGIYA I TERAPIYA [CLINICAL PHARMACOLOGY AND THERAPY]*. 2016;25(3):22-24. (In Russian)
13. Fumagalli S, Tarantini F, Guarducci L, et al. Atrial fibrillation is a possible marker of frailty in hospitalized patients: results of the GIFA Study. *AgingClinExpRes*. 2010;22(2):129–33. DOI: 10.1007/BF03324785

14. Mareev V.YU., Fomin I.V., Ageev F.T., i dr. Klinicheskie rekomendacii. Hronicheskaya serdechnaya nedostatochnost' (HSN) [Clinical recommendations chronic heart failure (CHF)]. Serdechnaya Nedostatochnost' [Heart Failure]. 2017;18 (1):3–40 (In Russian)
15. Bursi F, Weston SA, Redfield MM, et al. Systolic and diastolic heart failure in the community. JAMA. 2006;296(18):2209-16. DOI: 10.1001/jama.296.18.2209
16. Teixeira A, Arrigo M, Tolppanen H, et al. Management of acute heart failure in elderly patients Archives of Cardiovascular Disease. 2016;109(6-7):422-30. DOI: 10.1016/j.acvd.2016.02.002
17. Tromp J, Shen L, Jhund PS, et al. Age-Related Characteristics and Outcomes of Patients with Heart Failure with Preserved Ejection Fraction. J Am Coll Cardiol. 2019;74(5):601-612. DOI: 10.1016/j.jacc.2019.05.052.
18. Chugh SS, Havmoeller R, Narayanan K, et al. Worldwide epidemiology of atrial fibrillation: a Global Burden of Disease 2010 Study. Circulation. 2014;129:837– 847. DOI: 10.1161/CIRCULATIONAHA.113.005119
19. Lund LH, Benson L, Dahlström U, et al. Association between use of renin-angiotensin system antagonists and mortality in patients with heart failure and preserved ejection fraction. JAMA. 2012;308(20):2108–2117. DOI: 10.1001/jama.2012.14785
20. Matsushita M, Shirakabe A, Kobayashi N, et al. Gender Differences in the Social Determinants of the Long-term Prognosis for severely Decompensated Acute Heart Failure in Patients over 75 Years of Age. Internal Medicine. 2019;58(20). DOI: 10.2169/internalmedicine.2757-19
21. Pavlova TV, Krivova S.P. Antikoagulyantnaya terapiya u pozhilyh pacientov s fibrillyaciej predserdij s točki zreniya bezopasnosti [Anticoagulant Therapy in Elderly Patients with Atrial Fibrillation from a Safety Perspective]. Kardiologiya: novosti, mneniya, obuchenie [Cardiology: news, opinions, training.]. 2019;7(2):58–63. (In Russian)
22. Luk'yanov MM, Marceвич SYU, YAKushin SS. i dr. Kontrol' pokazatelya mezhdunarodnogo normalizovannogo otnosheniya na fone terapii varfarinom u bol'nyh s fibrillyaciej predserdij v ambulatornoj i gospi'tal'noj praktike (dannye registrov REKVAZA) [Control of the indicator of the international normalized ratio against the background of warfarin therapy in patients with atrial fibrillation in outpatient and hospital practice (data from the REKVAZA registers)]. Racional'naya farmakoterapiya v kardiologii [Rational pharmacotherapy in cardiology]. 2018;14(1):40–46. (In Russian)

23. Bassand JP, Fitzmaurice D, Camm J, et al. Is cardiovascular disease the primary cause of death in older age groups of patients with nonvalvular atrial fibrillation? Research results from the Register GARFIELD-AF. ESC CONGRESS 2014

24. Haas S, Goto S, Fitzmaurice D, et al. Monitoring of the international normalized ratio and treatment results in patients with newly diagnosed atrial fibrillation 1 year after initiation of therapy Register GARFIELD-AF. ESC CONGRESS 2014

25. JCS Joint Working Group Guidelines for Pharmacotherapy of Atrial Fibrillation (JCS 2013) *Circ J.* 2014; 78(8): 1997–2021

26. Osmolovskaya YUF, ZHirov IV, Tereshchenko SN. Antagonisty mineralokortikoidnyh receptorov v terapii bol'nyh s hronicheskoy serdechnoj nedostatochnost'yu. Pozicii 2015 g. [Mineralocorticoid receptor antagonists in the treatment of patients with chronic heart failure. 2015 positions]. *Terapevticheskij arhiv [Therapeutic archive.]*. 2015;87(9):77-83. (In Russian)

27. Ruff CT, Giugliano RP, Braunwald E, et al. Comparison of the efficacy and safety of new oral anticoagulants with warfarin in patients with atrial fibrillation: a meta-analysis of randomised trials. *Lancet.* 2014; 383(9921): 955–962. DOI: 10.1016/S0140-6736(13)62343-0

28. Kuchina AYU, Novikova NA, Suvorov AYU, i dr. Harakteristika pacientov s fibrillyaciej predserdij pozhilogo i starcheskogo vozrasta v klinicheskoy praktike [Characteristics of elderly and senile atrial fibrillation patients in clinical practice]. *Kardiologiya i serdechno-sosudistaya hirurgiya [cardiology and cardiovascular surgery]*. 2019;12(3):213-221 (In Russian)

29. Luk'yanov MM, Bojcov SA, YAKushin SS, i dr. Diagnostika, lechenie, sochetannaya serdechno-sosudistaya patologiya i soputstvuyushchie zabolevaniya u bol'nyh s diagnozom «fibrillyaciya predserdij» v usloviyah real'noj ambulatorno-poliklinicheskoy praktiki (po dannym registra kardiovaskulyarnyh zabolevanij REKVAZA) [Diagnostics, treatment, combined cardiovascular pathology and concomitant diseases in patients with a diagnosis of atrial fibrillation in a real outpatient practice (according to the register of cardiovascular diseases REKVAZA)]. *Racional'naya farmakoterapiya v kardiologii [Rational pharmacotherapy in cardiology]*. 2014;10(4):366-377. (In Russian)

**Conflict of interests.** The authors declare no conflict of interest.



DOI 10.34660/INF.2022.90.89.017

UDC 615.11: 322

## WOUND HEALING PROPERTIES OF FLAXSEED OIL

**Kudryashova Nataliya Olegovna**

Postgraduate

**Bogoslovskaya Olga Alexandrovna**

Candidate of Biological Sciences, Associate Professor

**Glushchenko Natalia Nikolayevna**

Doctor of Biological Sciences, Full Professor

V.L. Talrose Institute of Energy Problems of Chemical Physics

N.N. Semenov Federal Research center

for Chemical Physics of Russian Academy of Sciences,

Moscow, Russia

**Abstract.** The effect of flax seed oil on the wound healing of experimental full-thickness wounds was studied. Tests were conducted on mice with wound treatment with various concentrations of flax oils. It is shown that the most effective in the process of wound healing in terms of half-healing time is linseed oil at concentrations of 10% and 30%. In terms of complete wound healing time, linseed oil at a concentration of 30% and 50% is the most effective, reducing this indicator by 24% and 23% (14 and 14.3 days), respectively, compared with untreated animals.

Based on the data obtained, gels containing 20% and 10% linseed oil were developed. Rarely cross-linked acrylic polymer of the Arespol and MARS-06 brands, respectively, was used as a structurant. It has been shown that the developed gels reduce the half-healing time by 53.9% (Arespol) and by 50% (MAPC-06) compared with the untreated group.

**Keywords:** half-healing time, acrylic polymers, linseed oil, soft dosage form.

Traumatism is a serious problem in medicine. As a result of various injuries, the integrity of the integumentary tissue of the body is violated. Moreover, the longer the wound healing process lasts, the more likely it is to re-injure the still unrecovered skin, and the risk of active infection of the wound surface also increases. In addition, the currently deteriorating environmental situation increases the load on the protective tissues of the

body, including the dermis. In this regard, the search for biologically active substances and their compositions that accelerate the process of tissue regeneration is an urgent and important problem [1,2].

Taking into account modern ideas about the course of the wound process, which is characterized by the intensification of tissue lipid peroxidation, as well as the fact that natural antioxidants can actively influence regeneration processes, modern medicine is widely used to treat wounds, burns, etc. phytopreparations containing a complex of biologically active components with an antioxidant effect. In addition, today the level of allergic reactions (including allergic dermatitis) is very high, about 10% of the world's population suffers from them, and therefore the search for natural drugs is very important, since they rarely cause sensitization of the body than synthetic analogues [3, 4, 5].

Our attention was drawn to the fatty oil obtained by cold pressing of flax seeds, which has long been used in folk medicine for the treatment of skin diseases (psoriasis, dermatitis) [3]. The purpose of our work is to study the wound healing activity of linseed oil.

### **Materials and methods**

Flax seed oil (*Linum usitatissimum L.*) is obtained by cold pressing according to TU 9141-001-40713939-99. The manufacturer of linseed oil is "Vera" LLC, Kashin. The oil is a light yellow oily liquid with a characteristic odor and taste. Flax seed oil contains 6-16% linoleic acid and 3-57% alpha-linolenic acid. Vaseline oil was used to dilute the oil. Manufacturer "Moscow Pharmaceutical Factory", Moscow.

To study the effect of linseed oil on the rate of wound healing, female mice of the SHK line weighing 18–20 g were used. The animals were obtained from the Central Nursery of Laboratory Animals of the Russian Academy of Medical Sciences, Moscow Oblast. Experimental animal studies were carried out in accordance with the guidelines recommended by our institute, 1987 and "The Guide for the Care and Use of Laboratory Animals (National Academy Press Washington, D.C. 1996)". Mice were divided into groups of 5–7 animals each. Under ether anesthesia on the back of mice, hair was cut off, and a full-thick piece of skin was removed, with an area of 60 mm<sup>2</sup>. Mice of the experimental group immediately after the operation (and later daily) were treated with 0.2 ml of linseed oil or 0.2 g of ointment with linseed oil on the surface of the wound. Mice in the control group were treated with 0.2 ml of vaseline oil. The wound contours were transferred to transparent films once a day, which were then scanned on a Umax Astra 4500 scanner. The area of the wounds was calculated using the ImageJ 1.30 v computer program. According to the kinetic curves

of changes in the areas of wounds, the time of semi- ( $T_{1/2}$ ) and complete wound healing ( $T_{comp}$ ) was estimated. The control groups consisted of untreated animals (control 1) and animals, on the wound of which paraffin oil was applied (control 2). Statistical processing of experimental data was carried out according to generally accepted statistical methods using the computer program Statistica 6.0. The mean value –  $\bar{X}$ , standard error of the mean ( $\pm SE$ ) was calculated. The assessment of the significance of differences between the mean values of the two groups was carried out according to Student's t-test. Differences were considered significant at  $p \leq 0.05$ .

**Results and discussion**

The principles of damage treatment are determined by the state of the wound and the processes occurring during healing, as well as taking into account the moments that improve regeneration processes and create unfavorable conditions for the development of microorganisms in the wound [1, 2, 4, 5].

Activities in the treatment of wounds should improve the conditions for the natural course of the wound process. Therefore, they are somewhat different in clean or purulent wounds, as well as in different phases of healing.

The main tasks in the treatment of wounds:

1. the fight against acute life-threatening disorders - blood loss, shock, respiratory failure;
2. prevention and treatment of infectious complications;
3. ensuring the healing of the wound defect in a shorter time.

Our research is aimed at solving the third problem. Based on the experiments carried out, it can be concluded that linseed oil in different dilutions has a regenerating activity, the effectiveness of which depends on the concentration. The table shows the data on the change in the time of semi- and complete healing of wounds in mice of the experimental and control groups (Table 1).

**Table 1.**  
**Changes in the time of semi- and complete healing of full-thickness experimental wounds in the treatment with linseed oil at different concentrations**

groups	$T_{1/2}, \text{ o/k, \%}$	$T_{comp}, \text{ o/k, \%}$
Control - 1 (untreated animals)	100	100
Control -2 (treated with vaseline oil)	155±8.4	88.6±1.4
10% linseed oil	81.1±3.0*	83.8±1.2*

30% linseed oil	81.8±2.8	75.7±1.3*
50% linseed oil	87.1±3.2	77.3±1.1*
100% linseed oil	78.8±2.5*	80.5±1.4*

Data are represented as mean (X) ± SE, n = 5-7

\*Student's *p*-value *p*<0.05

It can be seen that flaxseed oil diluted with vaseline oil reduces the half-healing time of wounds with a maximum effect of 12.9% (50% flaxseed oil) compared to that for untreated animals. Undiluted oil reduces half-healing time by 21.2% (100% linseed oil) compared to untreated animals. Flaxseed oil actively affects the time of complete healing of wounds, reducing this figure up to 24.3% (30% linseed oil). To dilute flaxseed oil, vaseline oil was used, which increases the half-healing time of wounds by up to 55%, but reduces the time of complete healing by 21.4%.

Based on the data obtained, ointments were prepared based on a rarely cross-linked acrylic polymer - mARS (TU 6-02-221-96), which is easy to use, does not irritate the mucous membrane, does not cause allergic reactions, and when applied to the skin forms the thinnest smooth films without leaving greasy marks on clothes [6].

For example, we give an ointment prepared by us with the following composition (%): flaxseed oil - 10, mARS -1.5, tween solution -80 (1:4) - 6 ml, sodium hydroxide solution, 1 M/l - up to pH-5.5-6.0, nipagin - 0.02, purified water up to 100. The resulting ointment is a white with a yellowish tint creamy mass with a slight smell of the constituent components. Table 2. shows data on the change in the time of semi- and complete healing of wounds in animals of the experimental and control groups (Table 2).

**Table 2.**  
**Change in the time of semi- and complete healing of full-thickness experimental wounds in the treatment with ointment with 10% linseed oil**

groups	T <sub>1/2</sub> , o/k, %	T <sub>comp</sub> , o/k, %
Control - 1 (untreated animals)	100	100
Control - 2 (ointment base)	64.9±9.5*	98.8±1.3
10% linseed oil	46.1±4.5*	93.2±1.2

Data are represented as mean (X) ± SE, n = 5-7

\*Student's *p*-value *p*<0.05

It can be seen that when treating wounds with an ointment with 10% linseed oil in the composition of the polymer, the half-healing time of wounds decreases by 2.1 times compared to this indicator in untreated animals, but to a lesser extent affects the indicator of complete wound healing.

Therefore, lightly cross-linked acrylic polymer (mAPC) flaxseed oil formulations are a promising drug for wound treatment.

### References

1. Wounds and wound process. Teaching aid for interns, residents and practitioners. Krasnodar, 2016. 29 P.
2. S. N. Alekseenko, E. V. Drobot. Prevention of diseases Russian acad. of natural sciences, ed. House of Acad. natural sciences. - Moscow: Publishing House of Acad. of natural sciences, 2015. - 449 P.
3. Fedoseeva, G.M., Goryachkina, E.G., Mirovich, V.M. Medicines from plants. – Irkutsk: IGMU, 2011 – 74 P.
4. Garmaev B.-Ts. N. Wound healing effect of ointments with pentaphylloides fruticosa (l.) extract O. Schwarz. Diss. for the degree of cand. med. sci. - Ulan-Ude – 2017- 112 P.
5. Brkich L., Nedorubov A., Pyatigorskaya N., Brkich, E., Odintsova E. The Study of the Wound Healing Activity of the Gel with a Comprehensive Therapeutic Effect. - Journal of Medical Sciences, 2019,7(6)- P.908. doi:<https://doi.org/10.3889/oamjms.2019.220>.
6. Slepnev M. V. Technology of extemporaneous ointments using rare cross-linked acrylic polymers. Abstr. diss. for the degree of cand. pharm. sci. – Saint-Petersburg, 2004. 28 P.

## CONSTANT OR PERIODIC ACOUSTIC MONITORING OF THE ANIMAL'S BODY

**Tikhonenko Daniil Olegovich**

CEO BodyVo Technology Ltd,

**Kalachev Aleksandr Viktorovich**

Candidate of Physico-mathematical Sciences, Associate Professor

Altai State University

**Tikhonenko Zlata Olegovna**

Engineering BodyVo Technology Ltd

**Annotation.** The article is devoted to the formulation of a new approach to the study of the acoustic picture of the human body using mathematized methods of digital medicine. Special attention is paid to passive methods of obtaining information about internal processes in the human body associated with the radiation of acoustic vibrations.

**Keywords:** acoustics, stethoscope, ultrasound (ultrasound), phased acoustic antenna array (PAAA).

### Introduction

As has been repeatedly noted [1], the implementation of digital technologies in medicine is primarily associated with the "digitization" of data and the accumulation of big data.

On the one hand, this is an understandable trend of medical digitalization, and on the other, it is just a qualitative change, not yet associated with a new approach to the diagnosis of various conditions. In addition, it should be noted that acoustic analysis of medical conditions is usually performed by professional doctors, and for ultrasound – by narrow specialists, while stethoscopy is available to a wide range of medical professionals.

Acoustic analysis, due to its versatility, is a very effective tool for both general practitioners and specialists. We distinguish two classes – active research-ultrasound diagnostics (location) and passive listening (stethoscopy). In the future, we will focus on passive methods of analysis due to the fact that they produce a minimal effect on the body. It should be noted that both ultrasound examination and listening (auscultation) is a fairly conservative field and the use of new methods for analyzing audio signals is

associated both with this factor and with the lack of models and practices for receiving and analyzing sounds that require high computing power [1].

Acoustic control of the animal's body allows to assess the current state of its health with minimal anxiety and stress for the animal. It does not require any tests to predict the oncoming of critical events in its body, primarily related to internal diseases, or a critical increase in any values of indicators describing muscular, pulmonary, cardiological and vascular processes in the animal's body, for example, fatigue or fright.

There are a large number of digital veterinary ultrasound scanners, stethophonendoscopes, ECG systems, laryngoscopes, otoscopes available on the market.

### **ULTRASOUND SCANNERS**

#### **Draminski 4Vet veterinary ultrasound scanner**

For veterinary ultrasound examination of small animals, the Polish company DRAMIŃSKI has produced a multifunctional and autonomous model: 4Vet. This ultrasound scanner has a touch screen and a sturdy body, it is actively used in veterinary clinics, private offices and large farms. The built-in monitor transmits a high-definition image due to the colour Doppler format, which increases the accuracy of diagnostics. The device has many functions: probe frequency, colour gamut, magnification, focus, gain. It functions with most sensors, connects to a printer, and has the function of transferring data to external electronic media. It can work autonomously for several hours, weighs very little and is available for use by female veterinarians.

#### **Veterinary universal stationary device Chison qbit 10**

Universal stationary device **Chison qbit 10** is suitable for all types of ultrasounds, with equal success, it can be used for examinations in obstetrics or gynaecology, abdominal, cardiological and other types of research.

In the modern world, ultrasound examinations are the most popular methods of research. Ultrasound scanners can be combined with endoscopes, and CT/MRI scans can be used in research. Therefore, it is not surprising that ultrasound also supports connecting an ECG to the system. Ultrasound scanners can be used instead of electrocardiographs and using electrodes to conduct research in electrocardiography.

### **DIGITAL STETHOSCOPES**

In modern veterinary medicine of small pets, it is most often customary to use only indirect auscultation using a stethophonendoscope.

Auscultation is used to diagnose:

- changes in cardiac activity - rhythm, presence or absence of bruits or murmurs;
- the work of the respiratory organs – the presence or absence of stridors, bruits, murmurs, "moist" breathing;
- the work of the organs of the gastrointestinal tract - the nature of peristaltic noises, the presence of splashing.

### **Veterinary stethoscope Stethee Pro**

One can easily record and compare the sounds of the heart, lungs and other organs using the Stethee app.

Stethee is a powerful tool that helps to increase efficiency, productivity and improve the quality of medical care. Stethee is so easy to use. Connect Stethee directly to any wired or wireless Bluetooth headphones. Connect Stethee to your mobile device to instantly record the sounds of your heart, lungs or other organs.

The Stethee is without a doubt the most technologically advanced stethoscope ever created.

### **eKuore VET II electronic stethoscope**

eKuore Veterinary Stethoscope II is an electronic stethoscope for animal health that improves sound quality by digitally reducing ambient noise.

WiFi connectivity and compatibility with Android and iOS devices are available. Auscultation with filtering of lung or heart sounds and recording directly from a stethoscope. The eKuore II veterinary stethoscope is used for routine examination and monitoring of the patient's development. You can record auscultation sounds and phonograms using your smartphone or tablet. Share the files with a specialist or colleague to get an immediate second opinion. Replaceable chest parts are ideal for a veterinarian with patients of different sizes so there is no need to have different stethoscopes, for small, medium and large animals.

eKuore Vet APP is compatible with all your eKuore Animal Health devices. You can save the test results in the APP and directly send them to a specialist for an immediate second opinion or include them in your medical history.

- Recording and sharing of auscultation
- Real-time soundtrack on your smart devices
- Remote control of the device via the APP
- Live broadcast to an external speaker for educational purposes.



## **ECG SYSTEMS**

### **Veterinary ECG system 6 channels EK3008**

This is a digital veterinary ECG of the latest generation with a connection to a smartphone. The device allows you to collect, process and send a 6-wire ECG in just 30 seconds to a specialist and immediately get a second opinion.

## **LARYNGOSCOPES**

### **Veterinary laryngoscope ek3002w**

This is a video camera of the latest generation connected to a smartphone. Together with the esophageal tube, it allows you to examine the patient's body.

Destruction of strange bodies: You can use this video camera where you cannot do without a digital veterinary endoscope.

## **OTOSCOPES**

### **Veterinary otoscope ek3007**

A high-precision portable otoscope that connects to a smartphone or tablet.

Portable. Allows you to work without obstacles and can be used in home visits.

High accuracy. Excellent image quality, high resolution. Scaling x500.

Allows you to record and photograph the external auditory canal and transmit them to specialists.

Allows you to get a remote diagnosis. Adjustable LED. For more accuracy, it includes 6 LED lights. The intensity can be adjusted manually.

- Examination of the outer ear and eardrum;
- Dental examination;
- Dermatoscope;
- Examination of the nostrils.

## **THE PROJECT OF A PHASED ACOUSTIC ANTENNA ARRAY (BODYVO)**

The development of the project is a precision study of the parameters of acoustic signals. The technical implementation is carried out by placing an array of  $n$  by  $m$  compact microphones on the body-fitting t-shirt (in the case of the layout-21 microphones). The sound from these microphones is transmitted to the smartphone and processed on it.



**Figure 1. Placing microphones on a T-shirt**

Analysis of the spectrum (primarily the phase of the signal) will allow you to determine the direction and distance to all sound sources. Thus, **the following important parameters of the internal organs can be determined:**

- the main heart rate and pulse variability;
- work of the ventricles of the heart;
- basic breathing cycle for each lung;
- inhomogeneities and fluids in the lungs;
- movement of blood in the aorta and arteries.

After processing the signals, you can build:

- dynamic 3D model of the heart and lungs;
- blood circulation model with a calculation of blood pressure function.

For pregnant women:

- the heartbeat of the fetus and its position.

In the future, by studying the harmonics of the spectrum of acoustic signals of PAAA signals, we can determine the places of reflection of sound waves and establish:

- places of the appearance of tumours;
- problems with the intestines,
- blood clots in the blood vessels.

**The analysis of the sources of acoustic signals.**

The phased array acoustic antenna (PAAA) allows you to accurately

set the direction of the audio signal while operating with a part of the array makes it possible to calculate the points of intersection of the directions in space. To do this, you need to divide the PAAA into three (at least) sublat-tices. Then the intersection of the three rays in space will accurately give the location of the sound source.

These sources are:

- the ventricles and valves of the heart;
- bronchial channels;
- areas of sound abnormalities of blood vessels (narrowing or dilation), which give a pulse wave difference and are also the source of the sound.

When the body moves (walking, running, exercise), the position of the sound sources (the heart and its parts) changes, which allows you to create a dynamic three-dimensional model, which is also fundamentally new.

For pregnant women, you can create a unique picture of the change in the position of the fetus over time, focusing on the position of its heart.

The synphase of the heart of the mother and fetus is very important, according to this parameter at an early stage, you can diagnose many problems of growth and development of the fetus, as well as the post-natal period of its life.

The reflections of sound waves are easily identified by the phase change. Reflections will allow you to see:

- fluid in the lungs;
- heterogeneities in the tissues;
- seals in the liver and kidneys.

This solves the problem of early diagnosis:

- tumours;
- intestinal obstruction and adhesions;
- the presence of cysts.

### BODYVO FOR ANIMALS

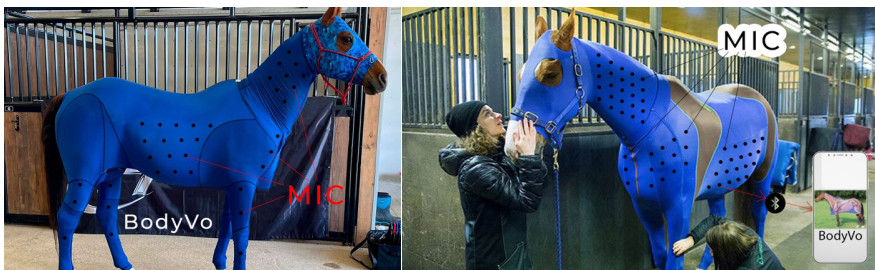


Figure 2. Placing microphones on horses

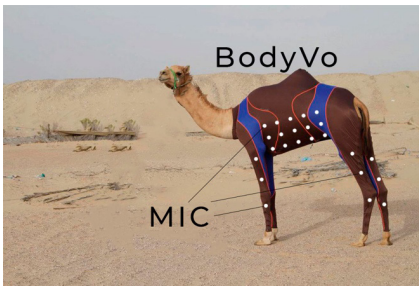
For animals, we began to use several phased acoustic microphone arrays **BodyVo**, fixed on the animal's body and receiving acoustic signals. Each microphone array is made in the form of two or more flexible blankets, capes or covers, worn on both sides on the back, croup, neck or abdominal part of the animal, or on the head or limbs of the animal.

An acoustic signal is transmitted from the microphones via **Bluetooth** to the mobile device. The properties of the signals received from all microphones (amplitude, phase, frequency of the signal, ...), as well as the location of the signal source inside the animal's body, including the place of reflection of sound waves, including from the internal organs, tissues and vessels of the animal's body, are determined.

After that, the received signals are saved, a range of signal properties is selected, which is considered normal and signals deviations of parameters from normal, indicating the source of the audio signal for which the deviation from normal is set.

In the case of chronic diseases, it is advisable that the microphone array would be on the animal constantly.

It is also advisable that the microphone array is used to monitor the condition of the animal before or during sports competitions, or after them.



**Figure 3. Placing microphones on camels**



**Figure 4. Placing microphones on dogs**

### **Technical results:**

- allows you to accurately determine the location of the sources of the sound signal in the body of animals, which is connected with their other anatomical device (walking on four limbs and the horizontal arrangement of organs).

This technology has high versatility and flexibility, does not require taking expensive and complex, hard-to-bear animal analyses, allows you to achieve better and faster results, is universal for various types of diseases,

allows you to quickly identify the appearance of pathologies and defects of the animal's body. It also allows you to classify the processes of the onset of critical events in the animal's body by the type of acoustic signals.

### FUNDAMENTALS OF A MATHEMATICAL MODEL OF THE ANTENNA ARRAY

We will consider PAAA as an analogue of a digital antenna array (DAA) (antenna array with digital signal processing) which is an antenna array (***An antenna array is a set of emitting (in our case, receiving) elements arranged in a certain order, oriented and stimulated so as to obtain a given radiation pattern***) [2] with element-by-element signal processing, in which the signals from the emitting elements are subjected to analogue-to-digital conversion with subsequent processing according to certain algorithms [3].

A more general definition of DAA involves digital diagramming for both reception and transmission of signals.

Thus, a digital antenna array (DAA) is a passive or active antenna system, which is a set of digital analogues (***digital-to-analogue***) channels with a common phase centre, in which the radiation pattern is formed digitally, without the use of phase shifters [3]. In foreign literature, the equivalent terms *digital antenna array* or *smart antenna* are used [4].

In our case, the DAA works in the acoustic range and on reception.

The difference between a DAA and a type of active phased array antenna (APAA) is in the methods of information processing. The APAA is based on the receiving and transmitting module (RTM), which includes two channels: receiving and transmitting. Each channel has an amplifier, as well as two devices for controlling the amplitude-phase distribution: a phase shifter and an attenuator.

In digital antenna arrays, a digital transceiver module is installed in each channel, in which the analogue signal amplitude and phase control system is replaced by a digital signal synthesis and analysis system (DAC/ADC) [3][5][6][7][8].

The theory of digital antenna arrays (DAA) was born as a theory of multichannel analysis (**Multichannel Estimation**) [9] [10]. Its origins date back to the 1920s with methods for determining the directions of arrival of radio signals by a combination of two antennas based on the phase difference or amplitudes of their output voltages. At the same time, the directions of arrival of a single signal were estimated based on the indications of arrow indicators or the shape of Lissajous figures on the oscilloscope screen.

In the late 1940s, this approach led to the emergence of the theory of

three-channel antenna analyzers, which provided a solution to the problem of separating the signals of an aerial target and the "antipode" reflected from the underlying surface by solving a system of equations formed from the complex voltages of a three-channel signal mixture [12]. The results of experimental measurements using a similar three-antenna device were published by Frederick Brooks in 1951[13].

The growing complexity of solving such radar problems by the end of the 1950s created the prerequisites for the use of electronic computer technology in this field [9] [10].

In 1957, an article was published by Ben S. Melton and Leslie F. Bailey [14], which proposed options for implementing algebraic operations for signal processing using electronic circuits that are their analogues, in order to create a machine correlator (*a machine correlator*) or a mechanical computer for signal processing based on an analogue computer.

The arrival of digital technology to replace analogue computing means literally three years later, in 1960, was embodied in the idea of using a high-speed computer to solve the direction-finding problem, initially in relation to determining the location of the epicentre of an earthquake [9] [10]. Among those who first implemented this idea in practice, it should be attributed to B. A. Bolt [15], who wrote a program for IBM 704 on seismic direction finding based on the least squares method. Almost synchronously with him, a similar approach was used by an employee of the Australian National University, Flynn [16].

Apparently, in the USSR first drew attention to the potential of multichannel analyzers Polikarpov B. I. [17] He considered the analyzers phase-type with equal or a multiple of the distance between the phase centres of channels, the outputs of which voltage are subjected to correlation processing, and use of computers is determined by the angular coordinates of the sources. Polikarpov B. I. pointed out the fundamental possibility of resolving signal sources with an angular distance less than the width of the main lobe of the antenna system radiation pattern [9] [10].

However, a concrete solution to the problem of superrayleigh resolution of radiation sources was proposed only in 1962 by Varyukhin V. A. and Zablotsky M. A., who invented an appropriate method for measuring the directions to the sources of the electromagnetic field [18]. This method was based on processing the information contained in the distribution of complex voltage amplitudes at the outputs of amplitude, phase, and phase-amplitude multichannel analyzers, and allowed determining the angular coordinates of sources located within the width of the main lobe of the receiving antenna system [9] [10].

Later, V. A. Varyukhin developed a general theory of multichannel analyzers based on the processing of information contained in the distribution of complex voltage amplitudes at the outputs of the antenna array [10]. This theory considers ways to determine the angular coordinates of sources depending on the angular distances between them, the phase and energy relations between the signals, as well as the functional schemes of devices that implement theoretical conclusions. The source parameters are determined by directly solving systems of high-order transcendental equations describing the response function of a multichannel analyzer. The difficulties encountered in solving systems of high-order transcendental equations were overcome by V. A. Varyukhin by "separating" the unknowns, in which the determination of angular coordinates is reduced to the solution of two or even one equation, and the determination of complex amplitudes is reduced to the solution of linear systems of equations of order  $N$  [19].

Of course, concluding the priority and importance of certain scientific approaches in the process of forming a general theory of the DAA is a thankless task, given the closed nature of most of the works and the lack of opportunities for detailed acquaintance with the scientific heritage of that time. The historical excursus described here only lifts the veil of time over the development of scientific research and was intended to indicate the general niche and time frame of the origin of the theory of multi-channel analysis against the historical background. A detailed description of the historical stages of the development of the theory of DAA deserves separate consideration.

Here we briefly consider the receiving channel of the DAA and PAAA. The basis of the receiving channel is the ADC [22] [23]. The analogue-to-digital converter replaces two devices in the analogue implementation of the active module: a phase shifter and an attenuator. The ADC allows you to switch from analogue to digital representation of the signal for further analysis in the digital signal processing scheme.

For the correct operation of the ADC, there are also two more devices in the channel.

Low Noise Amplifier (LNA) [22][23] raises the signal amplitude to the required level for further digitization.

A receiver protection device in the simplest case is a conventional spark gap or limiter that does not allow to overload the receiving channel with a high signal level (interference).

### **Frequency conversion in the DAA**

When working with signals whose digitization or digital-to-analogue conversion at the carrier frequency is inefficient (insufficient bit depth and

channel capacity of the existing ADC/DAC, their high-power consumption, etc.), one or more intermediate frequency conversions can be performed in the CAR [22] [23]. It should be noted that any frequency conversion introduces additional errors in signal processing and reduces the potential characteristics of the DAA.

### Conclusions

A new approach to acoustic analysis allows us to solve a lot of problems in the field of medical diagnostics. In particular, for acoustic DAA and PAAA, it is possible to identify and locate objects inside the body, the size of which is much smaller than the length of sound waves, which is quite a revolutionary result.

This is the advantage of digital medicine, which relies on mathematical methods, including in the field of signal processing – to get outstanding results of accuracy and depth of diagnostics, which will not only improve the quality of diagnostic procedures but also make them more understandable and accessible.

### References

1. Tikhonenko Daniil O., Kalachev Aleksandr V., Tikhonenko Zlata O. NEW APPROACHES TO THE ACOUSTIC ANALYSIS OF THE STATE OF THE HUMAN BODY// Proceedings of the International Conference “Scientific research of the SCO countries: synergy and integration” - Reports in English, December 30, 2021, Beijing, PRC. P. 175-185. ISBN 978-5-905695-82-7, DOI 10.34660/INF.2022.41.68.014
2. Inter-State standard 23282-91. Antenna arrays. Terms and definitions.
3. Slyusar, V. I. Basic concepts of antenna theory and technology. Antenna systems of Euclidean geometry. Fractal antennas. SMART antennas. Digital antenna arrays (DAA). MIMO systems based on the DAA. Sections 9.3 - 9.8 in the book "Broadband wireless data transmission networks". / Vishnevsky V. M., Lyakhov A. I., Portnoy S. L., Shakhnovich I. V.-M.: Technosphere. – 2005. P. 498 – 569 (2005).
4. Slyusar, V. I. Smart-antennas went into the series. Electronics: science, technology, business. - 2004. - No. 2. P. 62-65 (2004).
5. Slyusar, V. I. Digital diagram formation - basic technology of advanced communication systems. Radioamator. - 1999. - No. 8. P. 58-59 (1999).
6. Slyusar, V. I. Digital beam formation in communication systems: the future is born today. Electronics: science, technology, business. - 2001. - No. 1. P. 6-12 (2001).



7. Slyusar, V. I. Digital antenna arrays: the future of radar. Electronics: science, technology, business. - 2001. - No. 3. P. 42-46. (2001).

8. Slyusar, V. I. Digital antenna arrays: aspects of development. (link not available). Special equipment and weapons. - February, 2002. - No. 1,2. p. 17-23. (2002). Accessed June 4, 2014. Archived from the original on December 23, 2018.

9. Slyusar V. I. Origins of the Digital Antenna Array Theory. // International Conference on Antenna Theory and Techniques, 24-27 May, 2017, Kyiv, Ukraine. — Pp. 199-201. [1]

10. Slyusar V. I. Development of CAR circuit engineering: some results. Part 1. // The first Mile. Last mile (Appendix to the journal "Electronics: Science, Technology, Business"). — N1. — 2018. — 3. 72-77 [2]

11. H. T. Friis. Oscillographic Observations on the Direction of Propagation and Fading of Short Waves. // Proceedings of the Institute of Radio Engineers. — May 1928. — Volume 16, Issue 5. — Pp. 658—665

12. E. W. Hamlin, P. A. Seay, W. E. Gordon. A New Solution to the Problem of Vertical Angle-of-Arrival of Radio Waves. // Journal of Applied Physics. — 1949, Vol. 20. — Pp. 248-251)

13. Frederick E. Brooks. A Receiver for Measuring Angle-of-Arrival in a Complex Wave. // Proceedings of the I.R.E.- April, 1951. — Pp. 407—411)

14. Ben S. Meltont and Leslie F. Bailey. Multiple Signal Correlators. // Geophysics. — July, 1957. — Vol. XXII, No. 3. — Pp. 565-588

15. B. A. Bolt. The Revision of Earthquake Epicentres, Focal Depths and Origin-Times using a High-speed Computer. //Geophysical Journal. — 1960, Vol. 3, Issue 4. — Pp. 433-440

16. E. A. Flinn. Local earthquake location with an electronic computer. //Bulletin of the Seismological Society of America. — July 1960. — Vol. 50, No. 3. — Pp. 467-470

17. Polikarpov B. I. On some possibilities of using independent channels for receiving signals and using electronic computing equipment to improve the noise immunity and resolution of radar measurements//Collection "Express-information", BNT, No. 23, 1961

18. A. S. USSR No. 25752. A method for measuring the directions to the sources of the electromagnetic field. //Varyukhin V. A., Zablotsky M. A.-1962

19. Varyukhin V. A., Kasyanyuk S. A. On a method for solving nonlinear systems of a special type. - Journal of Computational Mathematics and Mathematical Physics, Edition of the USSR Academy of Sciences, No. 2, 1966

20. Marple-mI. S. L. Digital spectral analysis and its applications. Trans. from English. - Moscow, Mir, 1990. - 584 p.

21. Minochkin A. I., Rudakov V. I., Slyusar V. I. Fundamentals of military-technical research. Theory and Applications. Vol. 2. Synthesis of information support tools for weapons and military equipment. //Edited by A. P. Kovtunenکو. - Kiev: "Granmna". - 2012. - p. 7-98; 354-521 [3]

22. Slyusar, V. I. Ideology of building multi-standard base stations of broadband communication systems. Izvestiya vuzov. Ser. Radio electronics. - 2001. - Volume 44, No. 4. P. 3-12. (2001).

23. Slyusar, V. I. Multistandard communication: problems and solutions. Radioamator. - 2001. No. 7 - P. 54-54, No. 8. - P. 50-51. (2001).

24. Constant or periodic acoustic monitoring of the animal's body. Method of acoustic analysis of the state of the body. Application for the invention PCT/RU2021/000156, PCT/RU2021/000444, PCT/RU2021/000457.

DOI 10.34660/INF.2022.22.46.019

**WASTE DEPOSITION IN PERMAFROST SOILS OF THE ARCTIC.  
WASTE RECYCLING IN SOUTHERN CLIMATES**

**Sokolov Leonid Ivanovich**

Doctor of Technical Sciences, Full Professor

**Sokolov Kirill Leonidovich**

Student

Vologda State University

**Abstract.** The directions of waste management in different climatic conditions are presented. Recommendations on the deposition of waste in the Arctic soils are given. The types of waste composting in the southern climatic zone are substantiated.

**Keywords:** waste, permafrost soils, depositing, composting.

The Arctic zone is the most important strategic region of the planet, which, in addition to the concentration of natural resources, is the place where the geopolitical interests of not only the Arctic states, but also a number of non-Arctic countries intersect. The economic development of the Arctic, the expansion of the military presence in this special territory lead to no less intense environmental pollution of the Arctic zone, accompanied, among other things, by the accumulation of a significant amount of waste, ranging from municipal and ending with nuclear fuel waste. Carrying out measures for waste disposal is difficult and caused by the following factors: extreme natural and climatic conditions; focal nature of the development of territories; dependence of economic activity on supplies from other regions; low sustainability of ecological systems.

Deposition (burial) of waste is carried out at landfills. Waste storage landfills can be surface and underground. They are earthen containers, fully or partially buried and banded. When designing them, the terrain relief, geological structure and hydrogeological conditions of the territory are assessed. Depending on the relief, surface accumulations can be ravine, flat, foundation pits and trenches. In permafrost soils, trench landfills are usually used. The base (bottom) of the trench in climatic zones, where the formation of leachate is possible, must be buried at least 0.5 m into clayey waterproof

soils. When arranging landfills in difficult climatic conditions of the northern territories, in permafrost soils, the following factors should be taken into account. The depth of seasonal thawing of permafrost soils is, depending on the region, 0.5 ... 3.5 m, the thickness of the permafrost layer is from 5 m to 800 m. Groundwater is found in thawed and seasonally thawed layers and can communicate with water bodies. The surface of permafrost is impervious to groundwater. Typically, these waters are polluted and not used for water supply. The flow of groundwater causes thawing of the underlying frozen soil layers. Artesian waters under the layer of permafrost serve as sources of water supply. They must be protected from contamination by supra-permafrost groundwater in areas of fractured rocks. Trenches for MSW with facilities for collection and disposal of leachate are arranged only on thawed soils. On permafrost soils, the trench method with structures for the removal and disposal of leachate cannot be used.

The construction of MSW landfills on permafrost soils includes marking and excavation at the site of the landfill trenches. The excavation is carried out during the period of the beginning of soil freezing, then during the period of the beginning of soil thawing, layers of thermal and waterproofing are installed on the bottom and on top of the trenches, after which the trenches are filled with MSW, and in the next period of soil freezing, trenches are excavated on both sides of the trenches filled with MSW.

This method of erecting MSW landfills on permafrost can be explained as follows. It is known that the continuous distribution of a stratum of permafrost (PF), which is essentially an ideal aquiclude, provides effective natural protection of groundwater and soils from the penetration of pollutants into them. On the other hand, the possible thawing of PF becomes the cause of the environmental risk associated with the pollution of the components of the natural environment. This is especially true for high-temperature PF, which are in fact thermodynamically unstable cryogenic seals. Changes in the temperature regime and thermal state of rocks caused by the development of soils at the base of the landfill and the storage of MSW will lead to an increase in the average annual temperature and the gradual formation of taliks. Infiltration of precipitation into the trench will cause filtration degradation of the PF. One should also take into account the increase in soil temperature due to the biochemical decomposition of MSW. Considering that the concentration of pollutants occurs in the seasonally thawed layer and suprapermafrost waters, and their conservation in the PF layer, such a situation is unacceptable. This is due to the further development of technogenic geocryological processes leading to a deterioration in the quality of the natural environment and the emergence of zones of ecological risk.

Thus, the natural cryogenic confinement at the MSW landfill site will not be able to provide reliable protection of groundwater and soil from pollution without the use of special measures. The main task of these measures is, at a minimum, to preserve the natural temperature regime of PF and, as a maximum, to lower their temperature to values that ensure a stable state of rocks as a cryogenic aquiclude. For this purpose, the upper PF layer, located in the immediate vicinity of a possible source of heat influence (the bottom of the trench), is subjected to forced cooling (freezing). The remaining layer of seasonally thawed soil is also subjected to freezing. Thus, the temperature regime of the soils of the base of the trenches becomes less susceptible to the warming effect of the atmospheric air and stored in the summer MSW. To completely eliminate the mentioned effect on the roof of PF, as well as to prevent their filtration degradation, in addition to freezing the base of the trenches, heat and waterproofing of their bottom and top is arranged. Insulation of the top of unfilled trenches should be temporary until it is loaded by MSW, followed by a permanent insulating layer.

Thus, the creation of zones at the base of the trench with low temperature values (compared to the natural temperature regime), as well as the use of permanent thermal and waterproofing of the bottom and temporary, on top of the trench, is a preventive means of preserving PF in order to eliminate environmental risk when constructing MSW landfills. according to the trench scheme on high-temperature permafrost rocks.

The question arises: How to properly carry out a reliable and safe for nature landfill disposal of waste (not only municipal), but also from radiation-hazardous facilities in permafrost regions?

In this case, burial in permafrost must be done below the boundary of the zone of annual zero amplitudes . In this case, it is necessary to take into account the thickness of the seasonally thawing, active layer (up to one meter) and the boundary of the zone of annual zero amplitudes (10 - 15 m). Thus, the disposal of waste on the bottom territory of the landfill (usually a trench) is carried out below 10-15 meters from the surface of the earth. Below the boundary of the zone of annual zero amplitudes, a zone begins with a gradual change in temperature by 1°C every 33 m towards warming (towards the center of the Earth). Since the depth of laying the bottom of the landfill - the trench is significant, this requires a special organization of work on the landfill: wells are drilled with a step that ensures the required profile of the channel-trench, where shells are installed at a depth of at least 2 meters below the zone of annual zero amplitudes, and then, by explosion, they form a trapezoidal channel-trench with a dump.

Permafrost rock provides high conservation properties not only for mu-

municipal and industrial waste, but also for radioactive waste. It is a natural, endless, powerful cold accumulator. The heat released by radioactive waste into this permafrost is easily absorbed.

Thus, the bottom of the landfill (trenches where waste is placed) is located significantly below the zero-temperature horizon, the upper burial horizon is located at the level of the zero-temperature horizon (and for radioactive waste - below this level). Fertile soil is placed between the upper burial horizon and the ground surface. The location of the bottom of the landfill-trench below the zero-temperature horizon guarantees the absence of migration of substances, since there is no water movement in the indicated horizons. There is no need for waterproofing and thermal insulation of the bottom of such a trench landfill.

The location of the upper burial horizon (UBH) at the level of the zero-temperature horizon for MSW is the most optimal from an economic point of view, since when UBH is located below the horizon of zero temperatures, the costs of producing a landfill-trench increase, and when UBH is located above the horizon of zero temperatures, the sealing condition is violated, which leads to the need for additional sealing of the landfill, which also leads to increased costs.

The location of fertile soil between the upper burial horizon and the earth's surface is necessary both to preserve the ecology of the landfill and to restore the natural temperature balance of the landfill soil.

In order to improve the appearance and ecology of the municipal waste landfill after use (laying of municipal waste), the dump can be divided into two parts: fertile soil and parent rock, after filling the trench with waste, parent rock is placed on top of the waste, a fertile layer is placed on top of the parent rock.

With the specified location of the parent rock (for example, clay or sand) and the fertile layer, the substances of the upper fertile layer will participate in the general circulation of substances in nature.

Sources of waste accumulation in the Arctic: sea vessels; stationary objects (settlements, military units, polar stations); subsoil use objects (oil and gas industry); deltas of large rivers. On sea vessels, waste (metal, glass, paper, plastic, rags) should be sorted into containers, ensuring separate collection with subsequent delivery onshore to transport and delivery to sorting stations or to recycling sites. Directly on board, food waste is crushed through mills, passed through a screen with openings no larger than 25 mm and thrown into the sea if the distance to the coast is less than 3 miles (1.6 km). As a control measure, 24 hours before the arrival of the vessel at the port, the captain is obliged to send to the port authorities of the country in-

formation on the presence of waste on board the vessel in accordance with the established form. Although the requirements of Annex III to MARPOL 73/78 allow to throw into the sea at a distance not closer than 25 miles from the coast, buoyant separation, covering and packaging materials, and food waste and other debris - 12 miles (if shredded - at least 3 miles).

Modern mining facilities in the Arctic are owned by large companies, often - international ones. Directly at the production sites, in temporary shift bases, there are strict rules aimed at maintaining a favorable environmental situation in the work area. MSW are collected separately in groups (paper, plastic, metal, glass, food waste) in container bags, stored and disposed of in accordance with applicable regulations.

Thus, a significant negative impact on the ecosystems of marshes, tundras and polar deserts is due to a gradual increase in the area occupied by oil and gas production facilities. Large areas are occupied by industrial waste - dumps of soil at the sites of overburden and processed rocks.

In addition to the above, there is another way of waste penetration - the deltas of large rivers. Continental runoff is a significant source of various MSW entering the Arctic coasts. Large rivers of the Arctic - Onega, Severnaya Dvina, Pechora, Ob, Yenisei, Lena, Kolyma - carry out all the garbage of their basins into the sea and the coastal zone. In addition, there are many abandoned and sunken ships in the port areas (for example, there are more than 200 of them in the Kola Bay alone). Modern MSW are characterized by the presence of significant amounts of plastic (PET), film and other plastics. It is the rivers that carry such waste to the Arctic Ocean from the mainland. Unfortunately, the volumes of waste received with the river runoff have not been estimated, monitoring is traditionally carried out for the content of petroleum hydrocarbons, organochlorine compounds, heavy metals.

In the countries of the Arctic basin, the problem of accumulated MSW (Municipal Solid Waste) was first addressed only in the 1980s, and the corresponding programs (for example, in the USA) are planned until 2020 - 2025 and provide for significant financial costs for their implementation.

Abroad (in Canada, Alaska, Greenland, Norway) waste disposal (scrap metal, solid household and industrial waste, construction waste) in the polar regions was carried out by removing them from the Arctic. Household rubbish and waste were often isolated in landfills, which were sealed and marked as containing hazardous materials.

MSW containing pollutants are being transported to milder climates for recycling. Transportation of waste to less difficult climatic conditions (even to the south) is more justified than the construction of high-cost waste processing plants and the installation of specialized equipment for process-

ing waste from small towns and small settlements in the Arctic. Currently, there are special disposable containers, plastic packaging, bags and other means to ensure environmental safety in the collection and transportation of hazardous waste. For remote communities, incinerators are the solution to this problem, allowing small amounts of MSW to be disposed of locally.

Thus, for the processing of consumer waste in Arctic settlements, a possible solution can be both transportation in moderate climatic conditions, and the introduction of special high-temperature waste incineration plants (incinerators), where the combustion products are no longer so toxic. In addition, these plants are capable of converting combustion energy into electricity. The only limitation - is the high cost of such installations.

So, unlike other, warmer regions of the planet, the nature of the Arctic is not able to recycle the waste existing here.

Unified approaches to collecting, transporting, processing and depositing MSW for the north and south are unacceptable, while the following main directions can be distinguished:

- large amount of precipitation in winter, snow transport, low temperatures determine the complexity of the operation of special vehicles and special equipment for collecting and removing waste in the **northern zone**. Due to the increased fragility of metal and rubber, premature wear of the equipment occurs, and low temperatures cause the waste to freeze to collectors and vehicles;

- in low-rise buildings in the **southern zone**, waste should be collected in small plastic or paper collectors, which are manually or mechanically loaded into the body of a collection truck, similar to the method used in industrialized countries;

- in high-rise buildings or for a group of low-rise buildings in the **southern zone**, a standard sealed container on wheels made of galvanized iron, plastics, metal treated with an anti-corrosion and anti-adhesive coating should be installed;

- for bulky waste in the **southern and northern zones**, removable container-crates must be used.

The southern zone is characterized by high temperatures and the duration of the warm period, an abundance of vegetables and fruits and the length of the season for their consumption.

High outside air temperatures contribute to the rapid decomposition of organic waste materials, the accelerated development of microflora, including pathogenic microorganisms, and the emergence of flies. All this causes the need to reduce the storage time of MSW from one to 1.5 days, increased



requirements for the tightness of containers and vehicles, the need for their systematic and thorough washing and disinfection. For cities with a population of about 100 thousand inhabitants, located in the southern regions, it is advisable to use MSW field composting with a preliminary selection of waste fractions. Along with useful components (organic matter, nitrogen, phosphorus, potassium, calcium, etc.), the compost contains trace elements of metals, therefore, when it is introduced into the soil, it is necessary to take into account the background concentrations of these elements in the soil, so as not to exceed the maximum permissible concentrations (MPC) in soil and agricultural products.

Thus, separate collection of waste is required: metal, glass, plastic, paper (cardboard), food waste. Biodegradable waste (waste of plant or animal origin), food, kitchen, garden waste is sent for composting at home, or for field composting of special agricultural enterprises (industrial composting).

### **Composting organic waste in a southern climate zone**

Composting: home and field large-tonnage. The household generates a sufficient amount of its own organic waste, which can be easily converted into gaseous biofuel - biogas. This requires the appropriate capacity and temperature (more than + 20°C .... + 25°C, or better 34°C ..... + 55°C) and bacteria that live without oxygen in the air and process waste into methane gas. The oxygen-free process is an anaerobic process. In countries with hot climates, there is no need to heat up the digester tank (on an industrial scale such a tank is called "methane tank").

### **Summary**

Thus, in the Arctic, transport logistics gives preference to the export of MSW for processing in a temperate or southern climatic zone, because there is no possibility to recycle all the generated waste due to the fragmentation of accumulation sites, the complexity and high cost of their processing in harsh climatic conditions. For processing, including into energy, small volumes of generated waste, it is possible to use incinerators at the place of their accumulation. In the case of depositing MSW and waste from radiation hazardous objects in permafrost regions, disposal is carried out in permafrost soil below the boundary of the zone of annual zero amplitudes. In southern climatic conditions, it is advisable to use composting of biodegradable waste with a preliminary selection of waste fractions (metal, glass, plastic).

### **References**

1. Sokolov, L. I. Waste management+ : textbook / L. I. Sokolov/ – Moscow; Vologda : Infralngeneria, 2022. – 728 p.

**WASTE HIERARCHY. DEVELOPMENT OF THE WORLD MARKET  
FOR WASTE-TO-ENERGY PRODUCTION**

**Sokolov Leonid Ivanovich**

Doctor of Technical Sciences, Full Professor

**Sokolov Kirill Leonidovich**

Student

Vologda State University

**Abstract.** The sequence of priorities in waste management is presented. Examples of best practices are given.

**Keywords:** waste, hierarchy, management, recycling, energy-from-waste

Waste management issues have been regulated at the European level since 1975, when the EEC Waste Framework Directive (July 15, 1975) appeared, which contains basic terminology. It is now used in most of the EU waste legislation and in the national legislation of many European countries, and determines the direction of activities of states in the field of waste management.

In the subsequent period, a number of documents were agreed and approved, regulating the handling of specific types of waste, such as: *hazardous waste* (Directive № 91/689/EEC of 12.12.1991 on hazardous waste, supplemented by Directive № 94/31/EU of 27.06.1994), *used packaging* (The EU Directive on packaging and packaging waste of 20.12.1994), *polymer waste* (Council Directive № 96/59/EU of 16.09.1996 on the elimination of polychlorinated biphenyls and polychlorinated terphenyls), *waste electrical and electronic equipment* (Directive № 2002/96/EU of 27.01.2003 on waste electrical and electronic equipment and Directive 2002/95/EU of 27.01.2003 on the restriction of the content of certain hazardous substances in electrical and electronic equipment). The rules for the disposal of waste at landfills were established (Directive № 99/31/EU of 26.04.1999 on landfills), rules for waste incineration (Directive № 2000/76/EU of 4.12.2000 on waste incineration), rules for the transport of waste on the territory of the EU (Regulation EEC № 259/93 of 1.02.1993 on the supervision

and control of the transport of waste within, during import and export from the European Community). The European Waste Catalog - EWC was also approved (European Commission Decision № 2000/532/EU of 3.05.2000 approving the European Waste Catalog) and environmental harm reduction issues were considered (Sixth Community Action Program in the field of the environment, approved by Decision № 1600/2002 of the European Parliament and Council of 22.07.2002).

On December 12, 2008, a new European waste framework directive came into force, which further developed the EU waste policy (Directive 2008/98/EC). It reflects the EU resource policy: an integrated product policy based on a life cycle concept.

The EU framework directive

- introduces a five-stage waste hierarchy,
- introduces a product life cycle concept into waste management,
- new tools for waste prevention,
- defines the objectives for the material reuse of waste,
- requires the use of waste for energy,
- involves the exchange of information and “best practices” between states.

The directive offers a fundamentally new approach to understanding waste - they are not considered as unnecessary product to be eliminated, but as a by-product, raw material that can be used. It contains such types of waste as waste paper, metals, construction waste, certain types of ash and slag, granular stones, tires, textiles, compost, glass, wood, polymer materials, etc.

Waste hierarchy is understood as a sequence of priorities in waste management. Five-step hierarchy : avoidance (prevention), preparation for reuse, recycling, other uses for other purposes, e.g. energy, elimination (disposal).

The current waste situation in the EU member states looks different. If in Switzerland, the Netherlands, Sweden, Denmark, Belgium, Germany, Austria, Luxembourg the vast majority of waste is reused, and only a small share is deposited at landfills, then in other states, primarily in the new EU members, the volume of deposited waste significantly exceeds the volume of reused .

### **Prevention – is the first level of the waste hierarchy**

For the prevention (avoidance) of waste generation in the EU countries, 36 national and regional programs have been adopted. Programs target households, the residential sector, municipalities, agriculture and the extractive industries; most of them deal with such waste types as organic

(food waste), electrical and electronic components, batteries, packaging, hazardous waste .

Here are some examples of best prevention practices.

Great Britain - projects are being implemented to distribute biodegradable and then compostable packaging materials, to reduce food waste from the population, as well as the " Halving Waste to Landfill" project, aimed at reducing waste arising from construction or demolition of structures.

France - training programs and advice on minimizing packaging waste.

Belgium - regional program (Flanders) to significantly reduce household waste, with part of the waste after shredding being used for energy; reuse centers have been developed that collect, sort, repair and then sell unnecessary, old household items – clothes, household appliances, furniture, dishes, books and bicycles.

Ireland - a green business initiative that assists businesses and organizations in three areas – waste, water and energy.

Hungary - the practice of reusing and exchanging building materials between construction firms (exchange items – bricks, tiles, wooden construction components, window frames).

Austria - "lifestyle change" programs focusing on services instead of purchasing goods.

Italy - training and other services for households on composting food waste.

These are just a few of the many possible examples of how waste prevention works. We are talking only about the first steps so far, but the movement towards "avoidance and prevention" is intensifying every year.

### **Reuse – the second level of the hierarchy**

This is any operation by which products or components that have not become waste are reused *for the same purpose* for which they were originally produced. A classic example in this regard is glass containers and utensils (bottles, jars, glasses) that are not used in a given place, are reused in another. The scope of this principle of preparing for reuse, in essence, is small and it itself rather serves to promote thrift and prudence in society than to solve any serious economic problems.

In practice, reuse covers such types of waste as car parts, furniture, refrigerators, televisions, computers, clothing, kitchen utensils and kitchen appliances, building materials, garden tools, out of fashion jewelry, products, books. To collect all this, special centers are created, where the renovation (repair) and sale of all of the above are carried out on the second hand principle. In Sweden, a huge department store has been built, combining the traditional municipal center for the reception of old items

(furniture, computers, clothes, toys, bicycles, garden equipment, building materials) and their sale.

### **Recycling - the third level of the hierarchy**

This is any operation in which waste is processed into products, materials, regardless of whether the resulting product serves its original purpose or some other purpose. A specific type of recycling – is the processing of organic waste for composting. Recycling (processing waste into secondary raw materials) is today a key element of waste management. Up to 80% of municipal solid waste, as well as construction and demolition waste, can be recycled, namely: glass, ferrous and non-ferrous metals, textiles, paper, plastics, leather, fur, wood, cork, rubber, food and floral waste, vegetables, fruits.

In some cases, recycling of the material aims to recover the original material – for example, paper from recycled paper or polystyrene from polystyrene products, but the goal may also be to extract certain elements from complex products – for example, lead from car batteries or gold from computer boards, and also hazardous substances such as mercury from thermometers and fluorescent lamps.

The EU waste directive prescribes separate collection of at least **four fractions** of municipal solid waste – **glass, paper, metal and plastic**. At the same time, different national legislation can carry out an even more thorough sorting of waste.

At present, the results achieved in the recycling of municipal waste vary widely - from 70% in Germany and 60% in Austria, Belgium, Switzerland and Sweden to 2-10% in Serbia, Turkey, Slovakia and Malta. The targets set by the European Commission aim to ensure that by 2025 - 60%, and by 2030 - 65% of municipal waste will be recycled or treated for reuse.

Benefits of recycling:

- a) turns waste into resources;
- b) prevents the costs that society would have incurred in the course of its landfill;
- c) creation of additional jobs: it was found that the removal of 10 tons of waste to the landfill creates 6 jobs, and the recycling of the same 10 tons - 361.

Additional economic benefits are achieved when the recycled waste is used "locally", eliminating the need to import this category of material from other locations or countries. Thus, a country may not produce paper, but receive it by recycling waste paper.

Recycling, like no other waste management method, paves the way for tremendous resource savings. In the production of aluminum, recycling can save up to 95% of energy, copper – 85%, steel – 74%, lead – 65%.

Glass can be recycled any number of times without loss of quality or purity, while acquiring a variety of shapes; at the same time, one ton of natural raw materials is saved for every ton of recycled glass. High-tech fabrics and materials are produced from plastic, depending on the type, which are then used to make durable (often sports or professional) clothing, shoes, bags, finishing, building and construction materials, furniture (most often tables, chairs and benches), toys; woven and non-woven textiles, packaging, beams, pipes and many other products. Recycling one ton of plastic saves 5,774 kW · h of energy, 3.8-7.6 m<sup>3</sup> (1,000-2,000 gallons) of gasoline, 2.6 m<sup>3</sup> (685 gallons) of oil and 181.7 m<sup>3</sup> (48,000 gallons) of water. The resource of recyclable plastics is becoming large-scale: by volume (not by weight), humanity today produces as much polymers as cast iron, steel, rolled products and non-ferrous metals combined. This is such a versatile and "flexible" resource that experts today talk about the prospects for a **new "plastic economy"**.

Recycled plastic can be used in road construction. An ordinary asphalt road lasts a maximum of 50 years and constantly requires repairs. The Dutch company "VolkerWessels" today put forward the concept of a plastic "eternal road", which will not take long to build, which requires a minimum of maintenance and at the same time is safe .

The basis of the Dutch project – is modular plastic slabs with a hollow interior space for rainwater drainage and placement of communication cables. "PlasticRoad", as the project is called, assumes that such roads can be built 80% faster than conventional roads and will last three times longer. The modules being developed are resistant to temperature drops from minus 40 to plus 80, they are able to withstand the same load as traditional asphalt, they are easy to transport, and the soil under such highways is less susceptible to subsidence. At the end of their service life, such coatings can be recycled and reused. There are prototypes of plastic roads in Rotterdam. With the rapid development of organic agriculture, the recycling of so-called biodegradable waste (plant or animal waste), food, kitchen or garden waste, as well as paper and cardboard, is becoming increasingly important in recycling practice.

**Composting** is the ideal way to recycle organic kitchen, garden and agricultural waste. In practice, various systems are used – from industrial composting technologies to home (garden) composters. Large production facilities (composter plants) are also covered by the European Compost Network, which has 72 associate members from 28 countries of the EU.

Thus, with the opportunities that new industrial technologies open up, waste in a significant amount is converted into resources. The "linear waste

economy" with its principle "extracted a resource – produced a product – consumed it – deposited waste" is being replaced by a low-waste (circular) economy based on the principles of recycling waste and products . This reduces the need for primary resources and minimizes residual waste, pollutants and emissions. "Cleaning at the end of the pipe" loses its meaning. In the EU documents, the circular economy of the future is presented as a revolution leading to a new technological order – to a sustainable, low-carbon, resource-efficient and competitive economy.

Other uses for other purposes (including energy) – is the fourth level of the hierarchy

At this stage, the issues of processing waste with a certain calorific value for energy purposes - for the production of electricity and / or heat – are considered: in the EU documents and scientific literature, all this is covered by the term "waste-to-energy". The physical basis of the technologies used in this area is **incineration** – waste burning in special machines. In modern incinerators, a 95% incineration rate is achieved, which to an enormous extent relieves another area of waste management – landfill disposal. At the same time, the unburned residue no longer contains rotting organic substances, which are associated with the danger of epidemics and spontaneous combustion. At this stage, the principle operates: everything that is possible must be recycled, and if recycling is impossible (due to the quality or composition of the waste), – it must be converted into energy, but not buried in landfills. Converting waste to energy is costly from an economic point of view, but it could be an extremely profitable industry because municipal solid waste is a fuel comparable to peat and some brands of brown coal. This fuel is generated in places where energy is most in demand, i.e. around major cities, and has a predictable renewal. In this regard, the concept of "energy balance", proposed by the working group of the World Energy Council, attracts special attention: the energy obtained should cover the energy costs for the waste processing itself. Therefore, the choice of technology is most often determined by the balance of produced and consumed energy. Experts believe that in the near future combustion with the generation of electricity and heat will be the main method of waste processing. In the future, waste incineration power plants are likely to enter an integrated waste management system together with enterprises for the disposal and reuse of certain materials (glass, metal, paper, plastic).

**Another way** of processing waste for energy purposes is becoming more and more promising – the production of **biogas**.

Biogas is understood as gas obtained in special installations based on anaerobic (oxygen-free) methane fermentation of biomass. Biomass in-

cludes manure and renewable plant materials. With existing technologies, one ton of manure or other biomass gives about 500 cub. l of biogas, which is equivalent to 350 l of gasoline. Biogas is increasingly used as a fuel for transport: at the same time, the problem of reducing greenhouse gas emissions in the transport sector is being addressed. The contours of "green transport" are emerging. Biogas produces significantly less harmful emissions than traditional transport fuels; moreover, methane contains about 3 times more energy than gasoline. Globally, the share of biogas as a transport fuel is still small – less than 1%, but it is systematically growing in countries such as Germany, France, Sweden, Switzerland.

In Sweden, for example, 97% of the biomethane produced is used for these purposes. Since the end of the XX century, the Swedish companies "Volvo" and "Scania" have been producing and widely exporting buses to European countries that run on this fuel. One of the most exciting undertakings in this area – is the Stockholm-initiated "Baltic Biogas Bus" project, which involves 12 partner organizations from eight Baltic countries, including Estonia and Lithuania.

Deposition (burial) of waste – the fifth step of the hierarchy

The lowest level of the European "waste management hierarchy" – **landfill sites**; in the EU documents it is defined as the "least desirable option" and should be kept to the possible minimum. The basic legislative document in this area is the Council Directive of the European Union on landfills, adopted back in 1999 (Directive 1999/31/EC on the landfill of waste). The general goal of the directive was to impose strict requirements on waste and landfills in order to reduce negative impacts on the environment, in particular on surface and ground water, soil and air, including at the global level, along with the greenhouse effect. To ensure this, the directive prohibited the disposal of the following types of waste at landfills: 1) liquid; 2) flammable; 3) explosive or oxidizable; 4) medical (since there is a danger of infection); 5) used car tires; 6) some other types. The directive established that landfill disposal is permissible only for those wastes that have undergone treatment. It can be assumed that it was precisely this requirement that became a key factor in the dynamic development of the entire chain of the "waste management hierarchy" in the EU: "treatment" essentially means the need to stimulate and develop everything that is covered by the concept of "three Rs" – "reduce", "reuse", "recycle"; at more advanced stages, "prevent" was added to this.

Modern landfills for waste disposal require sophisticated engineering that minimizes the risk of harmful substances entering the environment. Currently, landfill is an intermediate or transitional, but still necessary solu-



tion for waste disposal. However, this solution is not the ultimate goal of sustainable waste management. MSW management systems must continue to prioritize the recycling of materials.

### **Development of the world market for waste-to-energy production**

The volume of waste generated around the world is growing. If now in Europe (including the CIS countries) 392 million tons of waste are generated per year, then by 2030 this figure will increase by 12% and reach 441 million tons per year, and by 2050 it will be 490 million tons. In Asia and Africa, the rate of waste generation is growing even faster - by 2030, their volumes are projected to increase by 30-40%.

Nowhere in the world has it yet been possible to involve 100% of waste into secondary material circulation. Why not 100%? A number of wastes are not recyclable: used hygiene products, some types of plastics, composite packaging, contaminated paper and plastic wrap, low quality paper and polymers that have already gone through several stages of recycling, small waste fractions.

The Confederation of European waste-to-energy Plants, CEWEP, has developed the first Sustainable "Energy-from-Waste" Roadmap to meet the EU Directive and achieve 10% landfill by 2035. The map examines only the introduction of technology "Energy-from-Waste" in Europe. Today we cannot talk about the transition to a circular economy in 2035 without solving the problem of **waste** that cannot be recycled. The CEWEP Roadmap proposes to recognize that for such waste, recycling to energy is the only possible way to safely dispose of it. At the same time, this method is more gentle on the climate, since otherwise this waste would end up in landfills. In addition, they are becoming a substitute for fossil fuels when supplying heat and electricity to the population.

According to the calculations of CEWEP experts, even if all laws and regulations for recycling into secondary raw materials are met, by 2035 Europe will produce about 142 million tons of residual waste that cannot be recycled. Today, the total capacity of European factories that produce energy from waste is 90 million tons per year. Another 11 million tons — are simply incinerated. Thus, the capacity deficit — is about 41 million tons. During the period from 2016 to 2019, 161 waste-to-energy plants with a total capacity of 60 million tons of waste per year were commissioned in the world. 80% of all new capacities were commissioned in China, 12% in European countries, and 8% - in all the rest . All in all, to achieve a 10% landfill, 170 new plants are needed. 91% of the commissioned capacities use grate firing technology, 3 plants – gasification technology, 1 plant – fluidized bed combustion.

The trend in recent years has been the start of construction of waste-to-energy facilities in countries where plants were not previously planned and built: Australia, UAE, Hong Kong, Mexico, Turkey. All of them use grate firing technology.

Thus, in the process of developing and improving MSW management systems, the waste hierarchy should be taken into account. Priority should be given to reducing waste by preventing waste and then preparing it for reuse and recycling. Waste-to-energy projects can be categorized as complementary technologies for re-generating energy from the remaining non-recyclable fractions of MSW. Under controlled conditions, converting waste to energy is preferable to recycling, but requires significant financial investment and is a low priority in the waste hierarchy.

### References

1. Sokolov, L. I. Waste management+: textbook / L. I. Sokolov/ – Moscow ; Vologda : InfraIngenieria, 2022. – 728 p.

DOI 10.34660/INF.2022.88.46.021

## THE CURRENT STATE OF THE SMALL CITY RESERVOIR OF THE VORONEZH CENTRAL PARK OF THE CITY OF VORONEZH<sup>1</sup>

**Kaverina Natalia Viktorovna**

Candidate of Geographical Sciences, Associate Professor  
Voronezh State University

**Abstract.** The work contains the results of a geochemical study of bottom sediments of the pond of the Voronezh Central Park. The degree of technogenic geochemical transformation of properties and chemical composition, bottom discharge for the period from 2012 to 2021 has been established. The current state of the small urban reservoir of the city of Voronezh has been investigated. The landscape geochemical conditions and the functional purpose of the city territory are attributed to the important factors influencing the levels of technogenic impact on the reservoir.

Due to the quantitative chemical analysis the trends of contamination of the depositing medium with hydrogen sulfide, oil products, heavy metals were determined. The levels of accumulation of phosphates, mobile sulfur and ammonium nitrogen have been established.

The revealed facts of technogenic pollution of bottom sediments indicate the potential danger and the need to improve the monitoring system of the reservoir.

**Keywords:** urban environment, small city reservoirs, pond of Voronezh Central Park, monitoring, bottom sediments, prioritized pollutants, quantitative chemical analysis.

Voronezh is a modern city with a rich historical past, complex modern infrastructure and a million population. It was founded in 1586 to protect the southern border of the Muscovite state from the Crimean Khanate on the undeveloped steppe lands of the "Wild Field". The border of the settlement ran from the mouth of the Voronezh River to the mouth of its tributary Peschanka.

After the fire of 1748, the city center was moved to the place that, on the modern map, is occupied by the main building of Voronezh State Uni-

---

<sup>1</sup>The study was carried out with the financial support of the Russian Foundation for Basic Research, project No. 20-05-00779

versity and the University Square of the regional center. The floodplain of the Voronezh River with an abundance of backwaters, channels and lakes for a long time limited the development of the city to the right bank and was actively used for economic purposes.

In the 19<sup>th</sup> century, almost all urban reservoirs became recreational. They have become an element of a complex of natural-man-made systems interconnected by the exchange of matter and energy that form an urban environment that meets all the needs of residents: biological, recreational, psychological, etc. [12].

The construction of a hydroelectric complex in 1971 on the Voronezh River determined the modern look of the city. Currently, the regional center is developing harmoniously along the banks of the Voronezh River, in the channel of which the central part of the city is located, occupied by a reservoir.

Regardless of their size, all urban reservoirs experience strong anthropogenic impact. It manifests itself in the form of violations of the natural hydrological regime (water discharge and level, temperature, configuration of the coastline, the amount and composition of transported substances), chemical pollution and littering [3, 6]. Cases of illegal use and withdrawal of water have been recorded within the city. Due to their small size, urban reservoirs remain outside state and municipal supervision. The state of small urban reservoirs is largely controlled by partial residents of the city, who inform the supervisory authorities about obvious problems.

### **Objects and methods of research**

As the **object** of the research, a popular place of recreation for the townspeople was chosen - the pond of the Voronezh Central Park. It belongs to the Voronezh hydrographic region. Its depth in some places reaches three meters, and the area of the water mirror is 693 m<sup>2</sup>. The **subject** of the analysis was the materials collected during the summer field seasons of 2020 and 2021, with sampling of bottom sediments.

The **purpose** of the work performed was to obtain up-to-date information on the state of the pond of the Voronezh Central Park. For its implementation, the following tasks were set and solved:

1. To take samples of bottom sediments and carry out laboratory research in the environmental-analytical laboratory of the faculty.
2. To compare the results obtained with the materials of previous studies.
3. To determine the factors influencing the development of the reservoir and assess the prospects for its existence in the future.

Voronezh Central Park is almost 180 years old. It was organized in

1844 as a "tree nursery" for the cultivation of ornamental and garden plants. During the fighting in 1942-1943, the territory of the park was badly damaged. After restoration, at the end of the 60s, the nursery received the name "Gorky Central Park of Culture and Leisure".

The park's reservoir has always been a central resting place. Initially, it was Lake Chernomor, which was filled with clean spring water. After the construction of interchanges and overpasses of the reservoir's North Bridge in 1980, the park began to degrade. More and more often the territory of the park was flooded, the lake "Nizhneye" with its boat station disappeared, and the central lake of the park turned into a pond.

Dense urban development of drainage areas, dry shallow years significantly reduced the volume of rain and melt water feeding the soil [8]. During the renovation of the park in 2014, the pond was overlaid with slabs and fenced off. The reservoir, encased in concrete, ceased to receive a sufficient amount of groundwater from the "Central" spring that feeds it.

The selected samples of bottom sediments were examined in the ecological-analytical laboratory of the Faculty of Geography, Geoecology and Tourism of the Voronezh State University. Physicochemical indicators of bottom sediments were studied according to the program, which provides for the control of the content of heavy metals, oil products, hydrogen index, ammonium nitrogen, phosphates and hydrogen sulfide (Table 1).

**Table 1.**  
**Methods for analyzing bottom sediments [7]**

<b>Indicator name</b>	<b>Method of determination</b>
Hydrogen exponent	Potentiometric method
Lead, cadmium, copper, zinc	Stripping voltammetry method
Petroleum products, ash content,	Gravimetric method
organic matter	Titrimetric method
Hydrogen sulfide	Photometric method

Hydrogen sulfide was determined from a wet sample with subsequent conversion to dry matter. The ecological assessment of the levels of heavy metals in the bottom soil was carried out according to the concentration clarke, calculated as the ratio of the content of a chemical element in the bottom soil samples to the soil clarkes compiled by A. P. Vinogradov in 1962.

### Results and discussion

The bottom sediments of the pond contain both autochthonous (obtained in the reservoirs themselves) and allochthonous (coming from outside) particles. Due to the accumulation of bottom sediments, the size of the reservoir and its morphometric parameters change. The composition changes due to chemical and biological processes occurring in the bottom soils and the bottom layer of water. Due to the specifics of a small reservoir (low flow rate, shallow depths, stagnation, etc.), there is an accumulation of pollutants coming from the adjacent territories. Chemical contamination is the most common and persistent, and can be organic and inorganic.

The pond of the Voronezh Central Park will be polluted with chemicals (Table 2) of organic origin (ammonium nitrogen, phosphates, oil products) and inorganic compounds (heavy metals, hydrogen sulfide).

**Table 2.**  
**The pH value and the content of pollutants in the bottom sediments of the pond of the Voronezh Central Park (2012) [5]**

No.	Analysis indicators, mg / kg	August 2012	September 2012
1	Hydrogen indicator, units pH	7,8	7,2
2	Hydrogen sulfide	7,0	0,32
3	Ammonia nitrogen	23,6	8,4
4	Petroleum products	13000	2830
5	Phosphate ion	195	1288
6	Lead	22	31
7	Cadmium	1	0,8
8	Copper	32	32
9	Zinc	88	15
10	Nickel	30	19
11	Manganese	29	494

Evaluating the results of the study of bottom sediments of the reservoir, carried out in August and September 2012 by the laboratory of Rosprirod-nadzor, it can be stated that the “blooming” of water ends when the average daily temperature drops from 19.2 °C to 14.4 °C [4]. Within one month, significant changes occur in the state of the reservoir. Thus, the concentration of hydrogen sulfide in the sediments decreased 22 times, and the acidity index changed from alkaline values to neutral values.

Pollution of the pond occurs with surface runoff from natural and anthropogenic sources, consisting of precipitation (rain and snow) and irrigation and washing water.

According to meteorological data, in August 2012, 186 mm of precipitation fell, which is 359% of the norm [4]. As a result of dilution by storm streams, the accumulated pollution in bottom sediments decreased: for oil products by 4.6 times, for ammonium nitrogen by 2.8 times, for zinc by 5.6 times, for nickel by 1.6 times, cadmium by 1.3 times.

The washout of the urban soil brought into the reservoir "nutrition" for blue-green algae - phosphates. Their concentration increased 6.6 times. Studies in August 2012 established an excess of the concentration of clarkes for cadmium ( $K_{K_{Cd}} = 7.69$ ), lead ( $K_{K_{Pb}} = 1.38$ ) and zinc ( $K_{K_{Zn}} = 1.06$ ). The ranged distribution of elements is as follows:  $Mn < Cu < Ni < Zn < Pb < Cd$ .

Subsequent monitoring of the state of the sediments, which followed in September 2012, revealed a different picture of the accumulation of heavy metals: cadmium ( $K_{K_{Cd}} = 6.15$ ), lead ( $K_{K_{Pb}} = 1.94$ ). In this case, the ranked series of the distribution of elements has the form:  $Zn < Mn < Ni < Cu < Pb < Cd$ . The concentration of manganese increased 17 times in comparison with previous observations.

The results of current research carried out in 2020 and 2021 are presented in Table 3.

**Table 3.**  
**The pH values and the content of pollutants in the bottom sediments of the pond of the Voronezh Central Park (2020 and 2021)**

No.	Analysis indicators, mg/kg	August 2020	September 2021
1	Hydrogen indicator, units pH	7,12	7,0
2	Hydrogen sulfide	<b>6,39</b>	<b>6,9</b>
3	Ammonia nitrogen	<b>805</b>	<b>552</b>
4	Petroleum products	45	33
5	Phosphate ion	<b>6893</b>	<b>5125</b>
6	Lead	0,58	0,44
7	Cadmium	Less than 0,1	Less than 0,1
8	Copper	0,98	0,45
9	Zinc	Less than 0,1	Less than 0,1
10	Nickel	13	10
11	Manganese	52	49

## Process Management and Scientific Developments

---

12	Organic matter,%	64,35	55,81
13	Ash content,%	35,65	44,19
14	Sulfur mobile	181,75	195,3

According to meteorological observations for the periods under study, a deviation from the average monthly values was established: for the temperature of August 2020, +1.2 °C to the average monthly temperature, and in August 2021, it was already + 4 °C. The amount of precipitation is less than the average for August (52 mm) and is only 13% of it in 2020 and 19% in 2021.

Dry hot periods limited the washout of pollutants into the body of water. Studies in 2020 and 2021 did not establish an excess of concentration clarkes for any element. In this case, the ranked series of the distribution of elements has the following form: Zn <Cu <Pb <Mn <Ni <Cd.

Phosphates and ammonium nitrogen continue to provide vigorous growth of blue-green algae, because their content is calculated in grams. Active "bloom" of water forms a stable hydrogen sulfide environment (more than 6 mg/kg). The accumulation of mobile sulfur occurs in the sediments. Its content even exceeds the gross maximum permissible concentration (160 mg/kg) by 1.2 times.

As a result, the self-cleaning process becomes insufficiently effective to maintain high quality. Water, enriched with elements and compounds for nourishing blue-green algae, begins to actively "bloom" destroying all oxygen. Hypoxia is detrimental to small reservoirs and triggers the destruction of the ecosystem. Foci of contamination by pathogens and viruses are formed, which are masked in the organic matter of bottom sediments.

Smoothing the natural landscapes of the park, overlapping the surface of the earth with concrete and asphalt does not allow rain and melt water to filter into the lower soil horizons and pour out into the pond of the Central Park. Torrential flooding of the park territory is of a regular nature and significantly worsens its condition. Washing off fertile soil horizons and stagnant water in low-lying areas lead to the death of trees.

In the warm season, the water begins to warm up strongly, and the active development of algae occurs, causing the water to bloom. Flowering can lead to mass death of fish and aquatic vegetation. The reservoir begins to be covered with a green dense "film" of algae, mud, and the color and smell change.

In the autumn period, reservoirs are drawn into a dense layer of leaf litter, the decomposition of which requires significant amounts of oxygen. By winter, oxygen does not have time to accumulate. In winter, a small



reservoir is covered with an ice crust and can freeze completely. This is the time of the year where the least pollution occurs. In spring, the reservoir is filled with waters of melting snow and ice, and pollutants come with these waters.

### Findings

1. The state of bottom sediments of the pond of the Voronezh Central Park depends on the constantly changing processes of urbanization and the nature of the weather.
2. Performing regular mechanical cleaning of the pond will get rid of debris (foliage, branches, large algae and silt deposits) that has got into the pond and stabilize the oxygen content.
3. For a reservoir in summer and winter, artificial aeration is vital to saturate the water with oxygen and remove harmful and poisonous gases.
4. The use of various reagents can slow down the explosive nature of the "blooming" of the reservoir.
5. The higher vegetation of the reservoir must be diversified with resistant species (water lilies) that will cover the surface of the water, protect the pond from heating.
6. Monitoring the condition of the pond with an increase in the frequency and quantity of water sampling to determine the content of harmful substances.

### Conclusion

The state of the bottom soil of the small central park reservoir of the city of Voronezh depends on constantly changing processes. These include mixed feeding of the reservoir, seasonal changes, seasons, as well as the intensity and direction of anthropogenic load.

Regulation of the current state of an urban reservoir is not possible without a retrospective assessment of the origin and history of development. The complex of measures for the rehabilitation of the pond of the Voronezh Central Park should include urban planning, economic, landscape, architectural, historical, nature conservation approaches.

### References

1. Aleksanyan Yu. V. Classification signs of urban reservoirs // *Water industry of Russia*. 2018. No. 3. P. 87-100.
2. Bezuglaya E. Yu. What the industrial city breathes / E. Yu. Bezuglaya, G. P. Rastorgueva, I. V. Smirnov. – Leningrad: Gidrometeoizdat, 1991. – 251 p.

3. Vorobyova I. A. Investigation of the reasons for the formation of high concentrations of formaldehyde in the atmosphere of the city / I. A. Vorobyova. – Proceedings of the A. I. Voeikov Main Geophysical Observatory – 2008. – No. 557. – P. 206-215.

4. Hydrometeorological Center of Russia "About the weather first hand" [Electronic resource] – URL: // [meteoinfo.ru/climate/klimatgorod/1685-1246618396](http://meteoinfo.ru/climate/klimatgorod/1685-1246618396) (access date 10/20/2021).

5. Report on the state of the environment in the Voronezh region in 2012 / Department of natural resources and ecology of the Voronezh Oblast. – Voronezh: Voronezh State University Publishing House, 2013. – 99 p.

6. Zavodchenkov A. F. Voronezh Oblast: nature and natural emergencies / A.F. Zavodchenkov, V. I. Fedotov. - Voronezh: publishing house of Voronezh State University, 2005. – 98 p.

7. Methods of environmental research: textbook for universities / N. V. Kaverina, T. I. Prozhorina, E. Yu. Ivanova, M. A. Klevtsova, S. A. Kurolap, O. V. Klepikov, A. G. Muravyov, A. N. Nikolskaya, V. V. Sinegubova. - Voronezh: Publishing house "Scientific book", 2019. – 355 p.

8. Rozhkov V. A. Soils and soil cover – witnesses and indicators of global climate change / V. A. Rozhkov // Soil Science. – 2009. – No. 2. – P. 134-143.

DOI 10.34660/INF.2022.84.64.022

## RATIONAL USE OF PADDLEFISH CUTTING PRODUCTS IN COMBINED FOOD SYSTEMS

**Antipova Lyudmila Vasilievna**

Chief Research Officer at REC "Living Systems", Full Professor

**Slobodyanik Valentina Sergeevna**

Doctor of Biological Sciences, Full Professor

**Setkova Alena Yurievna**

Externe

Voronezh State University of Engineering Technology

**Abstract.** Paddlefish is a freshwater sturgeon-like fish adapted to the conditions of Russian inland waters. It is grown in a pond polyculture together with silver carp, carp and grass carp. The peculiarities of nutrition and structure create conditions for increasing the volume of produced aquatic biological resources, expanding the range, improving the quality and biological value of fish products for the development of the domestic market and ensuring consumer demand. Evaluation of the mass yield of products when cutting the study of a complex of properties allows us to recommend paddlefish meat and liver for the production of combined food systems of high quality, low cost, competitive in the fish products market.

**Keywords:** paddlefish, meat cutting, liver, properties, combined food systems, quality, biological value.

An important problem of modern society is the provision of the population with food products in quantity, range and quality, guaranteeing an increase in the living standard of the population and the preservation of its health. The solution to this problem is possible with the efficient functioning of the food market, dynamic development of the agro-industrial complex, where an important place at the present stage is occupied by aquaculture production for the cultivation and processing of fish from inland water bodies of the country [1, 2]. The role of fish in human nutrition is steadily growing and requires a revision of traditional priorities. There is a need to create and develop a domestic market for fish products of wide consumer demand, as well as functional and specialized purposes. In this regard, in

many industrialized countries of the world, including Russia, there have been trends towards the development of new species of aquatic organisms. According to scientists and specialists, the tasks of increasing the production of fish products by mastering the methods of growing and developing new sources of aquaculture, expanding the range of fish products based on minced meat, improving the quality and reducing the cost while meeting the needs of the population for products with high nutritional value and guaranteed safety - the most realistic and effective way to achieve the goal [3, 4, 5].

In recent years, fishery enterprises have appeared in Russia, feeding the as yet uncommon species of freshwater fish - paddlefish. These include some enterprises of the Voronezh Oblast.

It was of interest to assess the prospects for breeding and processing this type of fish, the origin of which is associated with its breeding in the USA and China. Paddlefish and its trimming products are well known in these countries and have been produced in significant volumes for a number of years [6, 7]. According to preliminary estimates of the existing breeding experience, paddlefish can become one of the most important objects of inland fisheries, primarily not because it has high gastronomic qualities and black caviar, but primarily because it is the only representative of sturgeon-like animals feeding on zooplankton - the basis of food base and productivity of inland water bodies of Russia. The types of paddlefish differ in external data and nutrition, when the Chinese, in contrast to the American, consumes larger objects: shrimp, fish, crabs.

Considering the current state of the country's pond farms, when intensification is achieved through multicultural fish farming, fertilizing ponds, feeding, increasing the stocking density per hectare of surface area, etc., there is a significant prospect of paddlefish as a component of polyculture. As the experience of growing paddlefish in inland waters together with silver carp, grass carp and carp shows, it is possible to achieve a number of advantages: biological reclamation associated with improving the operation of water treatment plants, and process control capabilities.

The purpose of the work was to study the properties of paddlefish as a potential source of fish products of wide consumer demand, taking into account the conditions of cultivation in polyculture on the basis of "Pavlovskrybkhoz" CJSC (Voronezh Oblast).

The paddlefish was transported in live fish bags equipped with water tanks at a temperature not higher than +6 - +12 °C.

When carrying out experimental studies, the fish were preliminarily washed and dried. To determine the mass yield of cut products, internal

organs (liver, milk, heart, spleen, swim bladder, pancreas and intestines) were isolated. Previously, the scales and skin were removed, the head and fins were removed. The resulting cut products were weighed, and the average values from a series of experiments were determined. The results showed that paddlefish is characterized by a higher head yield due to the rostrum, which differs from common fish species (silver carp, carp by 2.6%, skinless fillet yield is 46–48%, depending on fish weight). The mass of milk is on average 42–46%, the anatomical structure and high yield of the liver (more than 18%), which is 6 times more than that of silver carp and carp, draws special attention. In this regard, it is of interest to study the nutritional properties of the liver as a separate object in obtaining food products. For comparison, the liver yield of Pacific cod is 4.2–6.8%, which is about 4 times less than that of paddlefish with the same fish weight. In this case, the structure of the fish liver is different. The paddlefish liver, in addition to the blood vessels and bile ducts characteristic of the organ, has a significant number of foci of hematopoiesis in the form of an accumulation of bright cells with large nuclei - precursors of blood cells. The possible inclusion of the liver as a raw material source of fish products will have a positive effect on the economic efficiency of the production of aquaculture fish species and the diversity of the range of fish products.

The chemical composition of the most valuable products of paddlefish cutting, determined in accordance with the methods [8], showed that the protein content is within 25%, which is higher than that of warm-blooded animals and traditional pond fish, the ratio of fat to protein is 0.30:1.0, which indicates the dietary properties of paddlefish meat. Paddlefish liver differs from meat in this indicator, it contains more than 2 times more fat. Analysis of liver biopolymers shows a significant proportion of essential amino acids and a large amount of fatty acids in the liver. Studies have shown that there are more essential amino acids in the liver and paddlefish meat than in similar processed animal products.

The available composition of minerals and vitamins should be added to the assessment of the biological value. The digestibility of proteins under the action of digestive enzymes in *in vitro* experiments is more than 90%, which is extremely important when creating food systems for specialized purposes. It should be noted that the content of the most deficient amino acids, tryptophan and lysine, in the composition of proteins of meat and liver of paddlefish, in the presence of all other essential amino acids, should be noted.

Chemical characterization, however, does not give a complete picture of the possibility and prospects of using an aquatic biological resource in

the composition of food products, since knowledge about the behavior of a raw material object in the process of technochemical action is important. Primarily important are functional and technological properties (FTP), which make it possible to evaluate the raw material as an integral part of the recipe, as well as the behavior of the system under the influence of technological factors. The FTP of paddlefish meat and liver was determined as described in [8]. In pursuit of the intended goal - the production of fish products for mass consumer demand, they determined the properties of coarse and finely ground raw materials as the basis for minced food products, including molded and pasty ones.

In the course of experimental studies, the maximum values of the water-holding, water-binding, fat-holding and emulsifying abilities of meat and paddlefish liver were established, which significantly exceed these values for silver carp and carp. On the one hand, this predicts good quality (consistency) and the yield of emulsion-type products, and on the other hand, it suggests an improvement in these indicators when using paddlefish cuttings in combined food systems.

Experimental and laboratory tests of molded products (cutlets) based on meat and fish food systems showed that technological losses during the heat treatment of semi-finished products using paddlefish and pork meat were minimal, the product yield was maximum (86%), and the finished products had excellent organoleptic characteristics.

When preparing fish paste according to the developed recipe, which includes silver carp fillet, paddlefish fillet and liver, some cereals and spices, it is possible to obtain a product with high biological value, relatively low cost, and consumer appeal.

The approbation of paddlefish liver as the only source of raw materials in the technology of canned food "Paddlefish liver pate" has shown the competitiveness and high quality of finished food products with technological advantages of production.

## References

1. Eganyan A.G. Improving the quality of food as a basis for increasing competitiveness / A.G. Eganyan // Food industry. – 2006. – №6. – P. 52-53.
2. Konstantinova L. L. Raw materials of the fishing industry / L. L. Konstantinova, S. Yu. Dubrovin. – SPb.: Giord. – 2005. – 240 P.

3. Antipova L. V. Pond fish: biotechnological potential and the foundations of rational use of resources; monograph / L. V. Antipova, O. P. Dvoryaninova, L. P. Chudinova. – Voronezh: VSUIT. – 2012. – 404 P.
4. Antipova L.V. Food biotechnology in ensuring proper nutrition of the population based on biological resources and the study of quality indicators of regional freshwater aquaculture / L. V. Antipova, O. P. Dvoryaninova, E. V. Kalach // Bulletin of the Voronezh State Technological Academy. – 2010. – №3. – P. 71-74.
5. Varekha E. Yu. Innovations - a formula for success, or on the way to a bright fish future / Varekha E. Yu., Chernyak Yu. D. // Rybprom: technologies and equipment for processing aquatic biological resources. – 2008. – №1. – P. 6-14.
6. Bredenko M. V. Development of paddlefish in Russia and the CIS / M. V. Bredenko, V. G. Chertikhin, E. A. Melchenkov // Fisheries. Ser.: Freshwater aquaculture. Analytical and abstract information. – Iss. 3. – M.: VNIERKH, 2000. – P. 30-37.
7. Vinogradov V.K. Biological bases of cultivation and cultivation of Paddlefish. Series: breeds and domesticated forms of fish / V.K. Vinogradov, L.V. Erokhina. – M.: Rosinformagroteh, 2003. – 344 P.
8. Antipova L. V. Modern methods of research of raw materials and products of animal origin / L. V. Antipova, S. A. Storblevtsev // Textbook: Voronezh, VSUIT. – 2016. – 544 P.

## COMPREHENSIVE PROCESSING OF RABBIT PRODUCTS: NEW TRENDS AND PROSPECTS

**Antipova Lyudmila Vasilievna**

Chief Research Officer at REC "Living Systems", Full Professor

**Setkova Alena Yurievna**

Externe

**Boldyreva Marina Sergeevna**

Externe

Voronezh State University of Engineering Technology

**Abstract.** Rabbit farming is an important subsector of modern livestock farming in the world. Currently, there are leaders in the production of rabbit meat in different countries, primarily China, Venezuela, Italy. Recently, they have been joined by the countries of Latin America and Africa. Russia is gaining a pace of development, leading to the emergence of large farm households, which requires the creation of processing enterprises, justification and launch of production of rabbit meat products of wide consumer demand, including functional and specialized ones.

When creating a processing sector, it is important to develop principles and methods for the use of all main and by-products arising in the technological chain. Meat on the bone, rabbit pulp have unique properties for human nutrition. The assortment line of sausages, semi-finished products and second ready meals of high biological value has been substantiated and proposed. The possibility of obtaining and using mechanically deboned meat, as well as rendered fats and adipose tissues, as a substitute for milk fat and bacon in the formulations of structured rabbit sausages, has been proven. The possibility of using an intestinal kit after special processing in the technology of natural sausage casings for forming sausages is shown. Dehaired skins under the influence of specific enzyme preparations are offered for obtaining semi-finished leather products.

**Keywords:** butchering of rabbits, rabbit meat, offal, mechanically deboned meat, adipose tissue, intestinal kits, skins, sausage casings, food, leather semi-finished products.



The world produces from 1.0 to 1.7 million tons of rabbit meat in different countries. Production volumes are characterized by pronounced zoning and are largely determined depending on the level of economic development of the country, culture and nationality of the cuisine, and religious beliefs. Despite the known beneficial properties of rabbit meat, the world trade in rabbit meat is poorly developed and is at the level of 12%. Countries - leaders in the production of rabbit meat: China, Venezuela, Italy, Hungary, etc. Recently, rabbit breeding has begun to actively develop in Latin America and Africa, as well as Spain and other countries. Of the rabbit products, the production of fluff and fur is popular in such countries as China, Chile, Argentina. The main consumers of such products are countries with high living standards: Japan, USA, Germany. The growing interest in rabbit products proves the possibility of organizing large-scale production, which obviously draws the prospects for the maximum use of the main (meat, offal) and by-products of processing (entrails, heads, paws, fat, tails, skins with defective fur, down, etc.).

Unfortunately, Russia still occupies one of the last places in the total production of rabbit meat in the world; the domestic market for food, feed, technical, cosmetic and pharmaceutical products is poorly developed. This, on the one hand, is due to the lack of volumes and the presence of small and medium-sized farming enterprises. On the other hand, the lack of scientific research results of substantiation and development of innovative technical solutions for the implementation of directions for the rational use of rabbit products on the scale of a modern range of products for various purposes, including functional and specialized.

The purpose of the work was to assess the mass metric indicators in the process of processing rabbits, to substantiate and develop technical solutions that increase the yield of useful products from a unit of processed raw materials.

At the same time, experience confirms that the indicators of the yield of meat and by-products largely depend on the breed, and, consequently, on genetically dependent indicators that determine the growth and mass characteristics, as well as disease resistance and fertility.

In this regard, the use of gene diagnostics methods for their selection and maintenance of rabbits, for predicting the yield of edible parts, where muscle tissue is of the greatest value, becomes relevant. Rabbit meat refers to white meat with a protein content of 17.0-20.5%, fat 6-9%. The organoleptic characteristics are significantly influenced by the composition of feed and the method of feeding. The high nutritional and biological value of rabbit meat has been proven by many researchers. At present, smoked

delicacies, products (pates) for sports nutrition, II ready meals for school meals have been developed on its basis. The possibility of rabbit meat while expanding the range of functional products is constantly expanding [1, 2, 3, 4, 5].

A team of authors from the Voronezh State University of Engineering Technologies has done a lot of work to assess the chemical composition, properties and develop the most rational ways to use by-products, including deep processing [5, 6, 7, 8] using modern known research methods.

In the course of the research experiments, it was found that the average yield of muscle tissue is 49-56%, adipose tissue 4-18%, bone 20-35%, connective tissue 8-12%. The highest yield of the most valuable tissue (muscle) depends on age and body condition. In terms of the quantity and quality of amino acids, rabbit meat is close to the ideal protein of FAO WHO and traces an analogy with poultry meat. Fattened rabbits contain white fat of dense consistency in the amount of 400-500, which solidifies at 39 °C, melts at 41-42 °C. According to the assessment of fatty acid composition, rabbit fat is more valuable than the fat of other animals, it contains a relatively large amount of polyunsaturated fatty acids (12.5%), the products produced are complex dispersion systems, the properties of which depend on the volume ratio of the dispersed phase and the dispersion medium, the nature and the strength of the bond between the dispersion medium and the dispersive particles. This ratio can be changed in various ways, where the use of food additives has gained significant popularity and distribution.

Rabbit offal is also rich in complete protein: in the liver 22.14%, in the lungs 15.77%, in the kidneys 14.03%, respectively, fat (%): 2.21; 2.58; 2.70.

It has been shown that the yield of slaughter and dressing products depends on the breed of rabbits. Comparative analysis showed that the yield of meat in a pair form is 51.8% for the white giant, 52.2% for the silvery giant, and 52.4% for the chinchilla. The output of skins, respectively, was (%) - 13.4; 13.3 and 13.3; kidney (%) 0.5; 0.6 and 0.6; ears, paws, tail (%) 4.4; 4.4 and 4.2; blood (%) 2.0; 2.1 and 2.1; liver (%) 3.4; 3.2 & 3.3; heads (%) 6.8; 6.0 & 6.5; intestines (%) 6.2; 6.3 and 6.3. Illiquid waste is (%) 10.3; 10.8 and 9.8, respectively.

Evaluating the directions of use of rabbit products, it should be noted that in practice, the cutting schemes for rabbit carcasses are based on cutting for trade and industrial processing, when certain anatomical areas and internal organs are highlighted. However, it should be borne in mind that such by-products as heads, ears, paws have not been sufficiently researched, and there are no possible innovations in application. As part of

this goal, the authors of the article propose the technology of chips from ears and jellies from meat of the head and paws. The products have satisfactory organoleptic characteristics. Meat on the bone goes well with vegetables and is useful in human nutrition in the form of stuffed, baked and fried foods, including for dietary and functional nutrition after optimization of recipe-component solutions. Rabbit meat is perfect as a source of complete protein and meat component in the composition of 11 dishes: stew, pilaf, natural cutlets from fillets, chopped cutlets, or meatballs for favorite national dishes. Developed and proposed pies from offal with the addition of pre-melted rabbit fat.

Looking at the prospects for the industrial processing of rabbits, one should take into account the labor-intensive deboning of carcasses. Due to the presence of such a drawback, the possibility of obtaining was investigated, the properties and ways of using the meat of mechanically deboned rabbits were studied. Mechanical deboning of rabbit carcasses was carried out on a "Unicon-400" deboning press. As a result, three fractions of mechanically deboned rabbit meat were obtained with a yield of 75, 78 and 82%, respectively. Such meat, in contrast to meat of manual deboning, is enriched with calcium, bone remains of 0.35-0.40 mm were found in it. This does not preclude the use of minced meat products in technology. Mechanical deboning meat of any of the 3 fractions contains a full set of essential amino acids, it has the best organoleptic properties.

Color characteristics determined by sensory methods, as well as structural and mechanical properties of raw materials objectively confirm the positive assessment of the tasters. Mechanically deboned meat has been successfully used in the technology of emulsified and minced meat products. The calculated biological value and digestibility under the action of digestive enzymes pepsin + trypsin in *in vitro* experiments confirm the promise of mechanically deboned rabbit meat in large-scale meat processing production.

The high yield and valuable properties of rabbit fat represent the prospect of obtaining fatty products and their possible targeted use. The adipose tissues of the subcutaneous and intestinal ridges were separated and collected during cutting. The tissue yield was (% by weight of carcasses): internal fat - 7.4; subcutaneous fat - 1.9; subcutaneous adipose tissue of the abdominal ridges - 3.2; the total amount of adipose tissue is 12.5. According to its physical and chemical properties, rabbit fat has the following indicators: color - dull white, consistency (at 15-20 °C) - solid; acid number - 0.5-0.7; taste - without extraneous taste and smell; iodine number - 61.4-62.0. In terms of the content of fat-soluble vitamins, rabbit fat is equal to

or superior to the meat of other animals. The histological picture of rabbit adipose tissue is represented by a cellular structure, which is expressed during storage and its destruction was observed by 6 days. Evaluation of the decay products of adipose tissue indicates the developing processes of autolysis, microbial enzymolysis and fat oxidation. Taking into account the melting temperature of the adipose tissue of rabbits, technological modes of heating have been worked out and recommended. The melting temperature depends on the degree of crushing of the adipose tissue. The adipose tissue, crushed to 3 mm, was easily amenable to fat melting at 70 °C, and homogenized at 60 °C. Processed rabbit fat is characterized by good organoleptic characteristics and is close to pork fat in the composition of fatty acids. Comparative calculations of the metabolic efficiency coefficient (MEC) showed a value of 0.037. Melted rabbit fat has been tested in the technology of condensed milk with partial replacement (25%) of milk fat, and also in the form of adipose tissue (subcutaneous rolls) has been tested in the technology of structural sausages from rabbit meat.

The technological, morphological and physicochemical properties of intestinal raw materials were evaluated. It was found that the intestinal mucosa has a characteristic size. The sections of the intestine have morphological differences associated with vital functions. The parameters of various parts of the intestine have been determined. Research of strength characteristics and stuffing capacity has been carried out. The technology of processing intestinal set for use as a molding material in the technology of sausages is proposed.

The desire of producers to maximize the receipt of the most valuable part of the carcasses - meat on the bone leads to a decrease in the quality of the fur. The technology of enzymatic processing of rabbit skins has been developed. For their dehairing, a specific enzyme preparation of domestic production was selected, which effectively reduces the retention force of fluff and hair in the dermis, as a result of which the hair and fluff are easily removed even with manual scraping. The hairless skins were washed and dried. They have a wonderful pattern, thin, transparent, easily dyed in any color.

The proposed technologies are easily reproducible, tested in experimental laboratory and pilot production conditions, and are recommended by the team of authors for implementation in sectors of the economy.

## References

1. Kotelevich V.A. Rabbit meat – an important reserve in organic products // Scholarly Scrapbook, V. 52, Iss. 3, 2016. – P. 137-140.
2. Volkova O.V., Inerbaeva A.T., Motovidov K.Ya. Morphological composition and biological value of rabbit meat // Processing of agricultural products, 2009, №8. – P. 97-100.
3. Kozyulin R.G. Development of molded restructured products from rabbit meat // Abstract diss., cand. tech. sci. – Moscow, 2006. – 24 P.
4. Volkova O.V. Development and commercialization of rabbit meat products // Abstract diss., cand. tech. sci. – Kemerovo, 2009. – 19 P.
5. Kalugin Y., Balakirev N., Fedorova O. Rabbit meat as a dietary product // Rabbit breeding, 2010, №6. - P. 56-57.
6. Sokolov A.V., Antipova L.V. Chemical properties of rendered rabbit fat // Meat industry, 2007, № 1. – P 60-64.
7. Sokolov A.V. Food and biological value of rabbit slaughter by-products / A.V. Sokolov // Materials of the XI reporting scientific conference of teachers and researchers of VSUIT for 2012. – Voronezh, VSUIT, 2013. – P. 71.
8. Antipova L.V. Integrated processing of rabbits: traditions and innovations [Text] / L.V. Antipova, M.S. Boldyreva, L.A. Popov. – SPb, 2021. – 250 P.

**SUPERCAPACITOR ENERGY-ACCUMULATION SYSTEM IN  
CONJUNCTION WITH A TRACTION CONVERTER FOR THE  
ACCUMULATION OF BRAKING ENERGY AND ITS RETURN DURING  
THE ACCELERATION OF RAIL TRANSPORT**

**Lifshitz Mikhail Valerievich**

General Designer, Chairman of the Board of Directors of ROTEC JSC.  
Distinguished Mechanical Engineer of the Russian Federation

**Objective.** To assess the technical feasibility and cost-effectiveness of the traction drive of a tram bogie with and without an installed supercapacitor energy-accumulation system (hereinafter referred to as an “EEA”) on a section of the tram No. 27 route in St. Petersburg; to determine the amount of accumulated energy in the EEA in tram-braking mode and the possibility of electric-energy savings in case of EEA use; and to assess the possibility of the autonomous movement of trams with EEA.

**Methods.** On the tram wagon model LM-68M2, city No. 7546, an electric energy-accumulator (EEA) was installed on the traction drive of the first bogie (BSPT-1). Tram route: Babushkina St. – Pribrezhnaya St. and in the opposite direction. Number of stops on the one-way route – 10. This tram has two traction drives installed for each bogie with identical settings responsible for the wagon’s traction characteristics, making it possible to compare the energy indicators of the traction drive of the bogie with and without the EEA. To ensure full utilization of the EEA’s power, the  $V_{T_{OTD}}$  of the first traction converter (BSPT) was turned off by the software method and the threshold for turning on the braking transistor was increased to 780 V. The movement occurred in the operating mode of a regular tram with stops at the stopping panels.

**Results:** a comparison of energy indicators leads to the conclusion that the use of EEA as part of rail transport yields a 40 % reduction in the average value of the current consumed from the catenary system and eliminates reverse-current injection into the catenary system during braking. The use of EEA as part of rail transport makes it possible to utilize the energy generated by the traction drive during braking. Energy in the amount of 0.288 kW\*h is accumulated per braking. It should be noted that in the absence of EEA, the entire generated volume of energy is released

into heat through dissipation onto the resistor modules and contact wire. The use of EEA in rail transport makes it possible to reap energy savings of 40 %. The use of EEA as part of rail transport supports “autonomous” running in case of a power failure in the catenary system, thereby allowing rail transport to exit a crossing or reach the catenary system’s next section.

**Practical importance:** to increase the efficiency of regenerative braking, it is proposed to use an electric energy-accumulator (EEA) on rolling stock, which would make it possible to accumulate braking energy and then use it in starting mode without transferring the regenerative energy to the traction network. The introduction of EEA as energy receivers on urban electric ground transport would make it possible to store braking energy in the battery pack and achieve autonomous running.

**Keywords:** braking energy regeneration of rolling stock, regenerative-resistor braking, energy accumulators, urban electric transport.

The constant growth of power rates is making energy savings a critical issue – particularly for urban electric-transport enterprises, which are the most energy-intensive consumers [1]. Effective means of saving energy include the use of regenerative braking on electric rolling stock (ERS). Theoretical and experimental works have made it possible to create domestic ERS with regenerative and regenerative-rheostatic braking [2, 3].

During regenerative braking, the train works in parallel with the traction units of substations. This feature determines the operating conditions of the entire power-supply system [4]. For rail transport, identifying the conditions that ensure the best use of the energy of electric braking, as well as the impact of regeneration on the power-supply modes of trains, is an urgent task [5].

The unique property of the electric motor – the reversibility of energy conversion – goes virtually unused today; the energy is dissipated through the heating of rheostats and turns into “energy waste,” heating the atmosphere. Only in the 21st century has a tool emerged allowing for its effective collection. Supercapacitor batteries, with a lifespan of hundreds of thousands of charge cycles, are not a consumable material, but part of the whole system.

The main producers of “energy waste” are electric (hybrid) transport of all types and lifting mechanisms. This energy can and should be collected and used locally or transferred to the grid. New energy is produced when the generated energy has already been collected [6].

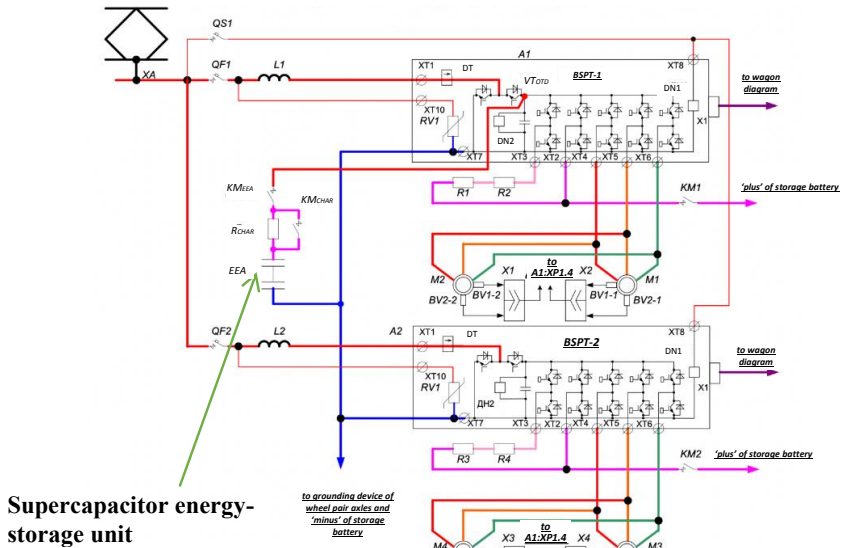
Using the example of a section of the tram No. 27 route in St. Petersburg with an installed supercapacitor energy-storage system, it was proven

that one traction wagon generates 142 kW\*h of clean energy per day. This is comparable to the operation of a 1,000 sq. meter solar park. The electricity generated by electric rail transport amounted to up to 40 % of the energy it consumes during acceleration.

The options for receiving regenerative energy can be presented in the following order:

- supercapacitor energy-storage unit: 7 serial modules MLSK 56-150, connection 7s1p;
- traction converter BSPT-1;
- tram wagon LM-68M2, city No. 7546.

On the tram wagon model LM-68M2, city No. 7546, an electric energy-accumulator (EEA) was installed on the traction drive of the first bogie (BSPT-1). A diagram of the EEA's electrical connection is presented in Fig. 1



Tram route: Babushkina St. – Pribrezhnaya St. and in the opposite direction. Number of stops on the one-way route – 10.

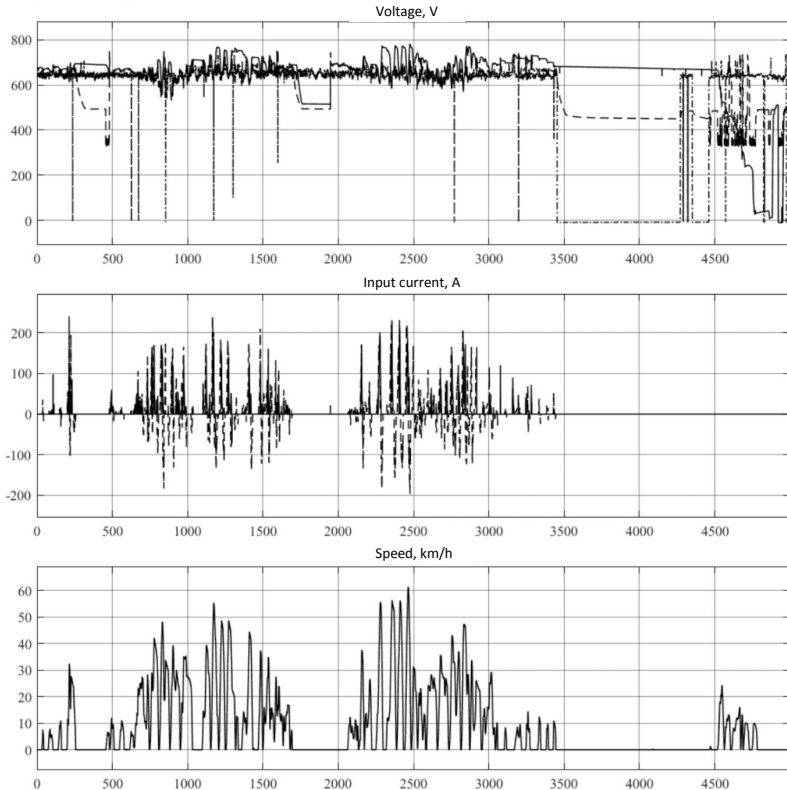
This tram has two traction drives installed for each bogie with identical settings responsible for the wagon's traction characteristics, making it possible to compare the energy indicators of the traction drive of the bogie with and without the EEA. To ensure full utilization of the EEA's power,



the  $V_{T_{OTD}}$  of the first traction converter (BSPT) was turned off by the software method and the threshold for turning on the braking transistor was increased to 780 V.

The movement occurred in the operating mode of a regular tram with stops at the stopping panels.

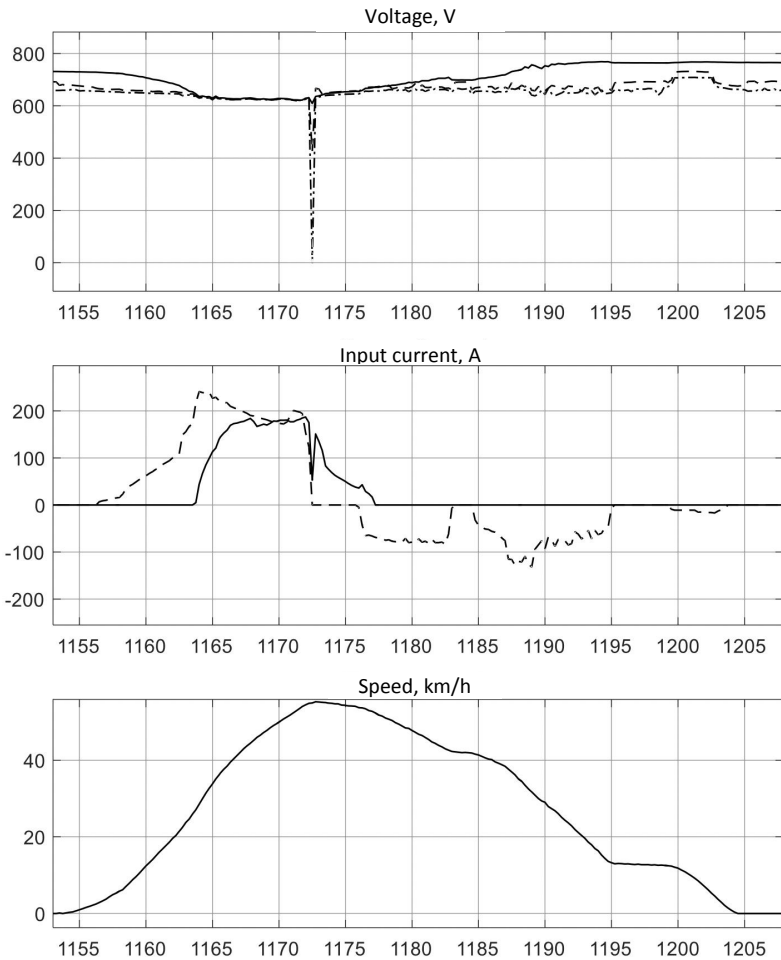
**Fig. 2** presents graphs of the change in voltage, current and speed over time during movement.



**Figure 2. Graphs of the change in voltage, current and speed over time during movement, where:**

- – voltage at the filter and current of the catenary system of the first bogie’s traction drive;
- – voltage at the filter and current of the catenary system of the second bogie’s traction drive;
- .-.-.-.- – voltage in the catenary system.

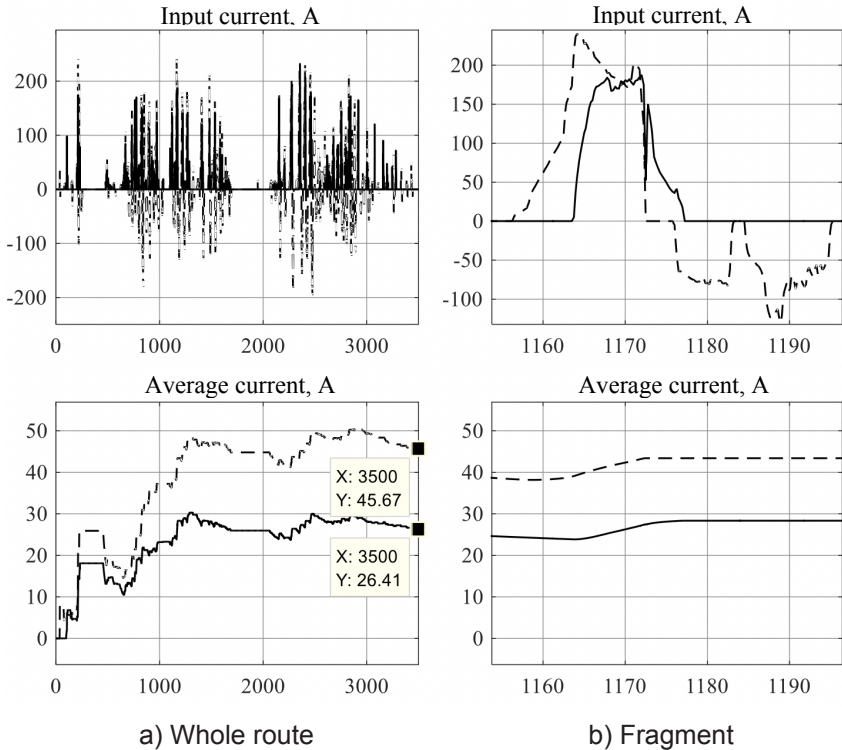
Fig. 3 shows graphic fragments of the change in voltage, current and speed over time during movement.



**Fig. 3 Graphic fragments of the change in voltage, current and speed over time during movement, where:**

- – voltage at the filter and current of the catenary system of the first bogie's traction drive;
- – voltage at the filter and current of the catenary system of the second bogie's traction drive;
- .-.-.-. – voltage in the catenary system.

Measurements and calculations were taken of the average value of consumed current for traction during movement of the first and second bogies, respectively. **Fig. 4** shows the yielded values.



**Figure 4 Graph of input currents and their average values during movement, where:**

————— – current consumed by the traction drive of the first bogie with the EEA;

----- – current consumed by the traction drive of the second bogie.

As is evident from the graphs, the average value of the current consumed by the traction of the first traction converter is 26 A, and that of the second – 45 A.

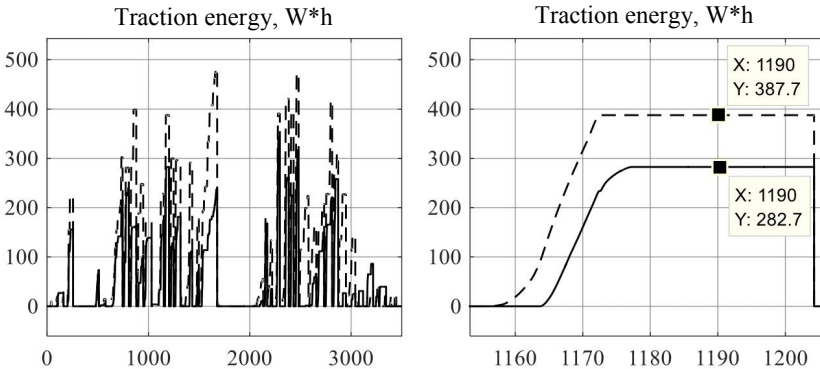
A comparison of energy indicators leads to the conclusion that the use of EEA as part of rail transport yields a 40 % reduction in the average value of the current consumed from the catenary system and eliminates reverse-current injection into the catenary system during braking.

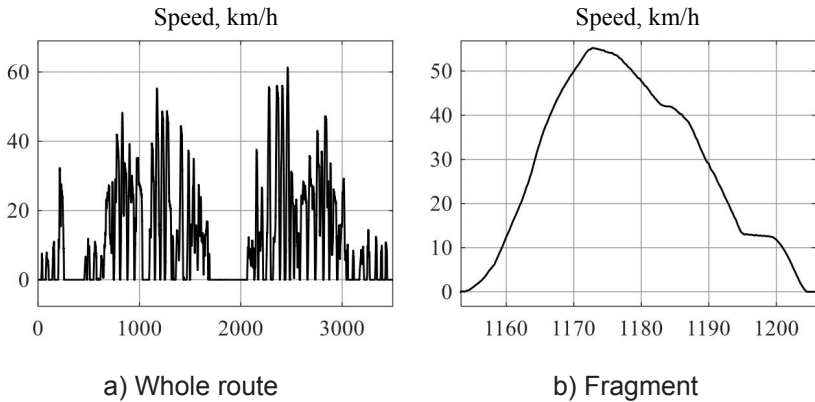
The total travel time of the route from the Babushkina St. stop to the Pribrezhnaya St. stop is 30 minutes. The number of stops on the one-way route is 10. During passage of this route, EEA operational data was recorded for both the intake of electricity and for its return.

Based on the results of analysis of the log files, it was found that during all the decelerations of the EEA, 10.363 MJ or 2.88 kW\*h were accumulated. At the same time, in the process of all accelerations, 10.606 MJ or 2.95 kW\*h were spent from the EEA.

The use of EEA as part of rail transport makes it possible to utilize the energy generated by the traction drive during braking. Energy in the amount of 0.288 kW\*h is accumulated per braking. It should be noted that in the absence of EEA, the entire generated volume of energy is released into heat through dissipation onto the resistor modules and contact wire.

Based on the data received, graphs were formed depicting the change in energy spent on traction from the catenary system (**Fig. 5**).





**Fig. 5** Graphs of the change in energy spent on traction from the catenary system, where:

\_\_\_\_\_ – current consumed by the traction drive of the first bogie with the EEA;

- - - - - current consumed by the traction drive of the second bogie.

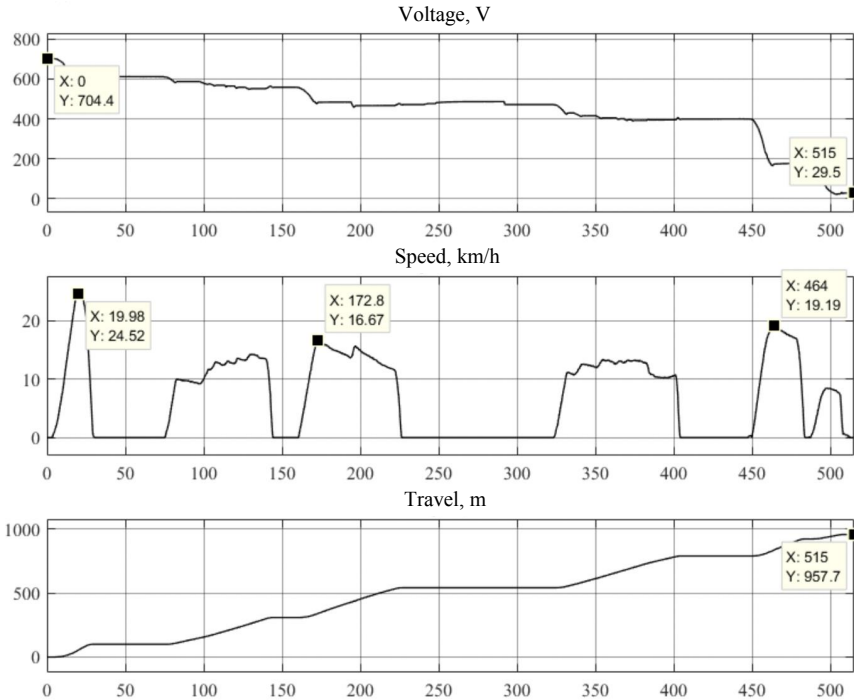
On the given fragment of the section, the value of the energy spent by the traction drive with the EEA is 282.7 W\*h, and by the traction drive without the EEA – 387.7 W\*h. The reduction in consumption from the catenary system, as well as energy savings, is 37 %.

**The use of EEA as part of rail transport makes it possible to generate up to 40 % of the energy spent on its movement.**

As part of the tests, an assessment was made of the possibility of a tram running autonomously on the energy of a supercapacitor accumulator.

The tests were conducted with a charged EEA and a lowered pantograph (no power supply from the catenary system), with only one bogie operating.

**Fig. 6.** illustrates graphs of the change in voltage, speed and distance traveled over time in “autonomous” mode



According to the results, the tram, without limiting its dynamic properties, **traveled a distance of 957 meters in “autonomous” mode**. At the same time, the decrease in the EEA’s voltage was 674 V – from 704 V to 30 V.

The use of EEA as part of rail transport supports “autonomous” running in case of a power failure in the catenary system, thereby allowing rail transport to exit a crossing or reach the catenary system’s next section.

### Conclusion

The unique property of electric machines – the conversion reversibility of electrical energy (from electrical to mechanical and vice versa) – is not being fully utilized. **Only the first conversion is being used**, while the energy generated during the second conversion is not being collected but discharged into the atmosphere through the heating of resistors and other system elements. It is precisely the use of the two transitions that will make

electric transport a truly efficient means of moving people and goods – and the cleanest.

The tests showed that supercapacitor batteries are the most efficient tool for the full utilization of the second transformation for the purposes of the generation of electrical energy and its subsequent use either at the generation location or with its subsequent transmission to the grid, making it possible to boost recovery rate from the existing 5-10 % to 40 %.

### References

1. K.G. Marquardt. Power Supply of Electrified Railways: Textbook for Higher Educational Institutions of Railway Transport / K.G. Marquardt. – M.: Transport, 1982. – 528 p.
2. A.S. Maznev. Electrical Devices and Circuits of Rolling Stock: Textbook for Students of Secondary Vocational Education Institutions / A.S. Maznev, O.I. Shatnev. – M.: Akademiya, 2008. – 272 p.
3. V.G. Shcherbakov. Traction Electric Machines: Textbook / V.G. Shcherbakov, A.D. Petrushin, B.I. Khomchenko, V.I. Sedov, S.A. Pakhomin, A.S. Maznev, P.G. Kolpahchyan; edited by V.G. Shcherbakov, A.D. Petrushin. – M.: FSBEI “Training and Methodological Center of Education on Railway Transport”, 2016. – 641 p.
4. E.V. Ter-Oganov. Power Supply of Railways: Textbook for Students of the Ural State University of Railway Transport / E. V. Ter-Oganov, A.A. Pyshkin. – Yekaterinburg Publishing House of USURT, 2014. – 432 p.
5. A.A. Bogdanov. Structure and Repair of Electric Trains of the Subway: Textbook for Vocational Schools / A. A. Bogdanov, V.S. Gusev, Yu.Ya. Mogilner, E.A. Sementovskiy; edited by E.A. Sementovskiy.– M.: Transport, 1991. – 335 p.
6. STF “Energoprogress” JSC, “Electric Energy Chronicles” (<http://vesti.energy-journals.ru/yenergeticheskie-otkhody-novyy-isto/>) – “Energy Waste” – New Source of Green Energy.
7. S.Ageev “TEEMP Manufacturing” Ltd., V.Sharyakov.”NPP EPRO” JSC. “Joint testing report of supercapacitory energy storage system in conjunction with traction converter for collecting braking energy and returning it during rail vehicle acceleration”, 2019.

DOI 10.34660/INF.2022.17.27.025

UDC 641:613.2 (075)

**DEVELOPMENT OF FOOD PRODUCTS ENRICHED WITH A  
COMPLEX OF DIETARY SUPPLEMENTS FOR CHILDREN**

**Vasyukova Anna Timofeevna**

Doctor of Technical Sciences, Full Professor  
Moscow State University of Food Production

**Krivoshonok Konstantin Viktorovich**

postgraduate  
Moscow State University of Food Production

**Akchurina Angelina Ildusovna**

technologist  
Limited liability company «A.bakery»

**Bogonosova Irina Aleksandrovna**

postgraduate  
Moscow State University of Technology and Management named after K.G.  
Razumovsky (First Cossack University)

**Bondarenko Yuri Viktorovich**

postgraduate  
Moscow State University of Technology and Management named after K.G.  
Razumovsky (First Cossack University)

**Alekseeva Anna Alekseevna**

student  
Moscow State University of Technology and Management named after K.G.  
Razumovsky (First Cossack University)

Every year the ecological and socio-economic situation worsens and, as a result, the quality of nutrition decreases. In this regard, the development and introduction into the production of functional food products that contain ingredients that can increase the body's resistance to diseases, properly regulate physiological processes in the growing body of a child are becoming relevant.

According to students and clinicians [1], the average main causes of morbidity, as well as mortality, the leading place is interested in malnutrition.

According to the FITZ Nutrition and Biotechnology, 20% of children today have serious health problems [2]. And many disorders are associated



with an unbalanced diet: obesity, high blood pressure and prediabetes in children, anemia, diseases of the gastrointestinal tract and thyroid gland... The diets are defective: schoolchildren eat less milk and fermented milk products by 20 percent than they should, cottage cheese by 40, fish by 50, fresh vegetables and fruits by 34. But the norm of pasta is exceeded by an average of 35 percent, sugar by 15, confectionery by 23. Carbohydrates are an excess, but the guys are not getting enough protein. Mineral substances and trace elements - too [2].

The range of dishes is narrow, there are not enough fruits, meat, fish, confectionery, there are no fortified breads and beverages. There are not enough food products containing probiotics and prebiotics, which are necessary for the normalization of the intestinal microflora.

The reasons for insufficient satisfaction of students with school meals are:

- lack of an effective system for monitoring the safety of technological processes, in particular based on the principles of HACCP;
- outdated equipment of school food halls;
- non-compliance of the premises for eating with modern requirements; unsuitability of the premises of school canteens for eating;
- poor quality of food products supplied to school canteens;
- lack of advanced organizational forms of organization and maintenance of school meals, including long-term contracts that allow motivating catering operators for long-term investments in the organization of school meals;
- low level of qualification of employees of various levels working in the field of catering, both on the part of catering operators and on the part of the school administration.

Among the reasons for the insufficient level of nutrition is also the low level of material prosperity of many families (in educational institutions, more than 12.1% of the total number of students are schoolchildren from low-income families), which does not allow parents to provide children with adequate nutrition at home and pay for their meals in educational institutions of various types.

Epidemiological monitoring studies conducted by the FIT of Nutrition and Biotechnology in various regions of Russia indicate that the structure of diets has significant deviations from the formula of a balanced diet, and primarily in the use of trace elements, polyunsaturated fatty acids (PUFA), vitamins, many organic micronutrients that are important in the regulation of metabolism and the functions of individual organs and systems. The use of dietary supplements is the fastest, economically acceptable and scien-

tifically sound way to solve the problem. One of the most important social, biomedical and economic tasks is to preserve the health and increase the life expectancy of the population. Often, the main causes of an unfavorable state of human health are unfavorable ecology, neglect of one's health, lifestyle, improper and inadequate nutrition [5].

Currently, from early childhood, as a result of improper nutrition, chronic lesions of the gastrointestinal tract are formed, such as, for example, chronic gastritis, chronic cholecystitis, biliary dyskinesia and others [1].

The deficiency or excess of macro- and micronutrients does not remain indifferent to the body. This causes the immediate occurrence of the disease (anemia, endemic goiter, obesity, etc.), or reduces the body's resistance to adverse environmental factors (acute respiratory diseases, infectious diseases), or creates conditions conducive to the development of a particular pathology (cancer, diseases of the cardiovascular system, gastrointestinal tract) [4].

According to the UN Economic and Social Council, as of September 2017, the population aged 0-14 years is 1860 million. Of these: 300 million children suffer from protein and energy deficiency, 5.6 million children - vitamin A deficiency (blindness), about 40 million children are obese [4].

Over the past 3-4 decades, the number of overweight children has been increasing. During this time, there have been many reports about the widespread prevalence of obesity among the population of highly developed countries. Obesity is a factor leading to the development of a number of diseases. Overweight increases mortality from cardiovascular diseases by 20-25% by 20%, and from diabetes by 1.5-2 times. Obesity (excess body weight by 60%) increases the risk of death from diabetes by 3-5 times, from heart attacks and strokes - by 40-60% and from various types of cancer - by 20% [4].

Currently, natural food, unfortunately, has ceased to be considered as a source of therapeutic and prophylactic substances. The human diet has changed dramatically in a short period of time. Most vegetables and fruits, whole grains, medicinal and spicy plants, and many products that have been used for medicinal purposes for thousands of years have disappeared from it. As a result, a paradoxical situation has developed: it is no longer possible to change the diet that has developed over the past decades and return to ancient food traditions due to the habits that have developed, the employment of a modern person, and the limited range of available products [6].

One of the ways to eliminate deficient conditions and increase the body's resistance to adverse environmental factors is the systematic use

of food enriched with a complex of biologically active additives with a wide range of therapeutic effects.

In Russia, distributors of dietary supplements refer to the opinion of pharmacologists, nutritionists that violations of vitamin status, micronutrient deficiency, are detected in almost all age groups of students living in different regions of Russia: the content of ascorbic acid in the blood was reduced in 70-90% of the examined children and adolescents, retinol - in 34-64%, thiamine - in 40-50%, riboflavin - in 21%, pyridoxine - in 35% [6].

In connection with the results of the study, it follows that the rational nutrition of children and adolescents is important to organize not only in the family, but also in the mode of the educational process. Daily regular and full-fledged, balanced nutrition is also necessary for the highest educational activity, without which the effectiveness of the pedagogical process is significantly reduced.

In Russia, the level of awareness of children and adults on nutrition problems is quite high (67-72%). However, the use of knowledge in practice can be stated in the families of only 9-15% of students, which is largely due to the socio-economic conditions and lifestyle of the families of students [6]. This problem is observed not only in Russia, but also in other countries of the world.

Thus, the goal of the private international school "Tenby international school setia ecohill", located in the Semenikh district of Kuala Lumpur, is to form a food culture among its students. In order to achieve this goal, weekly seminars are held for elementary school children, where the composition of everyday food is studied, as well as its effect on the human body in a language accessible to the child. In high school, trainings on proper and nutritious nutrition are conducted. In canteens, vending machines and retail outlets located on the school grounds, food and beverages containing synthetic food additives and adversely affecting the human body are not sold. In addition, the school annually reviews the components of the diet of its students and, based on the findings, carries out its improvement, including functional products [8].

The main principle of creating a functional food product is to achieve the highest possible level of usefulness and guaranteed safety of the product [4].

In order to understand what needs to be changed in the nutrition of a school student, it was decided to conduct daily surveys. So for one month, each student of the fifth, sixth and seventh grades filled out a questionnaire before the start of classes, which indicated when and what he had consumed during the previous day. At the end of the week, an analysis of

the nutritional value of adolescents was carried out.

The results of the analysis allowed us to conclude that the main menu of Kuala Lumpur teenagers includes rice, wheat or rice noodles and seafood, fruits, bakery products, national and European desserts. Among all teenagers participating in the survey, only 2% systematically consume soups and greens of various kinds. More than 73% of adolescents consume an average of 54.4 g of protein, 70.2 g of fat and 442.1 g of carbohydrates per day, no more than 7.2 g of fiber. According to WHO, the amount of proteins, fats and carbohydrates of a teenager aged 11-13 years should be 96 g, 96 g and 382 g, respectively. Nutrition analysis has shown that since the age of 11, the body does not receive the required amount of proteins and fats, but at the same time we have an overabundance of carbohydrates [4].

We have also conducted research on catering for schoolchildren in Moscow. An audit was conducted in 60 educational institutions of the city of Moscow, as well as an assessment of the main indicators of the effectiveness of catering for students in accordance with the SanPiN 2.3/2.4.3590-20. As a result of this work, it was noted that the main methods of improving the efficiency of the functioning of the school nutrition system are:

- improving the health status of schoolchildren; developing diets and dietary regimes that help reduce the progression of cases of diabetes, obesity, dystrophy and other nutrition-related diseases;
- ensuring a high level of coverage of hot meals for students of general education organizations of all ages, including children with disabilities;
- quality control of school meals, including public control; involvement of the parent committee to develop directions that contribute to the formation of consumer preferences of the student, his individual characteristics and predisposition [3].

In this regard, it was decided to increase the vitamin and mineral value of food, enrich vegetable and flour products with vitamins, minerals and essential amino acids in school nutrition.

Vegetable dishes are very poor in high-grade proteins, so increasing the concentration of essential amino acids in vegetable casseroles will solve the task.

In addition, confectionery products have high taste qualities, pleasant aroma, attractive appearance. They are independent food products, although they are, in fact, a dessert and are often consumed with drinks (tea, coffee, etc.). Despite the fact that confectionery products do not belong to everyday products, modern man, as statistics show, uses them almost daily. On average, their daily intake is about 50 g, which corresponds to half a chocolate bar, or five caramels. Due to the consumption of confec-

tionery products, up to 10% of the daily energy requirement is covered and up to 30% of the need for mono- and disaccharides is provided. From this point of view, the value of confectionery products in the diet is small, and they may well be replaced by other sugar-containing foods [4].

However, we should not forget about another important role of confectionery – social. Confectionery as a consumer product is able to raise the mood, allow you to enjoy the taste, give pleasure as a gift, their presence on the table creates a sense of celebration.

The peculiarity of the chemical composition of confectionery products is the low content of vitamins, minerals, i.e. physiologically active substances [3].

In order to offer schoolchildren not just confectionery products sold as ordinary cupcakes, but functional cupcakes, a private school in the Semikh district turned to the Albina Bakeri enterprise with a proposal to develop a functional cupcake.

The Albina Bakeri company is a young confectionery company in Malaysia, in the city of Kuala Lumpur, in the Selangor district. The serviced contingent of the company: entrepreneurs, schools, kindergartens and residents of Kuala Lumpur. In 2017, Albina Bakeri became a nominee for the Small Business of the Year 2017 award.

A cupcake is a flour confectionery product of volumetric shape based on flour, sugar, fat and egg products with large and (or) small additions (candied fruits, nuts, raisins, chocolate chips, etc.) or without them. With or without filling, with or without surface finish, the mass fraction of total sugar is not less than 9%, the mass fraction of fat is not less than 5%, the mass fraction of moisture is not more than 30% [3].

At the Albina Bakeri enterprise, vanilla cupcakes weighing 100 g are produced as ordinary cupcakes. They are implemented in educational institutions and kindergartens. The recipe of this product includes the following ingredients: confectionery fat, sugar, vanilla sugar, egg powder, premium wheat flour, baking powder, salt, yeast and milk. The proportion of ingredients per 1 kg of the finished product: premium flour 400 g; sugar 100 g; confectionery fat 160 g (including for greasing forms 10); melange 160 g; milk 100 g; salt 2 g, yeast 20 g; vanilla sugar 0.4 g. [9-11].

In connection with the results of the study, the main directions of the development of a functional product for students are to increase the amount of proteins, dietary fibers, while reducing the proportion of fats and carbohydrates, primarily sugars. Vitamins C and A are also an important component.

The formulation of the functional cupcake was developed at the Al-

bina Bakery enterprise in Kuala Lumpur, as well as at the Moscow State University of Food Production and the K.G. Razumovsky Moscow State Technical University (MCU) [1, 4, 6-11]. Three protein-enriched vegetable casseroles have been developed: potato, cabbage and vegetable. During the development process, the recipe for a regular cupcake was changed, namely:

- wheat flour of the highest grade was replaced with a mixture of flour of the 1st grade of wheat flour and chickpea flour of extra fine grinding;
- reduced the amount of sugar and fat;
- vanilla sugar was replaced with vanillin.

In addition, the developed functional product has a jelly filling consisting of the following ingredients: mango juice, jelly-forming agent, water.

The disadvantage of the new cupcake is a reduction in the terms and conditions of storage of cupcakes – at a temperature of +3 ... +5 °C for no more than 48 hours.

When developing a functional product for students of a private international school, the standards of the State of Malaysia were applied. The developed product fully meets the quality and safety requirements.

## References

1. Tutelyan V.A., Knyazhev V.A. Implementation of the Concept of the State Policy in the Field of Healthy Nutrition of the Population of Russia // Nutrition Issues. 2000. № 3. P. 4-7.
2. What happens to meals in school canteens / Rossiyskaya Gazeta, <https://rg.ru/2019/02/04/reg-pfo/chto-proishodit-s-pitaniem-v-shkolnyh-stolovyh.html>
3. Analysis of the nutritional value of functional flour products. / Vasyukova A.T., Moshkin A.V., Balazyuk N.V. //In the collection: Educational Environment Today and Tomorrow Materials of the X International Scientific and Practical Conference. Edited by Bubnov G.G., Pluzhnik E.V., Soldatkin V.I... 2015. P. 205-208.
4. Anisimova N.V., Sakharova I.N. – Effectiveness of the use of vitamin-mineral complexes in the diet of children and adolescents // Izvestiya PGPU named after V.G. Belinsky. 2009. № 14 (18). P. 80–87.

5. The use of dry functional mixtures in the technologies of bakery products /Vasyukova A.T., Puchkova V.F., Zhilina T.S. /In the collection: Bread and health of the planet Materials of the Second Eurasian Forum of Bakery Leaders. Based on the materials of the international Internet conference. 2015. P. 71-78.

6. Study of the concentration of vegetable oil in oil-water-flour suspension in the production of bakery products of high biological value /Vasyukova A.T., Abesadze L.T. // Technology and commodity science of innovative food products. 2013. № 4 (21). P. 37-43.

7. Katserikova, N.V. Technology of functional food products /N.V. Katserikova. – Kemerovo: Kemerovo Technological Institute of Food Industry, - 2004. - 146 c.

8. Organization of production and service at public catering enterprises / Vasyukova A.T., Lyubetskaya T.R. - Moscow, 2014.

9. Pankova, N.V. Innovations in the field of technology of public catering products for functional and specialized purpose /N.V. Pankova – SPb.: SPbGTEU, «LEMA»,2012. –184c

10. Renzyaeva, T.V. Expertise of flour confectionery products. Quality and safety / T.V. Renzyaeva, T.V. Savenkova, V.M. Poznyakovsky. – M.: INFRA-M, 2017. – 274 p.

11. Method for obtaining dry functional mixtures / Vasyukova A.T., Puchkova V.F., Kiryanova G.P., Moshkin A.V., Okhotnikov S.I., Kabanova T.V. - patent for invention RUS 2602629 07.07.2015.

## THE INFLUENCE OF HEAT TREATMENT OF MEAT PRODUCTS IN A COMBI OVEN ON THEIR QUALITY

**Vasyukova Anna Timofeevna**

Doctor of Technical Sciences, Full Professor  
Moscow State University of Food Production

**Edvars Rostislav Anatolyevich**

postgraduate  
Moscow State University of Food Production

**Vasyukov Maksim Viktorovich**

applicant  
Moscow State University of Food Production

**Lyubimova Kristina Vladimirovna**

postgraduate  
Moscow State University of Food Production

**Shagarov Stanislav Nurievich**

postgraduate  
Moscow State University of Technology and Management named after K.G. Razumovsky (First Cossack University)

The problems of ensuring the safety and quality of products are the most urgent for the food industry and public catering enterprises of the country. Currently, enterprises often create conditions in which it is not always possible to ensure unconditional food safety in the absence of a modern quality control system and safety of food raw materials and finished types of food products [1]. Especially relevant are the issues of safety of culinary products from meat. Heat treatment of raw meat products in order to bring it to a state in which it can be eaten is the most effective method of ensuring the safety of finished products. The influence of the modes of heat treatment of meat products in the steam convector on ensuring the quality of finished products has not been sufficiently studied and is of some scientific value. Many domestic and foreign scientists were engaged in ensuring the safety and quality of meat products [1-9]. So Peresichny M. I. studied the effect of combined methods of heat treatment (microwave + IR, microwave + conductive, microwave + IR + conductive) on the quality of meat culinary products [2].



V. M. Vazagov developed and substantiated the modes of heat treatment of large-scale semi-finished products in the middle of superheated steam, as well as in a steam-air medium at high pressure. [3]. Tarasenko I.I. (1984) studied the influence of traditional methods of heat treatment on the quality of meat dietary products (chopped steaks, large-piece semi-finished products) [4]. A. I. Zharinov developed a methodology for tracking and integrated quality control and safety of meat products [5]. Issues of improving the heat treatment of meat products were dealt with by Khlebnikov V.I. [6]. Raksha - Slyusareva O.A. proposed to use carbon fiber adsorbent to disinfect food products from pathogenic microflora [11].

However, there is not enough information about the effect of heat treatment modes in a combi oven on the quality of finished products. Therefore, conducting research aimed at solving the problems of ensuring the safety and quality of products is relevant.

**The purpose of the study** is to substantiate the advantages of heat treatment of meat products in a combi oven, in comparison with traditional methods, to obtain high-quality culinary products. In accordance with this goal, the issues of determining the degree of roasting and microbiological contamination of meat products after heat treatment in a combi oven were solved.

Meat is one of the most valuable human food products. Culinary meat products are always in high demand among consumers. However, this range of raw materials and semi-finished products does not have a long shelf life. The main directions of the state policy in the field of healthy nutrition is to solve the problem of maximum preservation of nutritional value, ensuring the quality and safety of food products. The current situation requires the use of innovative methods of influencing the microflora of raw materials of animal and plant origin, among which the thermal method of disinfection in a vapor-air environment is a promising one.

As a rule, microorganisms are absent in the blood and muscles of healthy animals. The significant content of microbes in meat and meat products is explained by their contamination during processing. Inside the muscles, microbes are found in the blood only in sick and weakened animals whose bodies are unable to prevent the penetration of microflora through the intestinal walls. During the primary processing of livestock, microbes from the coat, from the skin, from the intestines, from slaughter and processing tools, from equipment get to the surface of the carcass. Through the lymphatic and blood vessels, when exsanguination of carcasses on suspended paths, microbes can penetrate with air inside [1, 8].

After initial processing, carcasses can contain from tens to hundreds of thousands of microbes per 1 cm<sup>2</sup> of the surface [1, 8, 9].

In the process of transportation and commercial cutting of carcasses, the contamination increases even more. With the accumulation of a large number of microbes on the surface of meat, they spread along the blood and lymphatic vessels, bones, tendons into the inner layers. The penetration rate is lower, the lower the storage temperature, the higher the fatness, the carcass or the larger the surface is covered with fat. For example, at 0 ° C, the development of microbes and their penetration inside is slower than at 5 ° C; meat from well-fed animals of the same species spoils later than meat from lean, beef spoils slower than pork.

Especially important is the drying crust - the film formed on the surface of the meat during storage. Without being disturbed, it delays the penetration of microbes inside.

Even in meat that emits the smell of spoilage, bacteria are detected only up to a depth of 1 cm. If there are a lot of microbes in the inner layers, which can be found out by microscoping an imprint from a sterile cut on a slide, then the meat should be considered stale. Most often, the spoilage of meat as a product of protein composition occurs in the form of aerobic or anaerobic putrefaction [5].

In addition to the previously described pathogens of putrefaction, *Escherichia coli*, the bacterium *prodigiosum*, etc. can take part in the spoilage of meat.

The bacterium *prodigiosum* (bacillus of miraculous blood) is a small mobile bacillus; forms blood-red colonies or a continuous coating of red, pink colors on various products. According to the ability to destroy proteins, this group includes *E. coli* and *proteus bacillus*, which are conditional anaerobes. Among anaerobic bacteria, the active causative agents of decay are *putrificus*, *sporogenesis*, etc. This bacterium leads to the formation of unusually bright red spots on meat and other products. [10, 12-16].

Usually the microflora of minced meat is much more abundant than the microflora of a whole piece of meat. This is due to the fact that when meat is turned into sausage stuffing, there is a uniform distribution of microbes in large quantities that were on the surface of the meat, in the entire mass of minced meat. Part of the microflora enters the meat from a meat grinder and other equipment. This, as well as the presence of air in the minced meat, the availability of fragmented muscle tissue cells to microbes, lead to their rapid reproduction. Spoilage becomes noticeable at the content of 5-10 million in 1 g of bacterial cells [7].

Heat treatment is carried out in order to bring raw meat products to a state in which it can be eaten without additional heating, as well as to increase its shelf life.

As a result of physico-chemical changes occurring during heat treatment, meat products acquire a specific taste, smell, color and consistency.

Heat treatment is carried out in different ways: cooking, frying, baking, stewing, pripuskanie, blanching, passivation.

In the production of sausage products, blanching, cooking, frying, baking are used. Meat culinary products are made using cooking, frying, baking, stewing, and allowance.

Cooking of products is carried out in water, broth, milk, an atmosphere of saturated steam or moist air. The frying and baking process is carried out by heating the product in an atmosphere of heated air without adding water or other liquid containing water (broth, milk, sauce).

Currently, the cooking and frying process can be carried out in one device - a steam convector. Moreover, several types of animal and vegetable products can be brought to a state of culinary readiness at the same time.

During heat treatment, most vegetative forms of microorganisms are destroyed. So, in the process of cooking sausage, about 99% of the microbes in raw sausages are destroyed.

During the roasting process, a significant number of microbes are destroyed, while *Dac. Coli* and *Dac. Proteus* are partially preserved. However, in most cases, after cooking, the most stable coccoid forms and spore-bearing sticks like *Vas. subtilis - mesentericus* remain in the sausages.

Most of the pathogenic microbes do not form spores, as a result of which the cooking temperature is fatal for them.

The contamination of boiled sausage is affected by the initial content of microbes in the minced meat: the more the minced meat is seeded, the more microbes remain in the finished sausage.

Studies have shown that the microbial contamination of the finished boiled sausage is affected by the variety of veneered meat. The indicator of microbial contamination increased as the meat grade decreased and reached the highest value in sausages of grade III. These sausages are produced from blood, offal, meat trimmings containing a large amount of connective tissue, the most contaminated with microorganisms.

In the production of liver and blood sausages, pates, potions and jellies, meat products used in their manufacture are pre-boiled. Depending on the type and size of meat products, the cooking time ranges from 2 to 6 hours (scars, skin, veins).

Individual meat products (liver, meat) are subjected to short-term cooking in boiling water — blanching, as a result of which the products are slightly boiled throughout the thickness. Meat products are blanched in sliced form, in strips about 5 cm thick [6].

Smoked meats are immersed in water heated to 95 ° C to protect the products from excessive loss of moisture, water-soluble proteins and extractives, while protein coagulation occurs in the surface layer for 30 minutes. Further cooking is carried out at + 80...+85°C. The cooking time is 50-55 minutes per 1 kg of product [10].

Therefore, conducting research aimed at solving the problem of ensuring the safety and quality of products is quite important.

The object of the study was natural meat semi-finished products and products made of cutlet mass with vegetable fillers. Vegetables such as onions, carrots, zucchini, white cabbage were used as a filler. During heat treatment, the heating rate is of great importance. It depends on the heat capacity and thermal conductivity of the environment and the heated products, the specific surface area and density. Due to the low thermal conductivity of meat products, their heating in the form of large chunks is very slow [12-16].

We have prepared portioned semi-finished products from beef (sample 1 and 2) and pork (sample 3) of various fat content, as well as semi-finished cutlets with cabbage (sample 4) and zucchini (sample 5). The numerical values of the heat capacity, thermal conductivity and density of meat products are given below (Table. 1), cooked in a combi steamer.

**Table 1.**

**Indicators of physical values of meat products cooked in combi oven**

<b>Product Name</b>	<b>Heat capacity J/(kg·K)</b>	<b>Thermal conductivity W/ (m·K)</b>	<b>Density mg/m<sup>3</sup></b>
Fatty beef	2543	0,443	0,81
Skinny beef	3162	0,559	1,02
Fatty pork	2064	0,148	0,83
Cutlets with cabbage	3257	0,437	0,94
Cutlets with zucchini	3661	0,482	0,93

As a result of research, it was found that the more adipose tissue is in the sample, the lower its density. Fatty beef and pork have a density 0.19-0.21 mg/m<sup>3</sup> lower than lean meat. Heat capacity and i.e. area have the same dependence.

The products cooked in the combi steamer have different degrees of browning. The frying process was carried out on the "heat" mode at a temperature of 200 ° C. Studies of temperature regimes of portioned pieces of beef and pork of various fat content have been carried out. It was found

that in equal periods of time, fatty beef and pork are not equally fried due to different indicators of physical quantities. Since fatty beef has a greater thermal conductivity, it is fried faster for an equal period of time with pork [12-16].

### References

1. Popova A.V. Ensuring the quality and safety of food products. – Kemerovo, in Kemerovo Technological Institute of Food Industry, 2011.
2. Peresichny M.I. The influence of combined methods of heat treatment on the quality of meat culinary products: Author's abstract dis. Ph.D. – Moscow, 1980.
3. Vazagov V.M. Development and substantiation of the technology of frying large-scale meat semi-finished products at public catering enterprises: avtoref. dis... kand.tekhn.nauk / V. M. Vazagov.- Moscow, 1977. – 87p.
4. Tarasenko I.I. Influence of heat treatment methods on the quality of meat dietary products: Author's abstract dis. Ph.D. - Moscow, 1984.
5. Zharinov A. I. Sovremennyye obrazovaniya o safety myasoproduktov /A. I. Zharinov // Adaptation to the conditions of the agro-industrial complex of general methodology about the tracking and integrated quality control and safety of meat products: materials of the 7th Mezhdunar. nauch. conf. – M.: VNIIMP, 2004. – Ch. 1. – P. 144–151.
6. Khlebnikov V.I. Scientific Basis for Improving the Heat Treatment of Meat Products: Abstract of the Dissertation of the Doctor of Technical Sciences - Moscow, 1982. – 50 p.
7. Jakubczak, A. Antagonistic activity of lactic acid bacteria on strains of *Yersinia enterocolitica* O3, isolated from slaughtered pigs / A. Jakubczak, B. Kot, K. Bukowski // Adv. Agr. Sci. – 1996. – Vol. 5, № 1. – P. 31 – 35.
8. Food and health in Europe: a new basis for action Copenhagen, WHO Regional Office for Europe, 2005
9. Soklakov, V.V. Standard ISO 22000:2005: a new generation of food safety systems/ V. V. Soklakov // Standards and quality. – 2006. – № 12.
10. Lisitsyn A.B. Microstructural changes in beef and pork of various morphological groups in the process of thermal sterilization / A. B. LandSitsin, L. B. Smetanina, N. Y. Fedorova, S. I. Khvylya et al. // Sb. trudov. -M.: VNIIMP, 1997.- P. 59-76.

11. Raksha-Slyusareva O.A. Adsorption of pathogenic microorganisms - potential pollutants of food products by carbon fiber sorbents in model experiments / Raksha - Slyusareva O.A., Pimonenko M.Yu., Slyusarev O.A., Linichenko S.V., Tolkach O.V. // Commodity Science and Innovations. Sat. scientific works, vol.2. Donetsk: DonNUET, 2010. - P. 335-342.

12. Vasyukova A.T., Alekseev A.E., Moshkin A.V., Bondarenko Yu.V., Utyuzh, A.S., & Kulik A.A. Relations of strength of emulsions with content oil in Aqueous Solutions of Corn Flour and Dry Milk, International Journal of Pharmaceutical Research, 12 (4), 2020, 1797 - 1804 <https://doi.org/10.31838/ijpr/2020.12.04.256>

13. Vasukova, A.T., Adzhian, E.A., Strocovaand, A.S., & Moshkin, A.V. (2020). Influence of food additives for quality indicator of yeast dough IOP Conference Series:Earth and Environmental science, 677. 1-5. <https://doi.org/10.1088/1755-1315/677/3/032021> Access URL: <https://docplayer.net/212542870-Influence-of-food-additives-for-quality-indicator-of-yeast-dough.html>

14. Kabulov, B., Kassymov S., Moldabayeva, Z., Rebezov, M., Zinina, O., Chernyshenko, Y., Arduvanova, F., Peshcherov, G., Makarov, S., Vasyukova, A. (2020) Developing the formulation and method of production of meat frankfurters with protein supplement from meat by-products. Eurasia Journal of Biosciences, 14(1), 213-218. AccessURL: <http://www.ejobios.org/article/developing-the-formulation-and-method-of-production-of-meat-frankfurters-with-protein-supplement-7477>

15. Vasyukova, A.T., Puchkova, V.F., & Sharova, T.N. (2014). Basics of rational nutrition / Textbook. – Smolensk: Universum. - 250 p.

16. Vasyukova, A.T., Vasyukov, M.V., & Mushin, P.A. (2016). Structural and mechanical indicators of the quality of minced and cutlet meat mass with biologically active additives. Agro-industrial technologies of Central Russia, 2 (№ 2). – P. 15-20.

## THE STUDY OF BEER'S FULLNESS FLAVOR COMPOUNDS

### **Gribkova Irina Nikolayevna**

Candidate of Technical Science, Senior Researcher

All-Russian Scientific Research Institute of Brewing, Beverage and Wine Industry

– Branch of V.M. Gorbатов Federal Research Center for Food Systems

### **Eliseev Mikhail Nikolayevich**

Doctor of Technical Science, Full Professor

Plekhanov Russian University of Economics

**Abstract.** The study of the compounds responsible for the beer's taste formation is relevant today. Many authors add information about the concept of different flavors and aromas, as the instrumental base for the new compounds identification which present in the beer's structure is expanding. An attempted has been made to characterize the contribution of grain raw materials caramel to the evaluation of the taste fullness in the three beer's groups: light alcoholic, strong and dark ones. It is shown that caramels have a correlation with the taste fullness and it increases when non-starch polysaccharides are included in the model for the light beer's group, soluble nitrogen for the strong beer's group and coloring compounds - in dark beer.

**Keywords:** beer types, evaluation descriptors, beer quality indicators, caramel

### **Introduction**

It is known that beer is an alcoholic beverage based on grain and other plant raw materials, which form its organoleptic characteristics due to the compounds extracted by diffusion in the aqueous medium at elevated temperatures - from 47°C and above, as well as due to the vital activity of microorganisms. Many research works are devoted to quality issues trying to establish the connection between evaluation descriptors and physical and chemical parameters of finished beer [1-6].

Fullness of taste is one of the main beer's descriptor, allowing tasters to evaluate the type and quality of beer. The compounds responsible for the formation of flavor fullness are varied: they play primary and secondary roles in the effect of the drink on the receptors. The basis of perception and

taste fullness or "body" of beer are nitrogen and carbohydrate compounds [1,2,4], and for aroma are responsible - alcohols, volatile and other compounds [1,6,7].

The secondary parameters include grain raw material compounds - phenolic, coloring (melanoidins) [8,9], metal ions ( $\text{Fe}^{3+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Zn}^{2+}$ , etc.) [10] and microbiological (alcohol, esters, glycerol, etc.) [6,11].

The aim of the study was to determine the role of caramels in the formation of the beer's taste fullness.

### Materials

Samples of filtered pasteurised brewery products were purchased in the retail chain in the amount of 5 bottles (cans) of each sample and stored in a darkened room with controlled parameters: at a temperature of  $(15\pm 20)^{\circ}\text{C}$  and air humidity  $W \leq (75\pm 2)\%$  before the study. Beers analysed included 18 samples: 8 samples of light alcoholic beer (LAB), 5 samples of strong alcoholic beer (SAB), 5 samples of dark alcoholic beer (DAB).

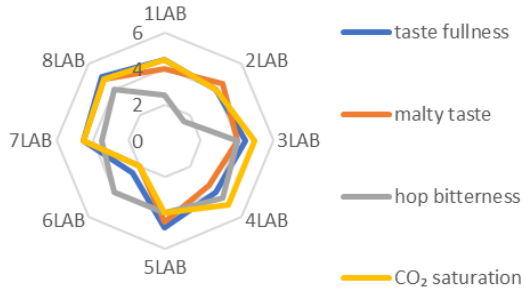
### Investigation methods

To determine the original extract and alcohol content the 2.13.16.1 standard MEBAK® method was used [12]; the color of beer, the EBC method (EBC Method 9.6) was used [13], the caramels content was used [14]; the soluble nitrogen content in beer samples the Kjeldahl method (EBC Method 4.9.3) was used [15]; the mass concentration of  $\beta$ -glucan, the standard fermentation method was used (8.13.1) [15]. Statistical analysis was performed in five replicates. Descriptive statistics were performed and values are expressed as mean  $\pm$  standard deviation (SD). In the studies, the Student-Fisher method was used, as a result of which multivariate models of the correlation-regression dependence of the studied parameters were obtained. The reliability limit of the obtained data ( $p < 0.05$ ) was considered to assess various factors affecting the content of polyphenols in all studies; statistical data were processed by the Statistics program (Microsoft Corporation, Redmond, WA, USA, 2006). The organoleptic analysis was done by a professional group of researchers, consisting of 10 people on a 5-point scale according to the characteristic taste descriptors selected. 5 points mean a strong descriptor shade, 4 points – a well-developed descriptor shade, 2 points – a slightly visible descriptor shade, 1 – a subtle descriptor shade. The results obtained were summarized and the average score was recorded.

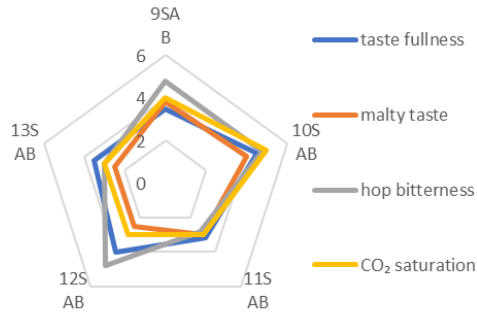
### Results and discussion

The 3 groups of beer samples organoleptic evaluation is shown in Figure 1 (a,b,c).

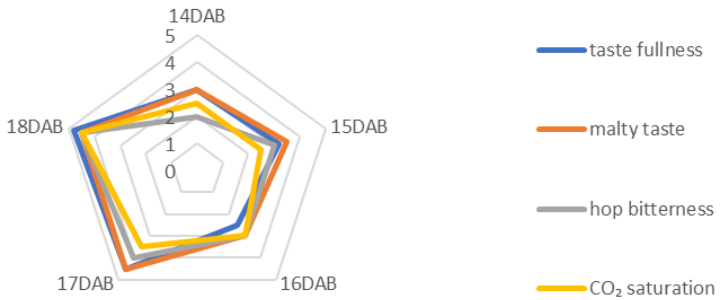




**a**



**b**



**c**

**Figure 1. The evaluation descriptors profilogram in the beer's group: light alcoholic (a), strong (b) and dark (c) samples**

Table 1 shows the quality indicators of the studied beer's samples.

**Table 1.**  
**The beer's group quality indicators**

Sample number	The content in samples, mg/L, reliability limit $p < 0.05$					
	alcohol, vol%	original extract, °P	$\beta$ -glucan (GI)	soluble nitrogen (SN)	color, °EBC (CL)	caramels (CR)
light alcoholic beer samples (LAB)						
1LAB	4.5±0.40	11.0±1.0	46.6±3.3	683.0±28	17.0±0.60	6.02±0.06
2LAB	4.6±0.40	10.7±1.0	62.1±4.4	459.4±20	5.25±0.20	4.97±0.05
3LAB	4.6±0.40	10.8±1.0	124.1±8.7	445.4±25	5.75±0.20	5.12±0.05
4LAB	4.2±0.40	10.0±1.0	69.8±4.9	610.7±24	9.75±0.30	6.02±0.06
5LAB	4.8±0.48	11.6±1.2	62.1±4.4	823.6±33	6.75±0.25	8.12±0.08
6LAB	4.8±0.48	12.0±1.2	45.0±3.2	686.0±28	5.0±0.20	3.01±0.03
7LAB	5.0±0.50	11.0±1.0	62.0±4.4	984.0±40	7.5±0.25	6.60±0.07
8LAB	5.0±0.50	12.0±1.2	120.3±8.5	743.0±30	7.25±0.25	3.01±0.03
strong alcoholic beer samples (SAB)						
9SAB	6.6±0.60	14.5±1.5	186.2±14	823.6±33	12.5±0.40	5.56±0.05
10SAB	6.6±0.60	15.0±1.5	166.0±12	694.7±28	11.5±0.40	4.95±0.05
11SAB	5.5±0.50	15.0±1.5	62.1±4.4	948.8±40	16.5±0.55	2.64±0.03
12SAB	5.9±0.60	15.0±1.5	155.2±11	767.6±30	16.5±0.55	6.02±0.06
13SAB	7.7±0.80	16.0±1.5	38.8±2.7	960.9±40	11.5±0.40	5.44±0.05
dark alcoholic beer samples (DAB)						
14DAB	9.6±0.90	3.8±0.40	57.4±4.5	540.7±21	20.0±0.70	5.65±0.05
15DAB	4.5±0.40	11.0±1.00	38.8±2.7	624.7±24	22.5±0.70	5.53±0.05
16DAB	4.7±0.50	11.3±1.00	77.6±4.8	1185.0±47	106.3±3.70	5.53±0.05
17DAB	4.5±0.40	11.8±1.00	75.6±4.8	980.0±40	25.0±0.70	5.2±0.05
18DAB	4.7±0.50	12.0±1.20	83.3±5.0	666.7±27	19.75±0.70	9.45±0.09

\* - each value represents the mean of five independent experiments (±SD)

Based on the Table 1 data, the correlation and regression parameters for the beer samples groups (LAB, SAB and DAB) were calculated and presented in Table 2.

**Table 2.**  
**Significant correlation characteristics between taste fullness (TF)**  
**and other indicators**

	Beer sample groups		
	LAB	SAB	DAB
Pair correlation coefficients, Rd	TF/GL =0.504; TF/SN; CL; CR=(0.211÷0.444)	TF/GL =0.579; TF/SN=-0,902; TF/CR=0.562	TF/GL =0.548; TF/CL=-0,608; TF/CR=0.610
Partial correlation coefficients, Rp	TF-G/L/SN=0,612; TF-G/L/CL=0.647; TF-G/L/CR=0.758; GL-CR/TF=-0.693	TF-G/L/SN=-0,911; TF-G/L/CL=0.581; TF-SN/CL=-0.976; TF-SN/CL=-0.910; TF-SN/CR=-0.876	TF-G/L/SN=0.663; TF-G/L/CL=0.870; TF-G/L/CR=0.528; TF-SN/CL=0.698; TF-CL/CR=-0.584
Multiple correlation coefficient R	0.9041	1.0	1.0
Determination coefficient R <sup>2</sup>	0.8174	1.0	1.0
Volume of intervening unrecorded parameters, %	18.3	0.0	0.0

The correlation-regression analysis has shown (Table 2), that in the beer with original extract (10÷12)°P a not strong correlation relation between pair variables of taste fullness and the content of caramels (R=0.444) is found, however the partial correlation coefficients show a strong relation between taste fullness, β-glucan content and caramel content (R=-0.693÷0.758), which explains the interaction between molecules of non-starch polysaccharide and caramels at tasteful perception of beer. In the group of strong beer with an original extract in the range of (14,5÷16,0)°P the pair correlation coefficient between the flavor fullness and the content of caramels is more weighty compared to the previous group (Table 2). Partial correlation coefficients show a close relationship between the taste fullness, soluble nitrogen content and caramel content (R=-0.876). The correlation characteristics of the dark beer group (Table 2) show a strong pairwise correlation between the taste fullness and caramels (R=0.610), and the partial correlation coefficients indicate a strong relationship between taste fullness, β-glucan content and caramels, as well as between fullness of taste, color intensity and caramels content. Note that the coefficient of overall correla-



## References

1. Krebs, G., Gastl, M., Becker, T. Chemometric modeling of palate fullness in lager beers. *Food Chemistry*. 2021, vol. 342, pp. 128253. <https://doi.org/10.1016/j.foodchem.2020.128253>.
2. Kato, M., Kamada, T., Mochizuki, M., Sasaki, T., Fukushima, Y., Sugiyama, T., Hiromasa, A., Suda, T., and Imai, T. Influence of high molecular weight polypeptides on the mouthfeel of commercial beer. *J. Inst. Brew.* 2021, vol.127, pp. 27– 40. <https://doi.org/10.1002/jib.630>.
3. Langstaff, S.A., Guinard, J.-X. and Lewis, M.J. Instrumental evaluation of the mouthfeel of beer and correlation with sensory evaluation. *J. Ins. Brew.* 1991, vol. 97, pp. 427-433. <https://doi.org/10.1002/j.2050-0416.1991.tb01081.x>.
4. Ragot, F., Guinard, J.-X., Shoemaker, C. F., Lewis, M.J. The contribution of dextrin's to beer sensory properties: Part I. Mouthfeel. *J. Ins. Brew.* 1989, vol. 95, pp. 427-430. <https://doi.org/10.1002/j.2050-0416.1989.tb04650.x>.
5. Langstaff, S.A., Lewis, M.J. The mouthfeel of beer — a review. *J. Inst. Brew.* 1993, vol. 99, pp. 31-37. <https://doi.org/10.1002/j.2050-0416.1993.tb01143.x>.
6. He, Y., Dong, J., Yin, H., Zhao, Y., Chen, R., Wan, X., Chen, P., Hou, X., Liu, J., Chen, L. Wort composition and its impact on the flavour-active higher alcohol and ester formation of beer – a review. *J. Inst. Brew.* 2014, vol. 120, pp. 157– 163. <https://doi.org/10.1002/jib.145>.
7. Serra, M., Funch, B., Forster, J. The raise of *Brettanomyces* yeast species for beer production. *Curr. Opin. Biotech.* 2018, vol. 56, pp. 30-35. <https://doi.org/10.1016/j.copbio.2018.07.009>.
8. Lentz, M. The Impact of Simple Phenolic Compounds on Beer Aroma and Flavor. *Fermentation*. 2018, vol. 4. <https://doi.org/10.3390/fermentation4010020>.
9. Martinez-Gomez, A., Caballero, I., Blanco, C. Phenols and Melanoidins as Natural Antioxidants in Beer. Structure, Reactivity and Antioxidant Activity. *Biomolecules*. 2020, vol. 10, pp. 400. <https://doi.org/10.3390/biom10030400>.
10. Zufall, C., Tyrell, T. The Influence of Heavy Metal Ions on Beer Flavour Stability. *J. Inst. Brew.* 2008, vol. 114, pp. 134-142. <https://doi.org/10.1002/j.2050-0416.2008.tb00318.x>
11. Salanță, L.C., Coldea, T.E., Ignat, M.V., Pop, C.R., Tofană, M., Mudura, E., Borșa, A., Pasqualone, A., Zhao, H. Non-Alcoholic and Craft Beer Production and Challenges. *Processes*. 2020, vol. 8, no 11, pp.1382. <https://doi.org/10.3390/pr8111382>.

12. Middle European Brewing Analysis Commission. Brautechnische Analysenmethoden. 3rd ed. Freising-Weihenstephan; Nürnberg, Germany: 1997. Band I Selbstverlag der MEBAK.

13. Koren, D., Hegyesné Vecseri, B., Kun-Farkas, G. How to objectively determine the color of beer? *J Food Sci Technol*. 2020, vol. 57, pp. 1183–1189, <https://doi.org/10.1007/s13197-020-04237-4>

14. Kokeb, A., Mamo, S., Gabbiye, N., Assefa, A. Synthesis and Characterization of Caramel from Simple Sugar for Brewing Color Application. 2015, pp. 53-60.

15. Institute of Brewing (IOB). Institute of Brewing (IOB) Recommended methods of analysis. *J. Ins. Brew.* 2007, 7, 54–76.

16. Norman, M. Terminology in Beer Reviews: thesis, Bachelor degree, English, 2019. University Gavle, 47 p.

DOI 10.34660/INF.2022.81.37.028

## THE STUDY OF CHERRY WOOD ANATOMICAL STRUCTURE TO USE IT IN THE ALCOHOLIC BEVERAGES PRODUCTION

**Zakharov Maxim Alexandrovich**

Candidate of Technical Science, Senior Researcher

**Zakharova Varvara Alexeevna**

junior researcher

**Dubinina Elena Vasilyevna**

Candidate of Technical Science, Principal Researcher

All-Russian Scientific Research Institute of Brewing, Beverage and Wine Industry  
– Branch of V.M. Gorbатов Federal Research

**Abstract.** The paper assesses the suitability of cherry's variety Vladimirskaya wood in the form of wood chips for aging fruit distillates with the obtaining competitive and high quality alcoholic beverages purpose based on the wood anatomical structure study under consideration. The cherry wood macrostructure data of microscopic research is presented, comparative estimation of anatomical structure of different kinds of fruit-tree wood is given. The results of the study revealed features of cherry wood that can have a positive effect on the extraction process of wood components, namely scattered vascularity, as well as a small number of tillas. Presence of dark-colored gum in wood testifies to presence in a core zone of necessary phenolic condensed compounds promoting positive processes from the point of view of organoleptic at ageing of distillates with the purpose of production of stable drinks.

**Keywords:** cherry wood, anatomical structure, wood macrostructure, extraction, aged alcoholic beverages.

### Introduction

It is known that the wood quality has a great influence on the characteristics of distillates in contact with different tree species during aging. Many works are devoted to the search of promising tree species for this purpose [2-4, 11, 13]. The interest in this area is dictated by the desire to diversify the taste perception of produced beverages and to reduce the economic costs of raw materials in the spirits technology.

It is the structural wood features that largely determine the aged beverages organoleptic properties, they also influence the rate of their maturation and the quality of extracts produced from wood [1,7-9,11,12]. Certain anatomical features of wood structure are used as selection criteria for its differentiated use in winemaking [2,13].

Regarding the application of cherry wood, research work continues. Now a brief characteristic of macrostructure and physical and mechanical properties of cherry wood (*Cerasus vulgaris Mill.*) is known [3,4,6]. Researchers state that "anatomical structure of wood is similar to that of genera *Armeniaca*, *Amygdalus* and *Peersis*, but the number of cells in the width of multi-row beams does not exceed five, and in some species (*C. mahaleb Mill.*) narrow beams prevail; vessels are somewhat sparser and more often assembled in groups" [5].

The research purpose was to assess the cherry wood suitability in the form of technological chips for fruit distillates aging and obtaining competitive and high-quality alcoholic beverages.

### Materials

As the study objects we used of ordinary cherry tree variety *Vladimirskaya* wood branches, age 10 years (Moscow region.). Preliminary assessment of the suitability of cherry wood chips for fruit distillates aging we conducted based on the study of the anatomical structure of cherry kernel wood.

### Investigation methods

Stereomicroscopy at a magnification of no more than 100<sup>x</sup> was performed on an MBS-10 microscope in the light-field and oblique light modes. The structures were photographed using a digital camera. Preparations for anatomical studies were made according to the methods generally accepted in botanical microtechnics and histochemistry [10]. Microscopy was performed using a research microscope Jenoval (Carl Zeiss) equipped with an ocular micrometer. Microlenses were used: GF-Plan 12.5/0,25; Plan 9/0,2, 160/0,17; Apochromat 40/0,95, 160/Cor 0,1-0,2; GF-Plan HI 100/1,25.

### Results and discussion

Studies have shown that cherry wood in its structure and properties is very similar to plum wood. It follows from genetic proximity of the considered genera and obeys the laws of homologous series of hereditary variability by N.I. Vavilov. In the countries of Western Europe, cherry tree is not defined as a separate genus at all, it is referred to the genus *Prunus*. However, we identified some differences in cherry and plum wood structure.

At the first stage of research, we studied the macroscopic structure of



cherry wood in three main sections (slices) of the trunk - transverse, radial, and tangential (tangential).

When analyzing the macrostructure in the wood samples under consideration, it is difficult to distinguish the core part. But the central part of the stem (two annual rings) has a brownish tint and resembles a core and, in fact, is a false core. The boundary between the sapwood and false nucleus is clear, running along the border of the second and third growth. No deposits of calcium salts were detected on the radial chipping. The annual layers are weakly sinuous, have an inconstant width, and are hardly distinguishable on the uncut end surface. The width of the annual rings varies from 1.5 to 3 mm. Bark, sapwood, kernel and core of cherry branch are well distinguishable in Figure 1a.

The core is pentagonal, 3 mm in diameter, composed of large thin-walled isodiametric parenchyma cells. There is a slight displacement of the medulla relative to the trunk axis, caused by the formation of traction wood in the stretched zone of the stem. Cherry traction wood is very close in structure and properties to the similar reactive wood of plum.



**Figure 1. The cherry branch cross-section: magnification 5<sup>x</sup> (a); magnification 50<sup>x</sup> (b)**

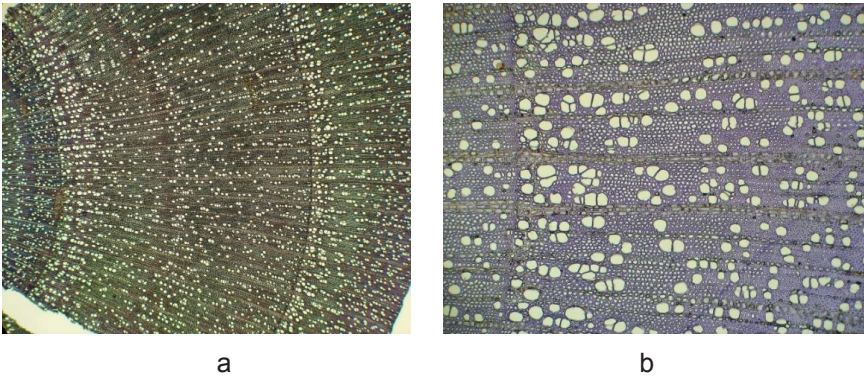
Vessels are small, invisible to the naked eye, but well discernible under a weak magnification of a stereomicroscope as separate grains, the frequency of which decreases from the inner border of the annual ring to the outer one. Core rays, adjusted for age, are narrower than those of plums. They expand from the first ring to the third, lighter, visible to the naked eye. In Figure 1b, the rays are in the form of radially diverging lines from the center. On the end surface, large (up to 2.5 mm long) heart repeats are

revealed, occurring not more frequently than  $2\div 3\text{ cm}^{-2}$ .

Cherry wood is strong and does not soften well in an alcohol-glycerin mixture. Mechanical properties of the sapwood and false core are approximately the same.

When examining the microstructure, it was found that the wood consists of vessels, fibrous tracheids, radial and heavy parenchyma.

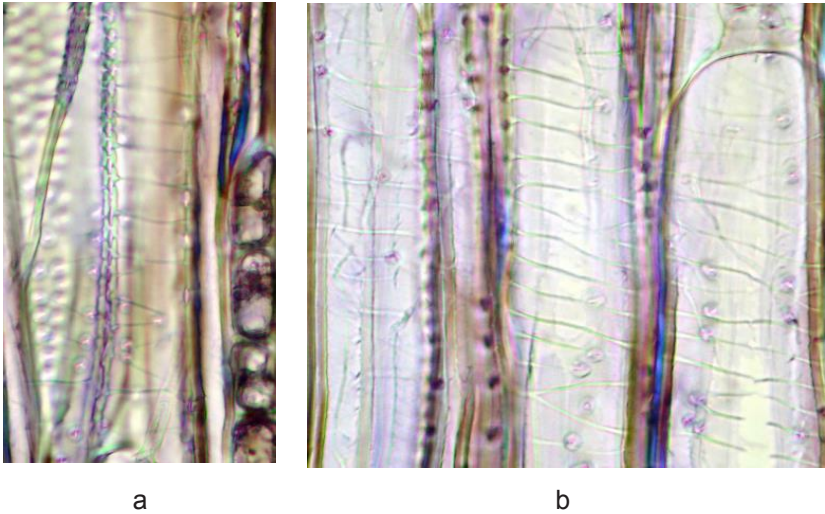
The wood is diffusely vascular with a tendency to ringlets (Figure 2).



**Figure 2. The cherry wood vessels in the form of individual light grains in cross-section**

Vessels of the same type (diameter  $30\pm 5\ \mu\text{m}$ ), thin-walled, rounded, slightly elongated in radial direction, not forming specific pattern. The most part of vessels are grouped by  $2\div 4$  in radial chains or nests. The apertures of vessels of broad rings are irregularly distributed in thickness of annual layer. In the early zone, they form a well-defined ring. In narrow growths, larger vascular openings are concentrated in the early wood. In the direction to the outer border of the annual layer, vascular lumen decreases in size and quantity. The lumen of proto- and metaxylem vessels are well distinguished in the first growth.

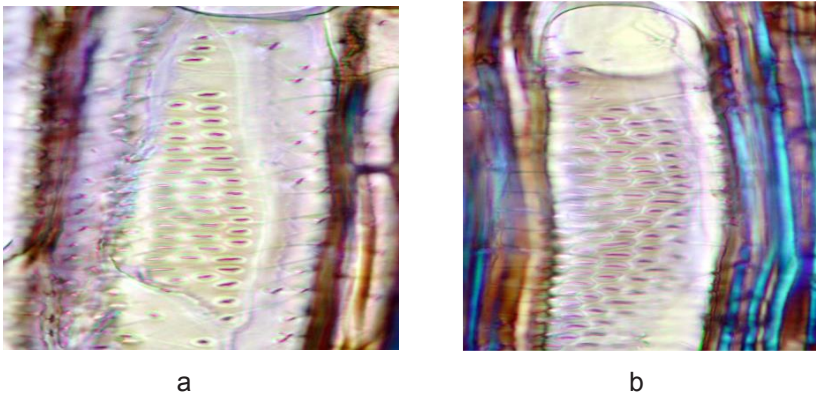
Most vessels have well expressed spiral thickenings (Figure 3a,b).



**Figure 3. The cherry wood vessels spiral thickening of in tangential (a) and radial (b) sections**

The relative pitch of the spiral is  $1/3 \div 1/2$  of the vessel's diameter. There are also tracheids with spiral thickenings with a relative spiral pitch of about  $1 \div 1/2$  of the tracheid lumen diameter.

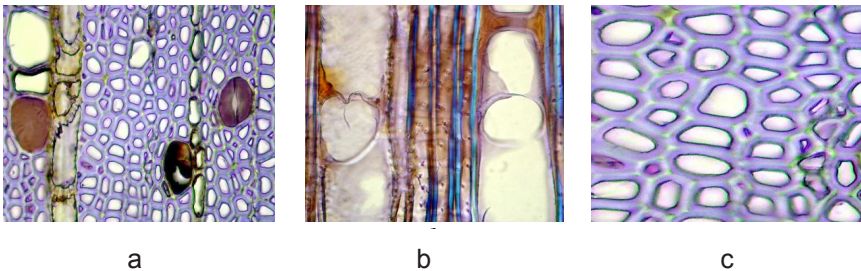
Intervascular pore size, similarly to plum wood, varied depending on the vessel's width (Figure 4 a,b).



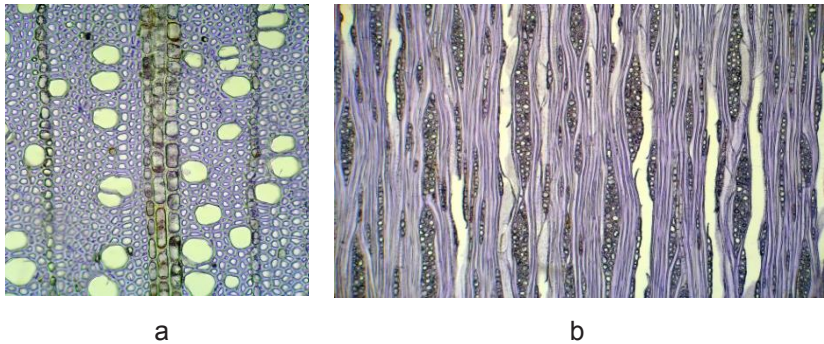
**Figure 4. The cherry wood vessel segments porosity of in the radial section: close porosity (a) and closed porosity (b)**

Intervascular pores are connivent (in wide vessels) and confined (in narrow vessels), regular. Internal openings of pair of pores elongated, at very narrow vessels crossed, not reaching margins of frons. Pores of vascular tracheids with crossed apertures.

The processes of nucleation in cherry and plum are very similar. Teals and meniscus-shaped biconvex orange-red drops of gum are found in the lumen of single vessels of the nucleus (Figure 5a,b). Single vessels are occluded. The contents of the teals are intensely colored. The wood main mass consists of fibrous tracheids with cell walls of medium thickness. The fibrous tracheids have an average lumen diameter (Figure 5c). The cross section of the fibrous tracheids has a rounded, weakly angular shape. On the cross section, cavities and channels of slit-like rimmed pores between neighboring tracheids are sometimes found. The tracheid lumen diameters in the early and late parts of the annual ring are approximately equal. Vascular tracheids are very rare. The medullary rays are numerous, single-row, double-row, and triple-row, consisting only of parenchyma cells (Figure 6a,b). Single-row rays are linear (from 3 to 15 cells in height), two- or three-row rays are fusiform, slightly wider than the diameter of vessels (2÷3 rows of cells in width, 6÷30 layers of cells in height).

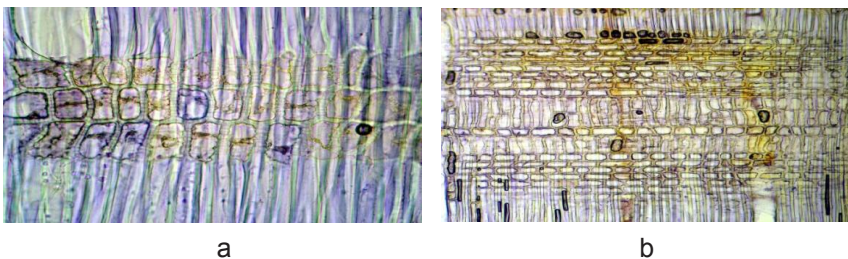


**Figure 5. Tillae on transverse (a) and "meniscus" of gum on radial (b) sections with fibrous character of tracheids on transverse section (c) in cherry wood vessel segments**

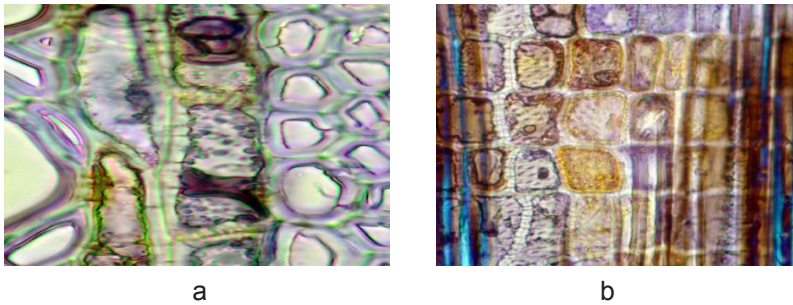


**Figure 6. The cherry wood rays on the cross section in the form of vertical bands (a), on the tangent section - spindle-shaped (b)**

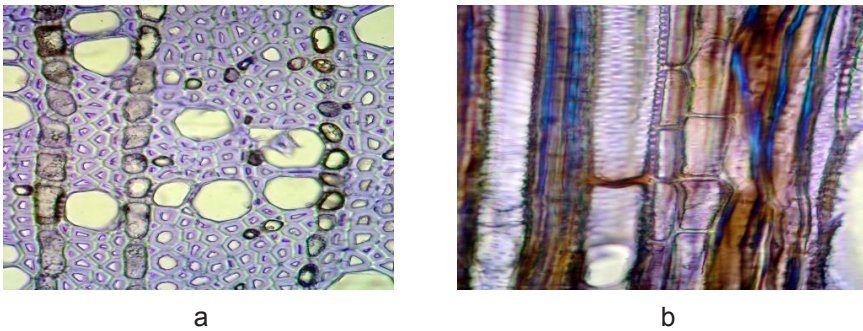
Single-row rays, in most cases, are homogeneous, consisting of square and less often palisade (at the border of growths) cells. Two- and three-row beams are heterogeneous, of mixed type, with square cells at the edges. Legging cells have a width/length ratio  $1/2 \div 1/4$  (Figure 7a,b). Palisade cages - height/width ratio  $2/1 \div 4/1$ . The square and standing cells rows are often present in the central part of the beam, which is not noted in the plum wood sample. Like plum, dark-colored plastic granules contain only a small percentage of ray cells (Figure 8a,b). This fact indicates a low content of oxidized tannins. The axial parenchyma is diffuse sparse with thin cell walls (Figure 9a,b). The axial parenchyma cells are cylindrical, partially filled with amorphous contents. The transverse walls of the parenchymal bands are straight. The pores between neighboring parenchyma cells are simple.



**Figure 7. The cherry wood rays on the radial section: single-row ray (a) and multi-row ray (b)**



**Figure 8. The cherry wood medullary ray cells containing dark-colored granules of plastic substances in transverse (a) and radial (b) sections**



**Figure 9. The severe cherry wood parenchyma in transverse (a) and radial (b) sections**

Nucleation processes in cherry and plum are very similar. Dynamics of plastic substances accumulation in parenchyma cells and formation of stained gum drops are also similar. Crystalline deposits were not detected in the examined samples of *Vladimirskaia* variety cherry wood.

Here are the main differences between cherry wood and plum wood: beams are smaller (row not more than 3), in plum - row to 6; square and standing cells may be in the central part of the beam, in plum - on the perimeter of the section; there are vessels with perforation plates of transitional type, characteristic of juvenile wood; wood contains little gum; tyloses are very rare, which is associated with age of the stem; maximum parenchyma is larger than that of plum.

### Conclusion

Thus, based on the studies conducted, features of cherry wood that can have a positive effect on the extraction process of wood components have been identified, which is confirmed by other studies [14]. This is due to structural features of wood: scattered-vessel structure with a tendency to ring-shaped vessels, low number of tillers and fibrous structure of tracheids with slit-rimmed pores will have a positive effect on the extraction rate when distillates are aged in contact with wood materials. Cherry wood quality is optimal in terms of the chemical structure: the presence of a significant amount of dark-colored gum, the low amount of tyllus with low-molecular bitter substances and the absence of calcium salts will contribute to optimal extraction processes, oxidation and other reactions aimed at obtaining a balanced in organoleptic indicators with high stability drinks.

### References

1. Aksenov, P.A., Korovin, V.V. The different geographical origin oak wood structure and chemical composition study to assess its suitability to produce high-quality brandy spirits. MSUL Bulletin - Forest Bulletin, 2007, no 5, pp. 9-16.
2. Aksenov, P.A., Korovin, V.V. A comparative anatomical study of oak wood used in winemaking. MSUL Bulletin - Forest Bulletin. 2010, no 3, pp. 5-15.
3. Benkova, V.E., Shveingruber, F.H. Wood anatomy of plants in Russia. - Bern: Haupt publ., 2004, 456 s.
4. Voroshilova, G.I., Snezhkova, S.A. A timber of forest-forming and associated species of the Far East. Tutorial. - Vladivostok. Far Eastern University publ., 1984, 156 s.
5. Gammerman, A.F., Nikitin, A.A., Nikolayeva, T.L. Identifier of woods by microscopic features with an album of microphotographs. M-L., publ., Academy of Sciences of the USSR, 1946. 143 p.
6. Atrohin, V.G., Kalutskiy, K.K., Tiurikov, F.T. Tree species of the world. T. 3. Tree species of the USSR. - M.: Wood prod. publ., 1982, 264 p.
7. Oganesyants, L.A. The oak and winemaking. – M.: Pischepromizdat publ., 1998, 255 p.
8. Oganesyants, L.A., Korovin, V.V., Aksenov, P.A. Variability in oak wood structure and its suitability for aging wine products. Winemaking and viticulture. 2006, no. 5, pp. 10-11.

9. Sarishvily, N.G., Oganesyants, L.A., Korovin, V.V., Telegin, Yu.A., Gordeeva, L.N., Kardash, N.K. Anatomical structure of oak riveting for winemaking as an indicator of its quality. Review information. Food and processing industry. Series 15. Wine-making industry. – M.: AgroNIITEIPP publ., 1996, vol. 2, 23 s.
10. Barikina, R.P. Handbook of Botanical Microengineering. Fundamentals and Methods. – M.: MSU, 2004, 312 s.
11. Madrera, R., Gomis, D., Alonso, J. Influence of Distillation System, Oak Wood Type, and Aging Time on Volatile Compounds of Cider Brandy. *J. Agric. Food Chem.* 2003, vol. 51, pp. 5709-14. <https://doi.org/10.1021/jf034280o>.
12. Kord, B., Hassankhani, M., Pourpasha, M.M. Empirical statistical model for predicting wood properties of *Paulownia fortunei*: Part 1: Physical and biometrical properties. *Maderas, Cienc. tecnol.* 2015, vol.17, no.4, pp.919-930. <http://doi.org/10.4067/S0718-221X2015005000080>.
13. Zoric, L., Ljubojević, M., Merkulov, L., Lukovic, J., Ognjanov, V. Anatomical Characteristics of Cherry Rootstocks as Possible Preselecting Tools for Prediction of Tree Vigor. *J. Plant Growth Reg.* 2011, vol. 10. <https://doi.org/1007/s00344-011-9243-7>.
14. Nunes, I., Correia, A.C., Jordão, A.M.M., Ricardo-da-Silva, J. Use of Oak and Cherry Wood Chips during Alcoholic Fermentation and the Maturation Process of Rosé Wines: Impact on Phenolic Composition and Sensory Profile. *Molecules.* 2020, vol.9, no 25(5), pp.1236. <https://doi.org/10.3390/molecules25051236>.



DOI 10.34660/INF.2022.46.13.029

## ANALYSIS OF SPATIO-TEMPORAL MULTIDIMENSIONAL VIBRATION SIGNALS

**Ismailov Bahram Israfil**

Ph.D., Department of "Instrumental Engineering"

Azerbaijan State Oil and Industry University

Baku, Azerbaijan Republic

ORCID ID: 0000-0002-5815-1253

**Abstract.** The report is devoted to the analysis of the results of monitoring vibration processes occurring in the nodes and elements of complex and unique objects. As an example of the study, the hydro-electro-mechanical equipment of the Hydroelectric Power Plant is considered. Monitoring and evaluating the behavior of a complex system allows you to detect deviations from the permissible limits and prevent the emergence and development of processes that threaten its safe operation at early stages. Analysis and evaluation of the processes occurring in the equipment are necessary to make the right decision on the control of dynamic processes. During the operation of the equipment, there is a manifestation of the activity of many sources of vibration and resonances in various planes. In addition to its own sources of vibration, the equipment is affected by the vibration spectrum of systems and devices operating in parallel, in connection with which the spatial-temporal analysis of the parameters of the equipment's vibration activity becomes relevant. The report analyzes the sources of vibration and presents the structure of the research model.

**Keywords:** vibration processes, Spatio-Temporal analysis, hydroelectric unit of a Hydroelectric Power Plant, Poincare, Recurrence plots,

### Introduction

Vibration analysis of a complex of technical means, consisting of various rotating parts, is an urgent task in industry. Vibration processes in multidimensional dynamic systems are manifested in the form of a wide range of vibrational forces, moments and resonances. During the operation of the equipment, the sources of vibration activity of the equipment can be both the technological process and unpredictable external influences [1-6].

The report examines the sources of vibration affecting the behavior of units and assemblies of complex technical systems, using the example of a hydroelectric unit of a hydroelectric power station.

In Figure 1 shows the structure of the hydraulic unit, highlighting the zones of the main sources of disturbances in the diagnostic space.

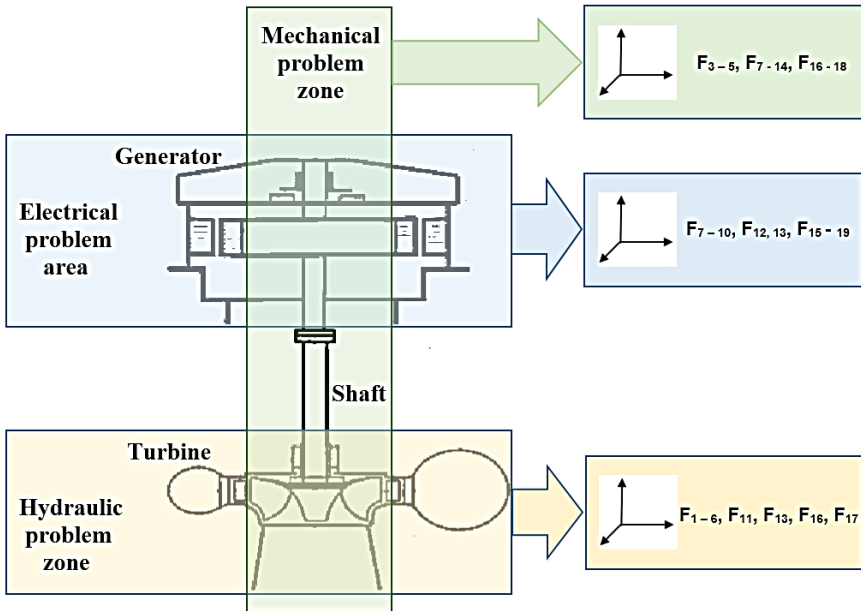


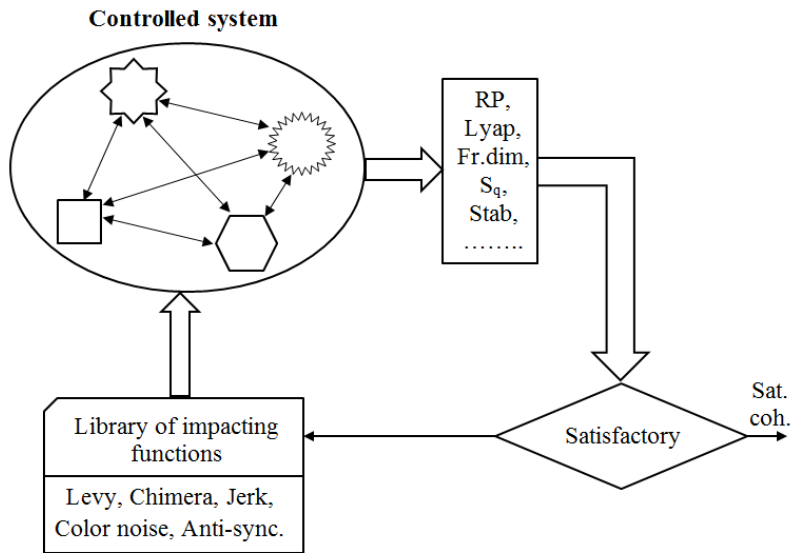
Figure 1. The main sources of vibration and disturbances in the diagnostic space:  $F_1$  - Vibration turbulent flow;  $F_2$  - Water energy management;  $F_3$  - Cavitation;  $F_4$  - Vibration of turbine blades;  $F_5$  - Regulation of the generated power;  $F_6$  - Hydro turbine blade frequency;  $F_7$  - Foundation vibration;  $F_8$  - Support structure vibration;  $F_9$  - Rotor eccentricity;  $F_{10}$  - Rotor imbalance;  $F_{11}$  - Shaft fatigue;  $F_{12}$  - Support bearing wear;  $F_{13}$  - Incorrect or poor quality lubrication;  $F_{14}$  - Influence of parallel-operating hydraulic units;  $F_{15}$  - Generators basic frequency;  $F_{16}$  - Uneven load in phases;  $F_{17}$  - The nature of the load;  $F_{18}$  - Influence of parallel generators;  $F_{19}$  - Breakdown of generator winding insulation

Analysis of vibration sources shows that they are mainly represented by hydraulic, mechanical and electromagnetic components. In the vibration spectrum of the units of the hydraulic unit, both low frequencies and high-frequency vibrations are observed. Sources of such a wide range and intensity of vibration are turbulent water flow, cavitation processes, friction processes in bearings, blade and main rotational speeds of the hydraulic unit, imbalance and eccentricity of the shaft, uneven load of the hydraulic generator in phases, etc.

**Analysis methods**

To study the observed processes, a model is proposed that takes into account the relationship and the influence and interaction of parts of the equipment and external forces.

Numerical modeling of the process under study begins with the presentation of a fragment of the time series of the observed process and the selection of areas of interest on it [7-10]. The structure of the research algorithm is shown in Figure 2. The result of modeling is the search for characteristics of the vibration process that satisfy the researcher.



**Figure 2. The structure of the research algorithm**

To assess the current situation, we conduct a nonlinear recurrent analysis of the observed of coupled controlled system with the construction of recurrent diagrams [10-15]:

$$PD_{i,j}^{\varepsilon,m} = \theta(\varepsilon - \|x_i - x_j\|) / \eta, x \in R^m, i, j = \overline{1, N},$$

where  $N$  is the number of states under consideration;  $x_i$ ;  $\varepsilon$  - the size of the neighborhood of the point  $x$  at the moment  $i$ ;  $\|\cdot\|$  - norm;  $\theta(\cdot)$  - Heaviside function [11-13], [14]. Considering that the time of the first return of Poincare (First Poincare recurrence times, FPRs) corresponds to a recurrence diagram (Recurrence plot, RP) of a certain process, that is, FPRs (RP) or [16, 17]:

$$(FRPs) \sim (RPs)$$

Next, the most informative parameters of the system behavior are calculated, such as the Lyapunov exponents, fractional dimension, Tsallis entropy, stability indicator, etc. According to the results of the analysis of the constructed RDs, we search for areas that meet the objectives of the research by the criterion:

$$AI(\hat{x}, \hat{y}, \hat{z}) = \underset{def}{sum} \underset{sem}{inf} I / a3$$

where  $AI(\dots)$  is the area of interest, formed on the thesis of the selection of information in such a way that it is the most meaningful from the semantic point of view  $\underset{sem}{sup}$  and the minimum  $\underset{V}{inf}$  in terms of the amount of information;

$a3$  - adequately  $AI$  taking into account reflexivity [16, 17], while taking into account that the measure of recurrence:

$$RR = \frac{I}{N^2} \sum_{i,j=1}^N R_{i,j}^{\varepsilon,m}$$

represents the probability of repeating trajectories when implementing a mapping

$$I(\dots) \Rightarrow C_{ref}(\eta)$$

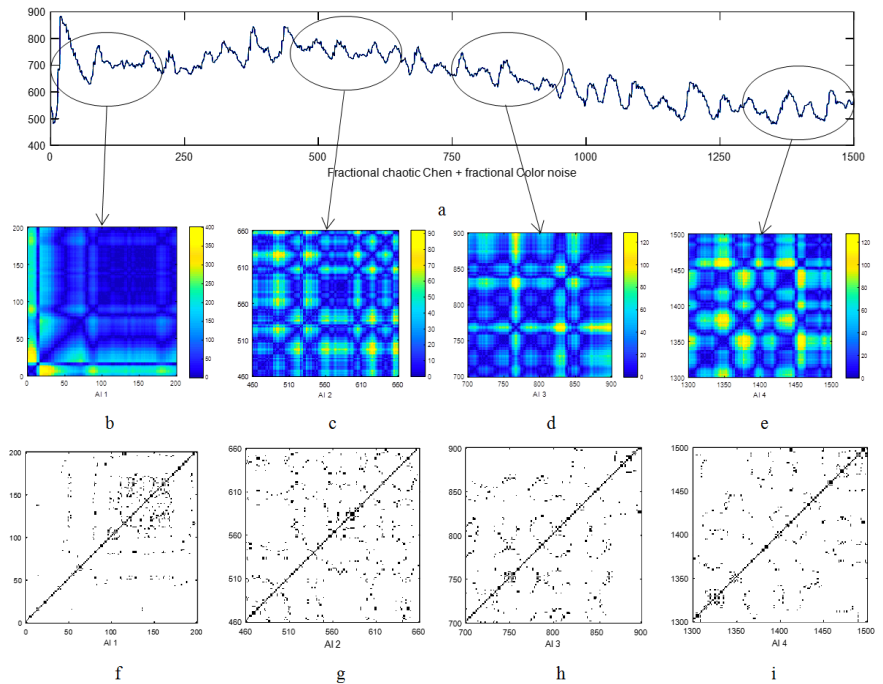
The next stage of research is associated with the calculation of informative parameters of the studied signals, their visualization and decision-making on the relevance of the effects and the choice of the type of impact. The structure shown in Figure 2 illustrates examples from a library of acting functions. It is known that systems with chaotic dynamics demonstrate high sensitivity to disturbing influences that are insignificant in intensity and time. In our case, the following functions were used as impacting functions: Levy flight, Chimera states, Color noise, Jerk, Anti-synchronization and others.

**Results of experimental numerical modeling**

Using the example of a complex signal of the fractional multidimensional Chen system, we will simulate the interactions with the wideband Color noise signal in the selected areas [18-21].

Along with calculating the parameters of control and measuring information, nonlinear recurrent analysis of the selected areas allows you to visually assess its dynamics.

The results of modeling the process of controlling the behavior of the system under study are shown on the example of Figure 3.



**Figure 3. Modeling of spatio-temporal analysis on the example of the selected areas of interest of the signal of the fractional Chen system, which are affected by the signal - Color noise: a - time series of the fractional Chen system; b, c, d, e - distance matrix; f, g, h, i - recurrent plots of the selected corresponding areas.**

To increase the efficiency of the analysis and estimate the parameters of the dynamics of the system under study and its signals, it is proposed

to use visual images of nonlinear recurrent analysis - recurrent plots. Possessing a high visual information content in the form of texture, topology and color palette of the points of the orbits of the process distributed in the phase space, recurrent plots can speed up the assessment of dynamics, trend and identification of hidden patterns. Informative visualization, along with the assessment of the calculated process parameters, will increase the efficiency of the analysis, make the correct and reasoned decision on the development of a control strategy and the choice of the type of acting forces.

### **Conclusion**

The report is devoted to the analysis, research and control of the dynamic of multidimensional vibration processes in complex technical systems. The analysis of vibration sources of the technical system and their influence on the dynamics and behavior of the controlled object is carried out. A model of a complex technical system is presented, on the basis of which methods for controlling vibration processes are demonstrated.

The article discusses examples of impacts on ongoing processes in order to obtain characteristics that meet the requirements of management.

The use of visual analysis based on the characteristic features of recurrent diagrams, in addition to traditional control methods, will enrich the arsenal of research tools and methods for assessing the situation and making the right decision on its management.

### **Research funding**

The work was carried out by the author as part of his scientific research and was not funded by grants or third-party sponsorship.

### **References**

1. Amevi Acakpovi, Essel Ben Hagan, Francois Xavier Fifatin. Review of Hydropower Plant Models. International Journal of Computer Applications (0975 – 8887) Volume 108 – No 18, December 2014. <http://dx.doi.org/10.5120/19014-0541>
2. Rati Kanta Mohanta, Thanga Raj Chelliah, Srikanth Allamsetty, Aparna Akula, Ripul Ghosh. Sources of vibration and their treatment in hydro power stations-A review. Engineering Science and Technology, an International Journal. 2016, 12p. <http://dx.doi.org/10.1016/j.jestch.2016.11.004>

3. Jijian Lian, Hongzhen Wang and Haijun Wang. Study on Vibration Transmission among Units in Underground Powerhouse of a Hydropower Station. *Energies* 2018, 11, 3015. 22p. <http://dx.doi.org/10.3390/en11113015>

4. Mechanical Vibration Monitoring. IRIS Power. <https://irispower.com/monitoring/mechanical-vibration-monitoring/>

5. Mohamad Hazwan Mohd Ghazali and Wan Rahiman. Vibration Analysis for Machine Monitoring and Diagnosis: A Systematic Review. *Hindawi. Shock and Vibration*. Volume 2021, 25 p. <https://doi.org/10.1155/2021/9469318>

6. Ismailov B.I. Analysis and Control of Dynamic Processes in Mechanical Parts of Power Equipment. *International Journal of Mechanical and Production Engineering Research and Development (IJMPERD)*. Vol.8, Issue 5, 2018. Pp. 347-352. <http://dx.doi.org/10.24247/ijmperdoct201839>

7. Ismailov B.I. Numerical methods of control the hidden oscillations of fractional-order chaotic systems. *Journal of Multidisciplinary Engineering Science and Technology (JMEST)*. Vol.3 Issue8, 2016. Pp.5490-5494. <https://www.semanticscholar.org/paper/Numerical-methods-of-control-the-hidden-of-chaotic-Israfil/9e0b7f0e4d0557f3e9b53fcf14a24b7cd7c0c3cb>

8. Ismailov B.I. Control of the dynamics of a complex system. *Eurasian Union of Scientists*. №12(69). 2019. Pp. 6-11. <http://dx.doi.org/10.31618/ESU.2413-9335.2019.5.69.498>

9. Ismailov B.I. Simulation of Influences on the Dynamics of Transitional and Recurrent Processes of Complex Technical Systems. *International Journal of Innovative Technology and Exploring Engineering (IJITEE)*, Volume-9 Issue-1, 2019. Pp. 4929-4932. <http://dx.doi.org/10.35940/ijitee.A8116.119119>

10. Vladimirsky E.I., Ismailov B.I. Transient and recurrence processes in open system. *International Journal of Advanced and Applied Sciences (IJAAS)*, 4(10) 2017, pp.106-115. <https://doi.org/10.21833/ijaas.2017.010.015>

11. Eckmann J.P., Kamphorst S.O., Ruelle D., Recurrence Plots of Dynamical Systems. // *Europhysics Letters*, 4. – 1987. – Pp. 973-977. <https://iopscience.iop.org/article/10.1209/0295-5075/4/9/004/meta>

12. Packard N.H., Crutchfield J.P., Farmer J.D., Shaw R.S. Geometry from a time series. // *Physical Review Letters*. Vol. 45, №:9, 1980. Pp. 712-716. <http://dx.doi.org/10.1103/PhysRevLett.45.712>

13. Varandas P. Entropy and Poincare Recurrence from a Geometrical Viewpoint. *Nonlinearity*. Vol. 22, №:10. 2009. 2365. <http://dx.doi.org/10.1088/0951-7715/22/10/003>

14. Thiel M, Romano M C, Read P L and Kurths J 2004 Estimation of dynamical invariants without embedding by recurrence plots. *Chaos* 14 234-243. <https://dx.doi.org/10.1063/1.1667633>
15. Bedartha Goswami. A Brief Introduction to Nonlinear Time Series Analysis and Recurrence Plots. *Vibration* 2019, 2, pp. 332–368. <http://dx.doi.org/10.3390/vibration2040021>
16. Vladimírsky E.I., Ismailov B.I. Synergetic methods of control of chaotic systems. Baku, "ELM" 2011. 240 P. <https://sng1lib.org/book/3198414/966b89?id=3198414&secret=966b89>
17. Vladimírsky E.I. Poincaré returns time in the interaction of chaotic and stochastic systems. *Eastern-European Journal of Enterprise Technologies*. №6/4 (60). 2012. Pp. 4-8. <https://doi.org/10.15587/1729-4061.2012.5673>
18. Chunguang Li, Guanrong Chen. Chaos in the fractional Chen system and its control. *Chaos, solitons & fractals*. 22 (2004), pp. 549-554. <http://dx.doi.org/10.1016/i.chaos.2004.02.035>
19. Christoph Holst and Hans Neuner. Spatio-Temporal Models for Vibration Monitoring of Elongated Structures Using Profile Laser Scans. *Remote Sens*. 2021,13, 1369. <https://doi.org/10.3390/rs13071369>
20. Ismailov B.I. Poincaré recurrence in open systems. *Journal of Multidisciplinary Engineering Science and Technology (JMEST)*. Vol. 3 Issue 9, 2016. Pp. 5565-5569. <http://www.jmest.org/wp-content/uploads/JMESTN42351773.pdf>
21. Ismailov B.I. Nonlinear recurrent analysis in signal processing problems. *Sciences of Europe*. Vol. 1, № 45. 2019. Pp.16-21. <https://cyberleninka.ru/article/n/nonlinear-recurrent-analysis-in-signal-processing-problems>



DOI 10.34660/INF.2022.99.84.030

UDC 681.518

**QUANTITATIVE AND QUALITATIVE ANALYSIS OF THE  
TERMINOLOGICAL DICTIONARY OF CONSTRUCTION AND  
PRODUCTION PROCESSES AUTOMATION, LEXICAL UNITS  
INCLUDED IN IT**

**Lozhkin Nikolay Dmitrievich,**

student

Kaliningrad State Technical University

**Abstract.** The article analyzes the typology of the dictionary and its parameters, which serve as the basis for the classification and description of the dictionary.

**Keywords:** Russian vocabulary, borrowed vocabulary, construction automation, automation of production processes.

In the course of the research, the author compiled a terminological dictionary for automation of construction and production processes, the total number of lexical units included in the dictionary is 9800. The full text of the dictionary is available at the links: [https:// slovar-avt.ru](https://slovar-avt.ru), [https:// slovar-avt.slovaronline.com/](https://slovar-avt.slovaronline.com/).

The terminological dictionary of automation and production processes construction is an electronic information resource that allows you to store and systematize the existing terminology in the field of construction automation, production processes and design. It is designed for a wide range of professionals, teachers, students, translators, including people for whom Russian is not their native language. At the same time, the vocabulary did not include lexical units that were recently actively used, but are now gradually falling into disuse due to changes in construction technologies and production processes.

It should be noted that almost half of the lexical units from the vocabulary are not words, but phrases (access administrator, curvature galvanometer).

About half of the studied words are used to denote the technical side of construction automation (rigid division into sectors), and the other half to denote the technical side of production processes in general (administrative and technical personnel, maintenance personnel).

As a result of the creation of the dictionary, it was completed. Quantitative and qualitative analysis was carried out in accordance with the following criteria:

- the ratio of Russian and borrowed lexicon;
- the ratio of common and narrowly professional words;
- the ratio of words that are used in other areas of activity and words that are used only in the automation of construction and production processes;
- the ratio of complex and simple words.

**Table 1.**  
**The ratio of Russian and borrowed lexicon**

	Share in %	Examples
Russian lexicon	20%	<i>Gait period, revision, contact gap</i>
Borrowed lexicon	80%	<i>Display, range, drift</i>

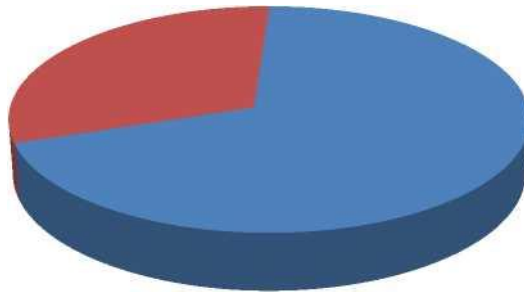
The table shows that borrowed words prevail. At the same time, the vocabulary included, in the main, not Anglicisms, but loanwords from the Greek and Latin languages. The majority of Russian speakers believe that they are native Russian words. These words have been firmly become a part of the Russian language (geometry, function) a long time before. It should be noted that anglicisms were less common (exception is a *driver, a frame*). This is because the sphere of construction and automation of production processes is characterized by a certain conservatism.



**Figure 1.** The ratio of borrowed and native Russian words in the dictionary

**Table 2.**  
**The ratio of common and restricted professional words**

	Share in %	Examples
Common vocabulary	70%	Geometry, gauge, function, personnel
Restricted professional vocabulary	30%	Saddle, agricultural sensor



Common vocabulary  
Restricted professional vocabulary

**Figure 2. The ratio of common and restricted professional vocabulary**

The overwhelming majority of words are known to a wide audience and more likely they are included into the category of common words than in the category of restricted specialized vocabulary. The words "function", "personnel", "range" are used both in the professional circle and by a wide audience.

Also in the course of the analysis, it was found that most of the professional vocabulary is used not only in the field of construction and production automation, but also in other related areas of human activity, for example: "display", "server", "array". Only a small number of words are associated with the specific features of construction and production processes automation. All of the above features allow us to draw a conclusion about the originality of professional vocabulary.

**Conclusion**

Thus, the following conclusions can be drawn based on the above.

Vocabulary is a collection of words of a particular language, a part of a language. It is the central part of the language, naming, forming and transmitting knowledge about any objects, phenomena.

As a vocabulary of a language, vocabulary consists of lexical units-words and phraseological units (stable phrases).

The word, in turn, is the basic unit of language. It can act as a complex response. So, in this case, a person expresses his/her own thoughts in his/her speech. And also, the word can be represented by a complex stimulus. In this case, it is understood and perceived by a person orally or in written form. In addition, the word has a graphic and sound form.

The graphic side allows you to recognize the word while reading and use it correctly in written form. To master a word means to master its meaning, form (sound and graphic), to be able to use it in context.

Professionalisms in the Russian language are divided into two groups - lexical and semantic. In lexical professionalism, the whole word is a term, and in semantic professionalism, only one of the meanings is special.

Professional vocabulary includes words that are used to name concepts from a specific field of knowledge, while the content of these words is known only to single-discipline specialists. It should be noted that there is a differentiation between the concepts of special and professional vocabulary. Special vocabulary is a broader concept, it covers not only restricted professional terms, but also terms related to social sciences, for example, terms related to philosophy. In this case, only restricted professional concepts, for example, from the field of mathematics, medicine or linguistics, are referred to the sphere of professional vocabulary.

Restricted professional vocabulary is specific in its meaning, because it has a connection not with everyday concepts, but with the concepts of their professional activity, which was proved in the process of empirical study - compiling a dictionary.



*Scientific publication*

**International Conference  
“Process Management and Scientific Developments”**

Birmingham, United Kingdom  
(Novotel Birmingham Centre, January 12, 2022)

Signed in print 18.01.2022. 60x84/16.  
Ed. No. 1. Circulation of 500 copies.  
Scientific publishing house Infinity, 2022.