

ARTICLES

Agricultural sciences

EFFECT OF ZINC CONTAMINATED SOIL ON THE SEEDS PROGENY ABOUT BARLEY

Vasilyev D.V. 3*Economical sciences*

ECONOMIC UNIVERSITY'S STUDENTS' ENTREPRENEURIAL INTENTIONS ANALYSIS

Danielyan A.G. 7

DIGITAL TRANSFORMATION OF BANKING SERVICES IN RUSSIA

Etembekov R.K. 13*Philosophical sciences*

PROFESSIONAL SELF-DETERMINATION OF PERSONALITY IN THE PERIOD OF TECHNOLOGIZATION OF SOCIETY

Kuznetsova A.Ya. 19*Geographical sciences*

DISABLED CHILDREN AND EDUCATION FOR SUSTAINABLE DEVELOPMENT

Bufalova M.A., Savvateeva O.A. 24*Medical sciences*

CLINICAL AND MORPHOLOGICAL FEATURES OF GLIOBLASTOMAS

Alaverdyan A.E., Volkova L.V. 28

ROLE OF HUMAN PAPILLOMAVIRUS IN CARCINOGENESIS OF DIGESTIVE TRACT

Reva G.V., Tolmachev V.E., Dynda Yu.V., Kim A.R. 33

RESULTS OF A MULTICENTER STUDY OF THE REASONS FOR THE TRANSFER OF 1-YEAR-OLD CHILDREN FROM BREASTFEEDING TO OTHER TYPES OF NUTRITION

Shtykova O.N., Legonkova T.I., Bobrick M.N., Kuzmenok E.A., Budina D.V. 38*Pedagogical sciences*

EFFECTIVE ORGANIZATION OF THE EDUCATIONAL PROCESS AS ONE OF THE MOST TOPICAL ISSUES IN THE MODERN TEACHING METHODS OF FOREIGN LANGUAGES

An Y.D., Zhdanova E.A., Alken S.H., Rakhmetova G.Sh. 43

TECHNOLOGIES FOR FORMING PROFESSIONALLY IMPORTANT QUALITIES IN FULL MILITARY-SPECIAL TRAINING OF FUTURE OFFICERS

Popova Yu.N., Mukhtarov S.A., Kuznetsov A.A., Blazomirskaya A.I. 47

NON-CLASSICAL PROBABILISTIC-STATISTICAL METHOD OF SCIENTIFIC RESEARCH AND ITS APPLICATION IN PEDAGOGY

Romanov V.P., Shiryayeva N.A. 52

**МАТЕРИАЛЫ XIII МЕЖДУНАРОДНОЙ СТУДЕНЧЕСКОЙ НАУЧНОЙ КОНФЕРЕНЦИИ
«СТУДЕНЧЕСКИЙ НАУЧНЫЙ ФОРУМ 2021»**

Медицинские науки

ЭФИРНЫЕ МАСЛА В ТЕРАПИИ ОНКОЛОГИЧЕСКИХ ЗАБОЛЕВАНИЙ,
ВОЗМОЖНЫЕ БИОХИМИЧЕСКИЕ МЕХАНИЗМЫ

Ихсанова А.И., Князева О.А. 57

РОЛЬ ГЕНЕТИЧЕСКИХ МАРКЕРОВ В ПАТОГЕНЕЗЕ АРТЕРИАЛЬНОЙ ГИПЕРТЕНЗИИ

Чазова Д.А., Сивакова Л.В. 62

Технические науки

МЕТОД И ПЕРЕНОСНОЙ КОМПЛЕКС ЭКСПРЕСС-АНАЛИЗА БУТИЛИРОВАННОЙ ВОДЫ

Мартынов В.В., Белозеров В.В. 66

Экономические науки

ОСОБЕННОСТИ УПРАВЛЕНИЯ КАПИТАЛОМ КОМПАНИИ В ПЕРИОД
ЭКОНОМИЧЕСКОГО КРИЗИСА И ИСПОЛЬЗОВАНИЕ ИНСТРУМЕНТОВ УПРАВЛЕНИЯ
ДЕНЕЖНЫМИ СРЕДСТВАМИ НА РАСЧЕТНЫХ СЧЕТАХ КРУПНЫХ КОМПАНИЙ

Батуриная О.А., Лунина Т.А. 72

КАЗНАЧЕЙСКИЙ КОНТРОЛЬ И ИТ – СИСТЕМЫ В УПРАВЛЕНИИ ФИНАНСАМИ
ТРАНСПОРТНОГО ХОЛДИНГА

Галтер В.В., Фомина Н.К. 77

ПУТИ ПОВЫШЕНИЯ ЭФФЕКТИВНОСТИ УПРАВЛЕНИЯ ИНВЕСТИЦИОННО-
СТРОИТЕЛЬНЫМИ ПРОЕКТАМИ НА ПРИМЕРЕ СТРУКТУРНОГО ПОДРАЗДЕЛЕНИЯ
ДИРЕКЦИИ ПО СТРОИТЕЛЬСТВУ СЕТЕЙ СВЯЗИ – ФИЛИАЛА ОАО «РЖД»

Яковлева Е.В., Никонова Я.И. 83

ARTICLES

EFFECT OF ZINC CONTAMINATED SOIL ON THE SEEDS PROGENY ABOUT BARLEY

Vasilyev D.V.

Russian Institute of Agricultural Radiology and Agroecology, Obninsk, e-mail: treworqwert@mail.ru

The rapid accumulation of heavy metals in fertile soils leads to a decrease in productivity and a deterioration in the properties of agricultural products and even a deterioration in the microbiological activity of soils. Zinc is both an important trace element, as well as a very toxic substance for plants, which quickly accumulates both in the soil and in the plants themselves. Although the direct effect of elevated soil zinc concentrations on plants is well understood, little is known about its effect on seedlings of plants. This work shows that increased Zn concentrations in soils can have a negative effect on the quality of barley seed progeny – reduce the mitotic activity of cells and increase the frequency of mitotic abnormalities in seedlings, which reduces the quality of the seed. But since zinc is also a biologically important element necessary for the normal growth and development of plants, its microconcentrations in the soil contribute to a significant increase in the germination energy of seeds grown on these soils of plants and thereby increase their quality. The greatest influence of zinc on the quality properties of seeds and the frequency of mitotic anomalies in their seedlings is observed on sod-podzolic soils.

Keywords: zinc, barley, mitotic anomalies, vegetation, seed quality

Soil pollution with HM is a serious and global environmental problem [1, 2], posing a very serious threat to the stability of the yields and the quality of crop products. It is necessary to determine the reliability of plant protection against the harmful effects of heavy metals (HM) not only by the growth characteristics and the process of development of the plants themselves, but also by the quality of their offspring, since this is one of the most significant indicators of the stability of populations. But, unfortunately, now the number of detailed laboratory studies impact research of HMs on plant offspring is very small. This led to the fact that there is no clear understanding of how dangerous heavy metals are for the second generation of plants and for the stability of populations. Of course, there are many field studies of the influence of HM on seed offspring, but in such studies it is difficult to isolate and quantify the influence of one particular factor. Among HMs, Zn is considered one of the most dangerous pollutants for agriculture because of its high rate of accumulation in soils and then in plants [1]. Although Zn is an important microelement for plants, in high toxic concentrations it inhibits plant growth and development and thereby significantly reduces the yield and quality of seeds, which makes the determination of optimal as well as maximum permissible concentrations of zinc in the environment a very urgent agrochemical task. Indicators based on the study of growth processes and mitotic anomalies are widely and effectively used to assess the effect of heavy metals on plant organisms. A decrease in the intensity of plant development processes is considered a very important criterion for assessing the risk of exposure to HM. Methods for analyzing mitotic anomalies in plants are considered to be the

most suitable for assessing the mutagenic risk of HM. [3]. They give reliable and well-reproducible results in experiments, and also make it possible to detect unfavorable processes at the early stages of the development of plant reactions to an unfavorable effect. In this regard, the determination of the regularities of the appearance of mitotic anomalies and changes in the intensity of growth and development of plants with soil contamination with heavy metals is a very important stage of research, providing information necessary for substantiating and making decisions on environmental issues and agricultural problems.

The presented work is devoted to the assessment of the qualitative characteristics of seeds obtained from plants grown on soils with different levels of contamination with zinc nitrate.

Materials and research methods

Studied the germination and abnormalities of mitosis in the cells of the apical meristem of seedlings of seed progeny of barley (*Hordeum vulgare* L., cultivar Zazersky 85) obtained in a vegetation experiment on three types of soils with different degrees of zinc contamination: 1) cultivated sandy loam sod-podzolic soil (25 50 100 150 and 250 mg/kg air dry soil); 2) typical heavy loamy chernozem (50, 100, 250, 500 and 750 mg/kg air dry soil); 3) boggy lowland peat (250, 500 and 1000 mg/kg air dry soil). The seeds were germinated in a thermostat (21 °C) in Petri dishes on filter paper moistened with distilled water.

In the process of germination, their germination energy was determined on the third day after soaking the seeds. Seed shoots 1–1.5 cm long were fixed in acetoalcohol to fix the cells during the first mitoses. The squashed preparations were stained with acetoorcein. In the

preparations, the number of dividing cells and the number of cells with mitotic abnormalities were counted (on average, 3-6 thousand anaphases were analyzed for each variant). When analyzing the spectrum of disorders, chromatid (single), chromosomal (double) bridges and fragments, multipolar mitoses, and chromosome lagging were identified. The preparations were examined using Nikon Eclipse 55i and Nikon Eclipse E200 microscopes. Complex (unrecognizable) anomalies were excluded from the analysis. This is bind to the fact that aberrations formed in the vegetative phase (before flowering) were later lost during meiosis and only symmetrical inversions and translocations could be preserved. The activity of the process of cell division of the embryonic meristem of seeds was assessed by the mitotic index (MI%). For this purpose, the number of mitoses was recorded in all prepared preparations. The mitotic index (MI) is calculated by the formula: $MI = ((T + A + M + P) / (I + T + A + M + P)) * 100$, where: T is the number of dividing cells at the telophase stage; A is the number of dividing cells in anaphase; M is the number of dividing cells at the metaphase stage; P is the number of dividing cells at

the prophase stage; I is the number of dividing cells in the interphase. The data obtained in the experiment were statistically analyzed in MS Excel. The method [4] was used to determine the sample size required to obtain statistically significant results. A check was carried out for emissions excluded from further consideration. The significance of differences between the samples was determined using the Student's test.

Research results and discussion

Reducing the viability of offspring is a very important and extremely dangerous consequence of exposure to heavy metals for plant populations reducing. It manifests itself in the morphological and physiological parameters of seeds. One of these indicators is the seed germination energy. It was found that the germination energy of barley seeds obtained from plants grown on soils contaminated with zinc nitrate tends to decrease with an increase in metal concentration in all studied soils ($r = 0.51-0.59$). However, at the same time, a low concentration of metal (25-250 mg / kg of dry air in the soil) is able to increase seed germination (Fig. 1).

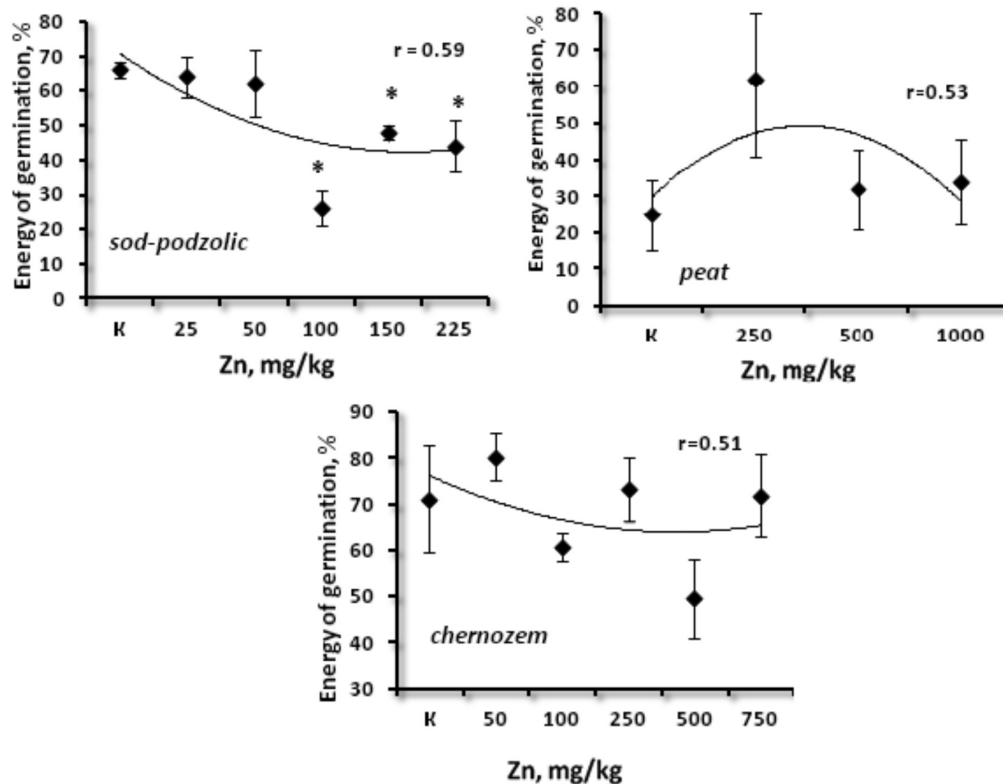


Fig. 1. Energy of germination of barley seeds.

Note. * – the difference is statistically significant from the control

The growth of seed germination is statistically significant on sod-podzolic and peat soils. Since zinc is a trace element necessary for oxidative and metabolic processes, the synthesis of enzymes, proteins, chlorophyll, the functioning of hereditary mechanisms for the formation of generative organs and seeds [5, 6], then insignificant levels of soil contamination can increase the germination of the resulting seed offspring. Only the excess of a certain critical level established for each plant species makes Zn toxic for them. Since the availability of zinc for plants depends on the properties of the soil, due to the high acidity, low volumes of cation exchange and the supply of humus in the seed progeny of barley obtained on sod-podzolic soil, a decrease in germination occurs with a significantly lower content of zinc.

The very first biological effects of soil contamination with HM can be found at the cellular level of organization. This was confirmed by the results of this study. The use of the method of cytogenetic analysis made it possible to reveal a statistically significant increase in the number of cytogenetic anomalies in seedlings obtained on soddy podzolic soil and chernozem. Seeds obtained on peat soils showed a tendency to an increase in the frequency of cytogenetic anomalies (Fig. 2). An increase in the frequency of anomalies in the cells of barley seedlings obtained on soddy-podzolic soils be-

gins at significantly lower zinc concentrations than in peatlands or chernozems, since zinc is more available for plants [5].

Despite the fact that for toxicants, as a rule, there are no specific abnormalities of mitosis, which would not have been observed and without their influence in control, it is still generally accepted that heavy metals, including Zn, are able to induce genomic disorders to a greater extent [5]. The results obtained in this study confirm this opinion. In support of this, analysis of the spectrum of mitotic anomalies detected in the course of the study showed a tendency towards an increase in the frequency of genomic disorders [7].

Therefore the increased Zn concentration in soils and its high accumulation in plant seeds promote the growth of mutations in the resulting barley progeny.

TM, and especially zinc, also has the can reduce the rate of cell division; due to this, the degree of their toxicity can also be assessed by determining the mitotic index. Therefore, in barley seedlings during the study, the activity of mitotic cell division was assessed. A decrease in the frequency of mitotic cell division was statistically significant in barley seedlings obtained on sod-podzolic soil containing 225 mg of zinc nitrate per 1 kg (Fig. 3). In seedlings of seeds obtained on other soils, the mitotic activity of cells did not depend on the concentration of zinc.

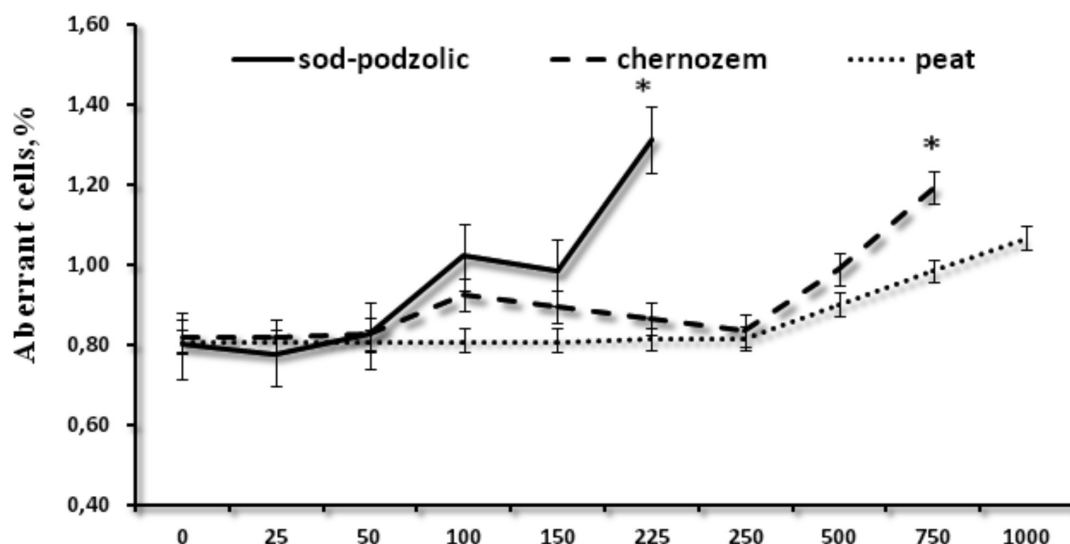


Fig. 2. Frequency of occurrence of mitotic anomalies in the cells of the root meristem of barley seedlings.
* – the difference is statistically significant from the control

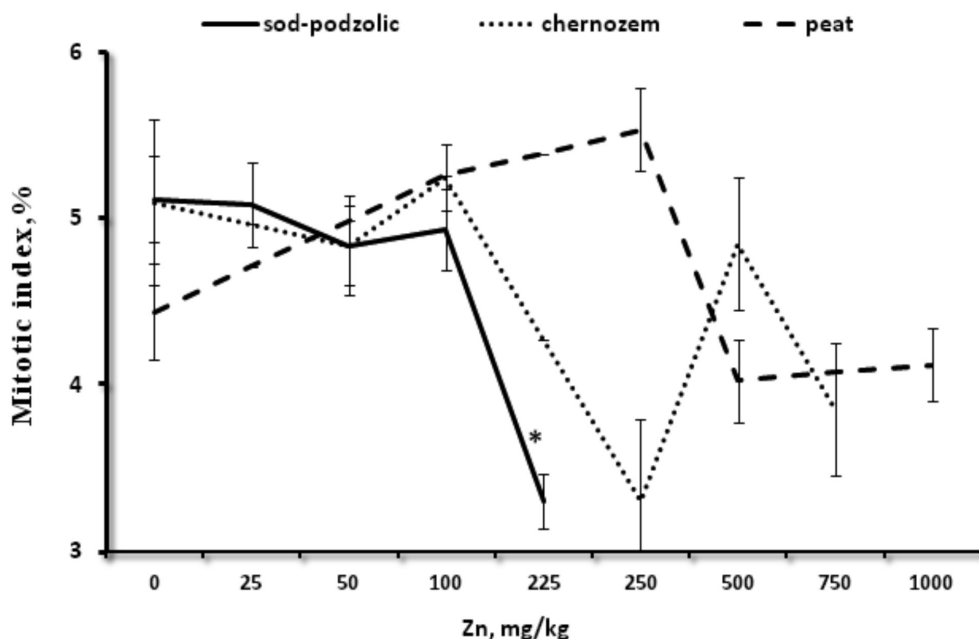


Fig. 3. Activity of mitotic division of cells of the root meristem of barley seedlings.

* – the difference is statistically significant from the control

Conclusion

Based on the results obtained, it can be said that small concentrations of zinc in the soils on which the barley crop was obtained have a positive effect on the germination of the seeds obtained. High concentrations can reduce seed germination, have a mutagenic effect on seed progeny, and reduce the mitotic activity of the cells of the root meristem. The toxic effect of zinc on barley seedlings depends on the type and agrochemical properties of the soil on which the crop was obtained.

References

1. Ilyin V.B. Heavy metals in the soil – plant system. Novosibirsk: Science. Sib. branch, 1991. 151 p.
2. Villiers F., Ducruix C., Hugouvioux V. et al. Investigating the plant response to cadmium exposure by proteomic and

metabolomic approaches // *Proteomics*. 2011. V. 11. P. 1650–1663. DOI: 10.1002/pmic.201000645.

3. Evseeva T.I., Geraskin S.A., Vakhrusheva O.M. Assessment of the contribution of radiation and chemical factors to the formation of biological effects in the mouse pea population from the territory of storage of radium production wastes (Vodny settlement, Komi Republic) // *Radiation biology. Radioecology*. 2014. T. 54. No. 1. P. 85–96. DOI: 10.7868/s0869803114010068.

4. Lemesko B.Yu., Gorbunova A.A., Lemesko S.B., Postovalov S.N., Rogozhnikov A.P., Chimitova E.V. Computer modeling and investigation of probabilistic laws. // *Bulletin of the Tomsk State University*. 2013. No. 1 (22). P. 74–85. DOI: 10.18799/24131830/2020/9/2806.

5. Micieta K., Murin G. Three species of genus *Pinus* suitable as bioindicators of polluted environment // *Water, Air, Soil Pollution*. 1998. V. 104. P. 413–422.

6. Titov A.F., Kaznina N.M., Talanova V.V. Heavy metals and plants. Petrozavodsk: Karelian Scientific Center of RAS, 2014. 194 p. DOI: 10.31857/s0044459620020086.

7. Vasiliev D.V., Anisimov V.S., Anisimova L.N., Frigidova L.M. Zinc delivery into barley plants on different types of soils and its influence on the quality of harvest seeds. *Trends in the development of science and education*. 2019. No. 50-3. P. 51–57. DOI: 10.18411/lj-05-2019-53.

ECONOMIC UNIVERSITY'S STUDENTS' ENTREPRENEURIAL INTENTIONS ANALYSIS

Danielyan A.G.

*National Research University Higher School of Economics, Moscow,
e-mail: artem_danielyan.1999@mail.ru*

In this paper the entrepreneurial intentions and attitudes of HSE students studying entrepreneurial disciplines – “Faculty of Business and Management” and an optional subject “Startup from scratch: the practice of business creating”, “Department of Innovation Management” were studied. During the study, a comparative analysis was carried out with the results of a similar study conducted in the city of Yaroslavl in 2017 among students of different faculties. The respondents were divided into 2 groups depending on their gender. It was hypothesized that the results of the study would differ from the results of the compared study, which was ultimately confirmed – most current respondents have a positive attitude to entrepreneurship and expressed a desire to do business. The main conclusion of the study is that the financial situation of the family, the attitude of the “social field” and the university environment together play a decisive role in the student’s attitude to entrepreneurship and entrepreneurial intentions. Gender differences were revealed – despite the identical manifestation of the identified key factors, male students are more decisive and more inclined to long-term planning than female students.

Keywords: entrepreneurship, entrepreneurial intentions, gender differences, business education, students’ entrepreneurial intentions

Under the influence of constant improvement of technology and automation of production, more and more citizens have concerns about their employment. According to the results of an analytical study by the Levada Center, the unemployment expectation index of Russians at the end of 2019 was the lowest in the 21st century – 62/100 as of September 2019 (latest data), not counting the post-crisis period of 2008, when the index fell to 27 / 100 (the lower the unemployment index, the higher the fear of unemployment) [1].

This problematic situation is exacerbated by the rise in technological unemployment during the growth of cyclical and international labor migration, which leads to a decrease in labor costs. To solve the problems of the tax burden of the budget, for example, in the form of a reduction in the volume of payments of benefits, collection of taxes due to the creation of new jobs, social upheavals, the quality and standard of living in the country and conditions for the realization of individuals, the state is constantly developing programs to support small and medium-sized businesses. Regional authorities are developing similar programs to support small and medium-sized businesses throughout Russia. There is an expert opinion that most of the population of the Russian Federation is financially illiterate, and they are characterized by a tendency to short-term planning. Even students are not an exception [2; 3].

Students have more time and opportunities to master financial aspects, because in Russia professional financial education begins at universities. To develop the level of entrepreneurship, it is first necessary to understand the entrepreneurial intentions of students and the factors affecting these intentions, since in this

status people are determined with their plans for life. Considering the research results showing the presence of certain gender differences in the entrepreneurial intentions of students in general, the purpose of the study was formulated as identifying the specifics of gender differences in the entrepreneurial intentions of students at an economic university. To achieve the goal, the following tasks were set:

1. Study similar research with students at non-economic universities
2. Conduct a survey among students at an economic university
3. Analyze research results and compare with research results
4. Summarize the research results and draw conclusions

As part of the research, a survey was conducted regarding the entrepreneurial intentions of HSE students and their attitude to this type of activity. The peculiarities of perception of entrepreneurial activity of students depending on gender were studied, general patterns and differences were revealed.

Materials and research methods

A cross-national 2012 study was studied by several researchers – Dabic Marina, Daim Tugrul, Bayraktaroglu Elvan, Novak Ivan, Basic Maja [4], which investigated gender differences in entrepreneurial intentions of students from more than 10 countries, with a total sample of 4000 students. The same researchers, already incomplete – Tugrul Daim, Marina Dabic, Elvan Bayraktaroglu, conducted a similar study in 2016, with a total sample of 4281 students [5]. Research results show that there are gender differences in student entrepreneurial intentions. These differences vary

from country to country, but to some extent they exist everywhere. Overall, female students are less likely to have entrepreneurial intentions because they are less self-confident and more stressful about entrepreneurship than male students. In Russia, a similar study was carried out by S.L. Talanov and A.A. Hajibabayeva in 2019 in the city of Yaroslavl, the results of which also indicate gender differences among students regarding entrepreneurial intentions [2]. A 2015 study by G.V. Shirokova, T.V. Tsukanova and K.A. Bogatyreva is aimed at studying the key factors influencing the entrepreneurial intentions of students, among the key factors indicated personal motives, university environment, family and socio-cultural context [6]. In terms of the university environment, it is said that more than 60% of Russian students did not have courses related to entrepreneurship. It points to the lack of support for entrepreneurial intentions of students from universities and concludes that the institutional environment of Russian universities is non-entrepreneurial. This is how the object of this study differs significantly from the already studied one – even though it is also a group of students, this study is focused on students at an economic university, precisely those areas that are focused on business education – this is the “Faculty of Business and Management” and an elective course “Startup from scratch: the practice of business creating” “Department of innovation management” NRU HSE. The administration of the studied areas places great emphasis on the entrepreneurial institutional environment, including in the courses students disciplines with an entrepreneurial theme and encouraging the entrepreneurial intentions of students, which is facilitated by the presence of an actively functioning business incubator. In this research work, the object of the study was also divided into two groups by gender to identify differences in students depending on be-

longing to one of the groups, or, conversely, to show that there are no differences. Thus, given the significant difference in the institutional environment, this study was hypothesized that its results will differ from a specific similar study conducted by S.L. Talanov and A.A. Hajibabayeva in 2019 in the city of Yaroslavl, with another object – students at the Yaroslavl State Pedagogical University named after I.K.D. Ushinsky, Yaroslavl State University named after P.G. Demidov, Yaroslavl branch of the Russian University of Transport. The results of this research will be revealed along the way, by comparison with the ongoing one. During the study, a similar questionnaire was used to clarify the differences. 159 students were interviewed – 88 males and 71 females.

Research results and discussion

First, the personal characteristics of the respondents were analyzed, in contrast to the Yaroslavl survey, where the respondents described the personal characteristics of entrepreneurs, and not their own (See Table 1).

The results show that there are no gender differences in many the given characteristics, however, the men described themselves as people with a higher degree of risk appetite and with a higher self-esteem.

It was decided to find out the degree of involvement of the “social field” of the respondents in entrepreneurship, which P. Bourdieu describes as an environment of social relations, which include parents, brothers, sisters, friends and relatives. According to the theory of P. Bourdieu, expectations are formed considering the opportunities, in this case, for doing business, there is a need to have access to some capital, for example, through “social field” [7]. Therefore, it is important to clarify the entrepreneurial status of the respondents’ relatives, as well as the presence of entrepreneurs among friends (See Table 2).

Table 1

Personal characteristics of respondents, multiple choice, %

Characteristics	Men	Women
Willingness to take risks	69	39
Selfishness	11	14
High self-evaluation	38	22
Openness to novelty	75	70
Ability to defend own point of view	75	69
Long-term orientation when planning	59	54
Sociability	73	73
Sense of responsibility	84	83
Other	2	0

Table 2

Involvement of the “Social field” in entrepreneurship, multiple choice, %

Is engaged in business	Man	Women
Mother	24	20
Father	49	50
Brother	11	11
Sister	4	3
Male friend	37	34
Female friend	8	19
Acquaintance / relative	53	57
None of the acquaintances	18	11

Comparing with the results of the Yaroslavl survey it can be noted that the number of our respondents who have no acquaintances engaged in entrepreneurship is much less – 63 % of the men and 45 % of the women in the Yaroslavl sample do not have such acquaintances. The parents of our respondents are much more involved in entrepreneurship – in the Yaroslavl sample they are engaged in entrepreneurship: for men – 6 % of mothers and 8 % of fathers, for women – 8 % of mothers, 13 % of fathers. However, according to these indicators, gender differences are practically not observed, apart from the number of entrepreneurs among female friends, which are much higher among women.

Further, the respondents’ attitude to entrepreneurship was studied (see Table 3).

Table 3

Attitude of respondents to entrepreneurship, %

Attitude	Men	Women
Negative	0	0
Neutral	15	32
Positive	85	68

The results show that no one has a negative attitude towards entrepreneurship, in contrast to the Yaroslavl survey – 65 % of men and 23 % of women. It is also worth noting that in the other sample, only 19 % of men have a positive attitude to entrepreneurship, but the percentage of women who have a positive attitude is equal to the percentage of this study – 62 %. Thus, it can be seen that in current sample the percentage of men who have a positive attitude to entrepreneurship is much higher than the same percentage among women.

The next step was to study the attitude of the respondents’ parents to entrepreneurship (See Table 4).

Table 4

Attitude of parents of respondents to entrepreneurship, %

Attitude	Men	Women
Negative	4	5
Neutral	25	28
Positive	71	67

We see that there is a certain negative attitude towards entrepreneurship here, but it is incomparable with these indicators of the results of the Yaroslavl survey – 65 % of men and 32 % of women described their parents’ attitude to entrepreneurship as negative. Consequently, the percentage of respondents who described their parents’ attitude to entrepreneurship as positive also differ greatly – 14 % of men and 21 % of women. There are no gender differences in this sample.

Also, the attitude of the respondents’ friends to entrepreneurship was studied (See Table 5).

Table 5

Attitude of respondents’ friends to entrepreneurship, %

Attitude	Men	Women
Negative	3	0
Neutral	14	26
Positive	83	74

A similar picture emerges in this aspect, an insignificant percentage of only male students from present sample noted the negative attitude of their friends towards entrepreneurship, while a significant percentage of students from the Yaroslavl sample included their friends in this group – 60 % of men and 35 % of women. Relative to this sample, it can only be noted a slight preponderance of the percentage of male students whose friends have a positive attitude towards entrepreneurship.

Further, the financial situation of the students of current sample was analyzed (See Table 6).

The results of the comparative analysis show that the material situation of the students in this sample is much better than that of the comparable one. Combining the first three categories and designating them as low-income families, it turns out that 29% of men and 40% of women in the Yaroslavl sample attribute themselves to this group, while in present sample this indicator is only 10% among male and 2% among female respondents. 29% of the men in the compared sample said that the family income is enough for current expenses, but not enough for a new apartment, and in this category this indicator exceeds the given indicator of this study (25%), but, due to this, the percentage of men in our sample did not experiencing financial difficulties, significantly exceeds the same indicator of the compared study – 10%.

The opinion of students regarding the knowledge, skills and abilities required for studying entrepreneurship in universities was studied (See Table 7).

There is a certain difference from the compared study – students' opinions on the skills and abilities that need to be studied in universities were studied, and not actually studied in their universities. The skill of saving was the least noted by respondents of both sexes. A larger percentage of males believe that the

skills of independence, sociability, efficiency, prudence and flexibility of actions in changing circumstances should be studied in universities than females. On the other hand, a larger percentage of women than men believe that long-term financial planning skills and economics should be studied in universities. Most of all, students of both genders noted the importance of studying flexibility in action in changing circumstances, establishing contacts and prudence in calculating risks.

Further, the opinions of students regarding the factors that most hinder entrepreneurship were studied (See Table 8).

The results show that the first three factors related to personal abilities were much more often mentioned by students of the Yaroslavl sample – for males – 89%, 86% and 84%, for females – 88%, 39% and 80%, respectively. Also, it can be noted that almost any factor was more often mentioned among the students of the compared study, which was possible due to multiple choice. With regard to gender differences within present sample, it can be noted that male students significantly more often noted the problem of lack of necessary contacts, and female students more often noted the riskiness of entrepreneurship and the lack of support from the authorities. Most often, students of both genders noted the problem of lack of start-up capital and a high degree of risk.

Table 6

Financial situation of students, %

Characteristics	Men	Women
Family income is not enough for quality food	1	0
Family income is sufficient for current expenses, but not enough to buy new clothes	3	0
Family income is sufficient for current expenses, but not enough for the purchase of new household appliances	6	2
Family income is sufficient for current expenses, but not enough to buy a new car	38	47
Family income is sufficient for current expenses, but not enough to buy a new apartment	25	24
Material difficulties are not experienced	27	27

Table 7

Skills and knowledge required for study, multiple choice, %

Knowledge, skills, abilities	Men	Women
Independence	62	48
Sociability	65	53
Building contacts	75	78
Efficiency (rational implementation of ideas in life)	65	57
Flexibility to learn new things	58	60
Long term financial planning	51	62
Prudence in calculating risks	75	64
Economy	56	60
Flexibility in response to changing circumstances	84	78
Saving	18	11

Table 8

The factors that hinder entrepreneurship, multiple choice, %

Factor	Men	Women
Lack of necessary knowledge, skills and abilities	42	40
Lack of contacts	46	26
Lack of start-up capital	55	62
Big risks	45	61
High taxes	30	27
Lack of government support	25	34
Lack of prospects in the Russian Federation	20	17
Other	7	1

At the end, the career plans of the respondents were studied. The students had to answer the question who they want to become in the long term (See Table 9).

Table 9

Career plans of students, %

Answer	Men	Women
Salaried worker	4	13
Entrepreneur	58	32
Combination	27	29
Not clear yet	11	26

There is tremendous variation in student entrepreneurial and career plans. Most of the respondents in the Yaroslavl sample plan to be an employee – 86% of men and 80% of women. Among our sample, the results show that male respondents more often than females answered that they want to become an entrepreneur, and female respondents more often than males answered that they wanted to become employees or had not decided yet.

Conclusion

Summing up, the main differences between the compared studies were emphasized:

1. The percentage of present survey respondents who have acquaintances engaged in entrepreneurship, including parents and relatives, is much higher.

2. The percentage of this survey respondents who have a positive attitude towards entrepreneurship is much higher.

3. The percentage of respondents to current study whose parents and friends have a positive attitude towards entrepreneurship is much higher.

4. The financial situation of the families of respondents studied in this research is much better.

5. A smaller percentage of our respondents have a problem with business opportunities.

6. The percentage of respondents showing entrepreneurial intentions is much higher.

Taking into account the entire comparative analysis between this study, the object of which is a group of students at an economic university of curricula focused on business education, and the Yaroslavl study conducted in 2017, it was concluded that the hypothesis put forward at the beginning of the study about significant differences in the results of similar studies was confirmed.

In general, the results of the study show that most questioned respondents want to become entrepreneurs or combine entrepreneurship with work – 85 % of men and 61 % of women. This can be attributed to many factors. According to P. Bourdieu's theory, which has already been mentioned, this alignment can be explained by the specifics of the respondents' "social field", in which everyone has a positive or neutral attitude to entrepreneurship, which may entail a positive attitude towards entrepreneurship on the part of the respondents. On the other hand, according to the results of a 2015 study conducted by G.V. Shirokova, T.V. Tsukanova and K.A. Bogatyreva, who was also mentioned in the work, plays a big role in the university environment, which makes this sample different too – courses related to entrepreneurship are taught in the areas studied, and, in addition, there is a business incubator that competes with global business accelerators. Regarding the gender differences in entrepreneurial intentions of questioned respondents, the results show that male students are more inclined to take risks and are more determined than female students, 26 % of whom said they had not yet decided what they would do in the future.

References

1. Levada Center. [Electronic resource]. URL: <https://www.levada.ru/indikatory/> (date of access: 15.01.2021) (in Russian).
2. Talanov S.L., Hajibabaeva A.A. Entrepreneurship in the life plans of university students: gender differences // *Woman in the Russian community*. 2019. No. 1. P. 52-63 (in Russian).
3. Kudashov V.N., Talanov S.L. Features of economic socialization of university students // *Alma mater: (bulletin of the higher school)*. 2016. No. 6. P. 34-39 (in Russian).
4. Dabic M., Daim T., Bayraktaroglu E., Novak I., Basic M. Exploring gender differences in attitudes of university students towards entrepreneurship. An international survey // *International Journal of Gender and Entrepreneurship*. 2012. № 3. P. 316-336.
5. Daim T., Dabic M., Bayraktaroglu E. Students' entrepreneurial behavior: international and gender difference // *Journal of Innovation and Entrepreneurship*. 2016. № 19. P. 1-22.
6. Shirokova G.V., Tsukanova T.V., Bogatyreva K.A. Factors of Formation of Entrepreneurial Intentions of Russian Students // *Bulletin of Saint-Petersburg University. Management*. 2015. No. 3 (in Russian).
7. Modern social theory: Bourdieu, Giddens, Habermas. Novosibirsk: Novosibirsk Publishing House. University, 1995. 119 p. (in Russian).

DIGITAL TRANSFORMATION OF BANKING SERVICES IN RUSSIA

Etembekov R.K.

Financial University under the Government of RF, Moscow, e-mail: Hotline3773@gmail.com

In this article the author describes the process of digitalization of the banking services sector in Russia on the example of well-known Russian banks, problems and prospects for the development of digital banking in Russia at the present time, the author's point of view on the general process of digitalization of banks is given, a legal point of view on the process of digitalization is considered, the problem of cybercrime in modern Russia is assessed. At the moment, Russia is at the stage of active development of digital banking; the state is supporting banks on the path to achieving a digital future. Many leading Russian banks are setting up research laboratories to search for new technologies for implementation. However, cybercrime has an extremely negative effect on the development of banks. Banks fight this serious threat by introducing new technologies, improving security, using sniffers to track fraudsters, and using client notifications to alert them to all possible methods of stealing their personal information. The Russian Federation supports banks in this by creating various security protocols and programs, for example, a biometric identification system. In general, all opportunities are open for Russian banks to digitalize and improve the quality of their services.

Keywords: digitalization, banking services, banks, cybercrime, net gain

Digitalization is inextricably connected with the society of the 21st century. More and more spheres are influenced by rapid technological development. Economy is situated at the forefront of the changes. A significant part of economy – financial sector – is being fulfilled with new technologies and innovations in interaction with computers and machines. This article is going to analyze the process of digitalization flowing in Russia. The results of digital revolution on banking services are the implementation of Digital Finances, Internet of Things (IoT), mobile platforms and Artificial Intelligence (AI). Today it is an axiom, that in the nearest future the preferred influence on type and character of financial interactions will have digitalization. Even today we already consider banks as high-tech companies [1].

Purpose of the study. Observe the process of digitalization of banking services in Russia and highlight the main stages of digitalization in general.

Research material. Scientific articles, reports of banking associations of Russia, scientific research, open electronic sources

Results of the research

1. Digitalization in Russia on the example of banks

The process of digitalization in Russia started at the beginning of 21st century. In Russia there was opened the first digital bank in the world- Tinkoff Bank. It was unnecessary to finance creation of departments in different cities. The more rational thing was to build an integrated financial system, which can correspond to many accesses from different parts of the world. Today Tinkoff Bank is the biggest digital bank in the RF, at the end of Q1 2017 net profit was 3.4 million of rubles and with index RoS (Return of Sales) of 43 % [2, p. 7].

One of the main players on the financial arena of Russia is Sberbank, that shows the biggest percent of innovations integrated. In 2015-2017 Sberbank introduced approximately 20 innovative projects based on digitalization, from controlling the bank accounts via platform Ethereum to digital workflow and different bonus programs [3, p. 2]. The expenses of Sberbank to innovative projects show a tendency of growth. In a quarterly report, the bank notes that it is actively using AI technologies, implementing AI processes with the help of almost a thousand of its data scientists. The effect of the implementation of AI initiatives at Sberbank in 2019 was estimated at 42 billion rubles [4, p. 78]. AI is integrated into the Sberbank platform at all levels. Eight platforms were put into commercial operation, including NLP, Speech Analytics, biometrics and others. According to calculations, Sberbank increased net gain by 73,31 %. Table (1) represents net gain of 5 main banks in 2020 in comparison with 2016. Data in the table allows us to assume, that one of the main reasons of growing net gain is the implementation and introduction of new technologies into banking services. Sberbank steadily takes the leading position in the list, having a significant lead over other banks. Therefore, Sberbank is an object of interest [5].

In the Central Bank of the RF was opened a "Department of financial technologies, projects and organization of processes". This department is analyzing new technologies and seeking for possible ways of implementation of these technologies into financial sector of the RF. There was created an association "Fintech", where the biggest representatives of Banking sphere of Russia became participants – The Bank of Russia, VTB, Sberbank, Alpha-Bank and others [2, p. 6].

Table 1

Net Gain of the first five biggest banks in the RF

Position	Bank	October, 2020	September, 2016	Change, thousand of rub.	Change, %
1	Sberbank	559 412 190,00	322 787 679,00	236 624 511,00	73,31
2	Alpha-Bank	180 692 333,00	-8 823 989,00	189 516 322,00	
3	VTB	52 193 737,00	42 340 524,00	9 853 213,00	23,27
4	Bank "Otkritie"	40 338 773,00	6 824 406,00	33 514 367,00	491,1
5	Tinkoff Bank	25 363 014,00	5 075 258,00	20 287 756,00	399,74

2. Process of digitalization of banking services itself

Digital transformation of banking services is a part of digital economy. At first digital economy touched only banking services, but now it penetrated everywhere, starting from digitalization of documents and ending with robotization of manufacturing. Digitalization itself is a high investment-required process. Digital Banking- is not only an interface applications and multi-channel customer service, but also offering an exceeded and full client service via automated processes everywhere, where there is an Internet access.

As all banking services are performed online, banks need to protect their data from malfunctions in the system stability and cyber-attacks. The whole work must be arranged with high precision. There must be used new systems to help banks integrate technological advantages. For example, BPM-systems (business process management) that coordinate the overall system of a facility with using means of automatization and integration of IT-technologies, that are necessary in making decisions. Another significant and important part of digitalization of banking services is Intellectual System of Control (ISC). The purpose of such systems is to optimize the work of managers, to minimize the level of human work at all levels and to transfer many processes in an automatic mode, which is seen on the example of Sberbank [2, p. 10]. Furthermore, banks need to analyze and protect data. One of the modern systems of protection of banking services performed online is Unified biometric system (UBS) – digital platform, created by “Rostelecom” company on the initiative of Ministry of connection and mass communication of the RF and the Central Bank of the RF, of identification by voice and face [6]. The implementation of distant identification in the financial sphere is regulated by Federal Law № 482-FZ on December 31, 2017, that makes changes into Federal Law № 149-FZ “On Information, Informational technologies and protection of information”. As part of the development of the Unified Biometric System, “Rostelecom”

has implemented a platform for detecting attacks on biometric presentation – BIS Platform [6]. The company announced this on November 27, 2020. A multi-level information security system allows to repel an attack at the moment, when receiving a banking service or purchasing goods and services, the user confirms his identity – records a video and says a sequence of numbers. The solution developed by BI Solutions, a Russian developer of solutions in the field of information security and biometric technologies, allows the simultaneous use of technologies from different developers. Banks also need to establish a special IT department, involved in coding and protecting data of customers. The success of banks is also estimated with their ability to protect personal data of customers.

To create a system of protection of personal data, banks operate with Federal Law “On personal Data”. Since the data is stored in automated bank system, that has different levels of protection, there are special standards of personal data protection established by the Central Bank of RF. In Russia today there are several standards that regulate such relations. These standards prescribe the construction of several subsystems. These subsystems are: 1) Systems of authentication, access and control of personal data; 2) the registration of personnel's actions related to personal data of customers and avoidance of illegal actions; 3) provision and maintenance of unified informational library of personal data; 4) internetwork security, that excluding access to personal data for those users that have no permission for it. In terms of decentralized systems, it is necessary to install cryptographical elements for encryption and protection of transmitted data [7].

Another very important point is that banks should aim at increasing the quality of interaction with customers and attempts to improve this interaction to new levels. Today customers are satisfied with a very quick service and convenient options. This ideology is not based on assumptions and myths. To increase productivity and Index NPS (Net Promoter Score), banks need to increase the quality of services pro-

vided and reduce processing time [8, p. 3-4]. In general, in Russia Banks, being involved in process of digitalization, pass several steps, represented on Fig. 1.

3. Cybercrimes and banking in the 21st century

At the beginning of 1990 the whole world faced cybercrime. A high proportion of informational technologies in all the spheres of the world, including financial sphere, in the 21st century gave a strong stimulus for development of cybercrime [9].

Cybercrime society uses a wide range of tools: from spam and targeted messages to hacking software and hardware. Mass character acquired theft of money, personal data of customers, evidence that include trade secrets, malfunctions in mobile devices and applications, hacker attacks via harmful software and trojans, DDoS- attacks, blackmail of owners of personal data and credentials stolen. According to Positive Technologies, the line between cybercrime and other types of illegal activity has been increasingly blurred in recent years. A significant part of the incidents is not directly related to the theft of money, but only to the theft of confidential information, when hacking computer systems is a preparatory stage for conducting fraudulent schemes and operations that cause financial, economic and even political damage.

Speaking about financial sphere, the main aim of attacks is still financial benefit (about

62%), but a percentage of data theft is increasing. This happens due to the fact, that operations aimed at obtaining data, in most cases also contain financial connotations: stolen data are subsequently used to steal money. The main attacked system remains the processing of bank cards. Hackers try to get to the interface of the processing control system, regardless of its type, or to the database server in order to secretly increase balances and limits of previously prepared and the cards in the possession of their accomplices. Then on these cards all are removed available funds through ATMs. Theft of information from financial institutions has already become a multifunctional criminal business. Passwords and logins from various credentials, bank card details occupy about 80% of all information sold on the shadow Internet networks. The tendency of growth of attacks, aimed to obtain personal data, will continue. The criminals will continue to attack weak points in informational defense in order to theft personal data. In the zone of increased risks are also financial facilities, including banks. Methods of hackers do not remain unchanged. To hack and bypass protection methods hackers use novel harmful programs or modifications of traditional viruses. They more often use complicated and multi-stage tools, including many different processes, to successfully perform an operation. Common delivery method malware remains phishing mailings [10, p. 52].

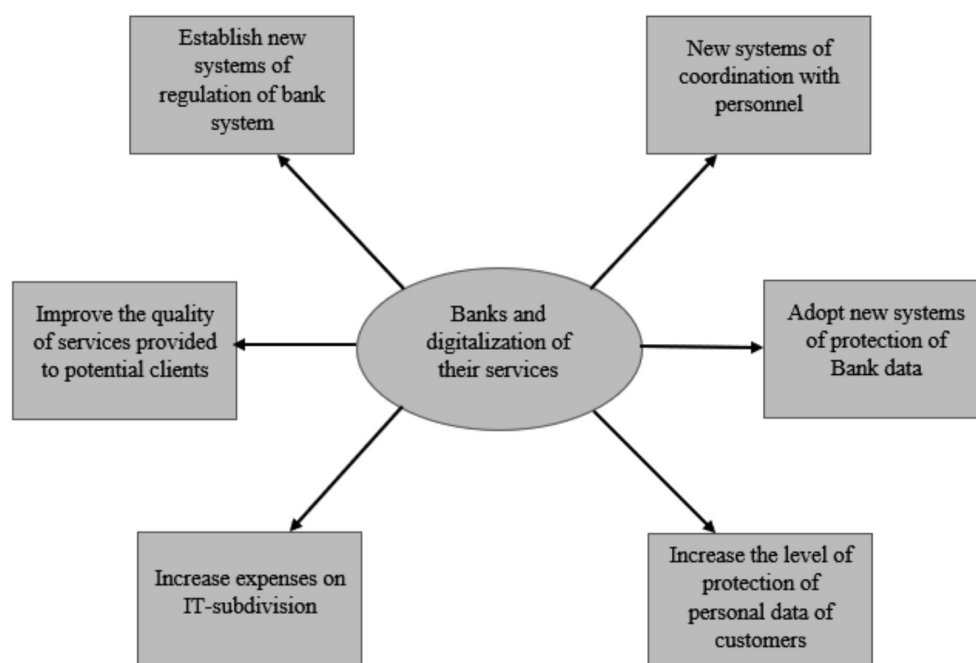


Fig. 1. Steps in digitalization of banks in the RF

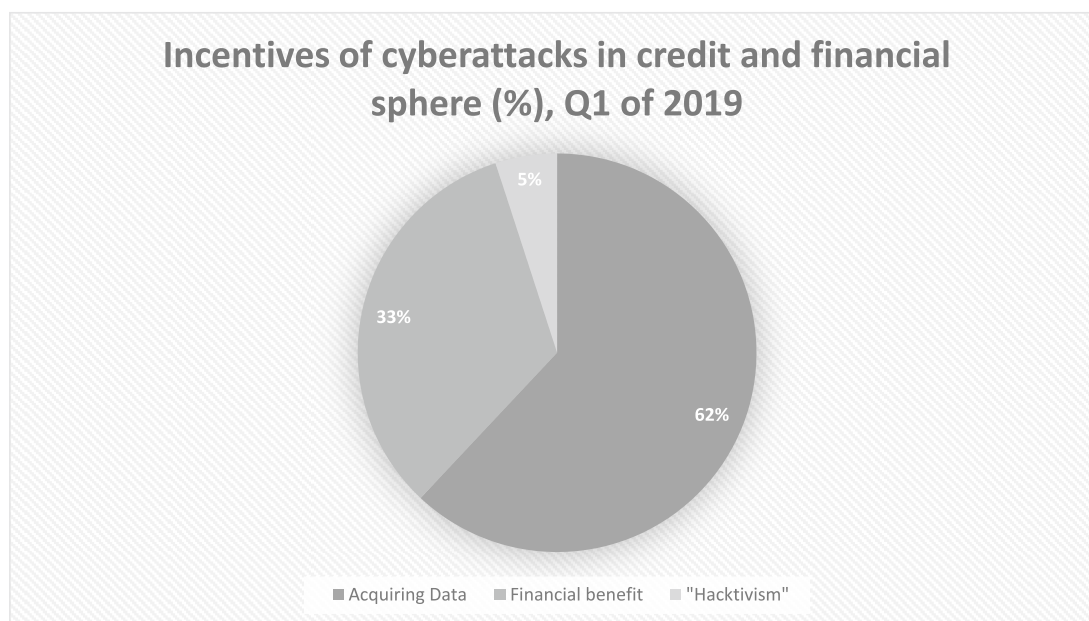




Fig. 2. Incentives of cyberattacks in credit and financial sphere in the RF

Table 2

Problems of digitalization in the RF

 <p style="text-align: center;">State</p>	<ul style="list-style-type: none"> · In case of massive automatization new approaches for education will be necessary · New kinds of facilities and relations will demand new type of regulation and control · All people will be involved to digital economy partly with assistance from the state. There also required a digitalization of state and municipal services
 <p style="text-align: center;">Companies</p>	<ul style="list-style-type: none"> · There must be presented an ideology of permanent innovations. · Success of digitalization is connected with cooperation with educational and research centers, as well as high-tech companies

Monitoring results of BIZONE show that 27-30% employees of Russian companies open emails with malicious attachments allegedly from contractors and colleagues. But e-mail is far from the only way for viruses to spread. For example, users are actively downloading files from torrent trackers, which means the risk infection increases many times. There is a noticeable increase in infections ransomware. This type of cybercriminal activity is increasingly used in combination with phishing. In the future perspective social engineering and harmful software will be the main weapon in the hands of hackers. Banks will have to face a serious power, and they will have to struggle with it via introducing new technologies, improving the defense, using sniffer programs to track scammers. Another effective method

is customer notifications. This method is used today. Banks will notify users about possible and new ways of scammers to theft information from direct interaction with them.

4. Perspectives and problems of Digitalization in the RF

Digitalization sets many problems to both Russian Companies, including banks, and state itself. Some of them are represented in Table 2 [11, p. 4].

From one side massive automatization require availability of people, that aware, how to operate with machines and computers. That is why education is becoming more and more demanded nowadays. State must revisit process of education fundamentally to fit the requirements of today's paradigm. Furthermore, new kinds of relations and entities will demand a

completely new methods of regulation. In case of banking services, as all of them are being digitalized today, Russian government should continue to develop normative acts, that concern the activity of banks in the sphere of digital economy. But the state itself must keep up with the times. Transformation of the most state services into digital world will push people to interact with the new digital world, including both the digital economy and digital banking [11, p. 51-53].

From the other side companies, as well as banks, must accept the ideology of permanent innovations. The world today is very dynamic and quick, new technologies appear every time. The subjects of economy must adopt these technologies very fast and even try to develop its own exclusive developments in order to remain competitive. As it was said before, education is very important. Banks can sign contracts with educational centers and retaining centers to teach their employees with new skills and abilities.

For Russia itself involvement of digital economy and digital banking is very perspective. According to the data of global institute McKinsey, expected economical effect of involvement of digital economy in the RF to 2025 will be 4.2-9 billion of rubles or 20-35 % of expected growth of the whole GDP [2, p. 3]. [11, p. 4]. In terms of market volume and structure, as well as institutional and regulatory environment Russian fintech sector is at an early stage of development. Open development in perspective legislation can give fintech companies every chance to become from innovative laboratories to aggressive competitors to classic banks and even press their positions in the market. Only in 2016 the number of companies on Russian market of fintech services increased by 1/3. The small number of such companies can be explained that on the Russian venture market there are few huge private investors or the fact that they prefer to invest abroad, and state investors are reluctant to invest in risky startups in the early stages of development of the project. An important perspective is the development of mobile offline payments. In China e-wallets in the form of applications for smartphones, for example, Alipay, WeChat Pay and Caifutong have become the daily lives of consumers. Despite the fact, that the use of QR codes to pay for purchases did not take root in Russia, new technological solutions (such as NFC technology, used providers of mobile payment systems – Apple Pay, Google Pay, etc.) has potential for distribution among Russian consumers. Institutional

infrastructure of Russian sector is on the first stage of development. There are already sectoral incubators and accelerators of involvement of technologies, for example Future Fintech, and huge banks have created their own laboratories (“Alpha-Laboratory”, “Sberbank Technologies” and etc.) [11, p. 96-97]. Successful examples of coordination of banks and fintech companies arise. For example, in mortgage lending, Tinkoff Bank acts as an interface for attracting customers and interacting with them, while partner banks are directly involved in mortgage financing [11, p. 97]. If the regulatory and infrastructure environment will begin to transform at an accelerated pace, the role of fintech companies may become more meaningful. Removing obstacles to development financial technologies (including the opening of banking APIs and the ability to identification of clients without their personal presence) will lead to market redistribution in favor of new players. In this scenario, traditional banks have a risk of becoming an industry infrastructure – similar with reinsurance companies in the insurance market. In its turn high-tech innovative companies close to customers and transactions, such as payment systems (Visa, Mastercard), providers mobile payment systems (Apple Pay, Google Pay), financial aggregators services will become the masters of client preferences.

Conclusion

Even today we can see all the benefits and drawbacks of digitalization of banking services. A lot of operations are executed online, without direct presence at the bank. We can safely transfer money to any person in the world, contact with the bank’s support services in convenient mobile applications, pay with our phones without credit cards, use our biometrics to perform all the operations connected with finances and many other things. Digitalization is going to change our life completely. Despite of the fact, that due to digitalization we gained a new weak point represented by our personal data, stored in the banking servers, it became easier for us to perform all the functions necessary today. Banks are concerned about the protection of personal data of their clients and the quality of protection is being improved day by day. The Russian Federation is fully trying to force the current trends towards digitalization, which can be seen from the regulations adopted by the Central Bank and the government of the Russian Federation. Banks itself establish laboratories, aimed at creating new technologies, organize festivals, where people can present their start-ups in the digitalized banking.

In general, the enhanced process of digitalization in Russia only begins, and there are many perspectives and barriers, which we will have to overcome.

References

1. Khubulova V., Seregina Ya. Khachatryan M., Digital Transformation of the financial sector of the economy // Expert Council Bulletin. 2019. № 3 (18). P. 48-51.
2. Miroshnichenko M.A., Trelevskaya C.-A.I., Mamykina E.V. Studying the process of "Digitalization" of the banking sector within the framework of the ecosystem of the digital economy in Russia // Scientific journal KubSAU. 2017. № 133 (09). P. 1-14. Doi:10.21515/1990-4665-133-034.
3. Svetlana Yu. Pertseva Digital Transformation of the financial sector // Innovations in management. 2018. P. 48-52.
4. Annual report. 2019. Sberbank [Electronic resource]. // URL: <https://www.sberbank.com/common/img/uploaded/files/pdf/yrep/sberbank-ar19-rus.pdf>.
5. Banks rate on Netgain // URL: https://www.banki.ru/banks/ratings/?PROPERTY_ID=30.
6. Unified Biometrical System, BIS Platform [Electronic resource]. // URL: <https://www.tadviser.ru/index.php/>
7. Protection of personal data in banks [Electronic resource]. // URL: <https://searchinform.ru/resheniya/biznes-zadachi/zaschita-personalnykh-dannykh/realizaciya-zashchity-personalnykh-dannykh/perechen-personalnykh-dannykh-podlezhashchih-zashchite/zaschita-personalnykh-dannykh-v-bankakh>.
8. Votintseva L., Andreevna M., Kovalenin I., Votintsev R. Digital transformation of Russian banking institutions: assessments and prospects // IOP Conference Series: Materials Science and Engineering. 2019. № 497. P. 1-6.
9. Dementeva M.A., Likhacheva V.V., Kozyrev T.G. Cybercrimes in the banking sector of the Russian Federation: ways of identifying and combating // Economic Relations Journal. 2019. Vol.9. no. 2. P. 1010-1019.
10. Association of Russian Banks "Russian banking system today. Interaction of real and financial sectors in conditions of digitalization of economy". September 2019 [Electronic resource]. URL: https://asros.ru/upload/iblock/c30/20397_informatsionnoanaliticheskoeobozreniesentyabr2019.pdf.
11. Alexander Aptekman, Vadim Kalabin, Vitaly Klintsov, Elena Kuznetsova, Vladimir Kulagin, Igor Yasenovets Digital Russia: New Reality. 2017. // McKinsey report.

PROFESSIONAL SELF-DETERMINATION OF PERSONALITY IN THE PERIOD OF TECHNOLOGIZATION OF SOCIETY

Kuznetsova A. Ya.

Novosibirsk State Pedagogical University, Novosibirsk, e-mail: phileducation@yandex.ru

It is shown that the competence-based approach in education has now been enriched by research on professional self-determination. The study aims to prove the cognitive nature of mastering the professional self-determination of the individual. In modern scientific sources, the phenomenon of an individual's awareness of their competencies is becoming more and more relevant. An analysis of modern scientific sources is presented, where self-determination is presented as a personal characteristic of an individual, as a factor that activates a person's own resources. It is emphasized that professional self-knowledge is as continuous as personal development. The value of professional self-determination for the formation of civil society is shown. The problem of professional self-determination is presented as a component of scientific problems of the integrity of the individual and the integrity of society. The need to supplement the scientific and technological knowledge of a specialist with humanitarian knowledge about himself is affirmed. It is pointed out that the recognition of the integrity of man means that the science of man contains the result of studying his spiritual and material nature. The dependence of the professional self-determination of an individual on the scientific and technological state of society has been studied. Professional self-determination is affirmed as a necessary element of the consistent cognitive and progressive movement of society. The theory of professional self-determination is built on fundamental ideas about individuality. The study is based on the principled statement of the role of the subject in the study of man, his education, interactions between man, society and nature.

Keywords: personality, self-knowledge, self-determination, scientific and technical society, competence-based approach, humanitarian knowledge

The concept of "personality" in the conceptual space of the modern paradigm of education takes the place of a connecting link between the concepts of "individuality" and "society". The formation of personality is carried out on the basis of the natural inclinations of individuality through interaction with the society in which the individual is socialized [1]. Socialization processes in a technological society are more and more formalized with a simultaneous weakening of humanization. At the same time, the individual remains the main source of humanization. Over time, the development of the individual leads him to an awareness of his natural inclinations. The goals of the individual are primarily focused on the activity development of specific abilities. Further development of the individual leads him to self-awareness as a citizen, a member of society, inclusion in the life of society, the formation of his professional competencies. Formed professional competencies of an individual acquire a personal character. Professional self-determination in a technologized society becomes a fragment of the self-development process. Professional self-determination is carried out as the development of self-knowledge of the individual. At the same time, professional self-understanding, as socialization, contains elements of civil formation.

Literature review

In modern scientific sources, in the study of an individual's awareness of their competencies, professional self-determination is widely represented [2]. Modern publications on the study of professional self-determina-

tion are based on the connection between the characteristics and nature of professional self-determination with the personality traits of the student. The results obtained, characterizing the personality, are used in the design of subsequent professional activities. The results of self-determination are used in the formation of the concept of "professional life". The study of professional self-determination currently includes the following problems: the study of psychological readiness for professional self-determination; study of psychology and types of professional personality; age characteristics of personal self-determination; the problem of the formation of legal capacity when choosing a profession; psychological and pedagogical diagnostics; expert assessment and monitoring of the quality of education. It is noted that professional self-determination requires continuous renewal as an element of a dynamic socio-economic environment. Professional self-determination is becoming more and more relevant throughout a person's professional life. At the same time, a person's self-awareness also develops. The launch of self-development mechanisms activates a person's own resources.

In the context of the problem of professional self-determination, specific practical tasks: support, encouragement and assistance throughout the professional life; professional advice; technologies of psychological and pedagogical education; diagnostics of personal development. Research has shown that professional self-determination is as continuous as personal development. [3]. The continuity of professional self-determination is studied

starting with vocational education [4]. Various types of activity are considered in the context of professional self-determination [5]. Self-knowledge allows an individual to correlate the choice of profession with the awareness of his own individual natural data. Professional self-determination is presented as a complex process of self-knowledge, containing reflection and self-regulation and aimed at self-actualization of the personality [6, 7]. Researchers explain the need for professional self-determination of young people by socio-economic transformations in the sphere of their future labor activity. Educators-researchers explain the requirements for the formation of personal characteristics of young people also with the requirements of new educational standards. Studies show that training that meets the vocational guidance set by educational standards can be productive for the development of personal characteristics of young people. The analysis of the results obtained allows us to draw a conclusion regarding the satisfaction of young people with the chosen profession.

The analysis of the results showed that the subjects with low civic identity are characterized by extreme egocentricity and egocentric motivation, underdevelopment of self-regulation functions, rigid thinking, and stereotypical behavior patterns. The authors come to the conclusion that the life of such individuals is aimed at achieving selfish goals without the desire to engage in socially significant activities. Such a personality crisis leads to the fact that adolescents with an average level of civic identity experience an existential crisis caused by undefined social roles, undeveloped motivational, cognitive, volitional and moral aspects of their personality, as well as an external locus of control leading to low personal activity and civic position [8]; the problem of the priority of professional and social values united in a person reveals the problem of professional and personal goals of an individual's development [9]. Since professional self-determination is performed as an element of personal self-knowledge, it leads to an awareness of the important personal qualities of an individual.

This property of self-determination makes it possible to take it into account when programming the formation of professional competencies. The study of the phenomenon of professional self-determination makes it possible to identify important personal qualities [10]; the innovative potential of the individual. The personal formation of an individual in society can be initiated and supported by the education system. The problem of the possibility of influ-

ence is studied. The value of professional self-determination, professional self-awareness for the formation of civil society is shown. education system to focus, starting with the professional identity of high school students. For such an influence, the education system must have a social order, taking into account spiritual and moral orientations [11].

The problem and purpose of the study

The most obvious rational, corresponding to the civilizational movement, technological transformations are necessary for the education system, starting with the higher education system. The development and improvement of the scientific and technical society is associated with its dehumanization. The development of scientific and technical forms of life continues in society. The technologization of society creates such serious problems as the violation of human integrity and the exhaustion of natural resources. Purpose of the study: to show the regularity of mastering the skills of professional self-determination at all stages of education and that the practice of professional self-determination fits into the solution of the problem of the dialectical development of society during the period of its technologization. Significant changes in the subsequent consistent development of society can be made in the process of moving towards self-knowledge. The professional self-determination discussed in this study is a fragment of such self-knowledge. In modern society, professional self-determination is becoming more and more significant and corresponding to its technological transformations. A cognizing person in the world of modern science is immersed in two delimited, separated discourses: natural science and social and humanitarian. The problem is to preserve the qualities of the humanistic direction in the process of technologization.

Research results and discussion

During the period of the scientific and technological revolution, from the end of the 18th century, the division of the content of science into humanitarian and natural science begins [12]. N.D. Kondratyev at the beginning of the 20th century established a certain correlation between the economic development of society and the level and direction of scientific and technical ideas he mastered. The detected mutual influence includes the human factor. Conclusions N.D. Kondratyev points to a deep connection between the technical, economic and humanitarian factors of human life. To establish a new economic and technological

order, the new generation needs to master new scientific and technical ideas. This task falls on the education system. To establish a new economic and technological order, the new generation needs to master new scientific and technical ideas. This task falls on the education system. Historically, the technologization of society, its economic structure, and the patterns established by N. D. Kondratyev at the beginning of the 20th century are consistently reflected in the content, forms and methodology of education. As a result, the economic structure of society indirectly through technologization influences the content of education, which is acquiring more and more scientific rigor, and the forms of education also become technologically rigorous. The implementation of technologization is increasingly dependent on the human factor. Technological changes that come in society with each new technological order are accompanied by an ever-increasing penetration of science into the life of society. The interrelation of technology and economy makes the social and humanitarian influence of the new technological order inevitable. At the same time, the problem of the integrity of education remains unresolved. There is no noticeable rapprochement between natural science and humanitarian knowledge, and the continuously continuing technologization of society divides them more and more [12]. S.Yu. Glazyev points out that by the beginning of the 21st century, society had reached a technological maximum. As a result of the transformations caused by the scientific and technological revolution, changes in society led to saturation with scientific knowledge and transformations. At the same time, economic transformations in society have intensified. Socio-economic and new technological factors turned out to be deeply connected. This connection contributed to the maximum activation of the natural ontological capabilities of society. Representation of the development process in the form of 5 technological orders helps to assess the changes that have occurred in the public resource.

By the beginning of the XXI century, in the global development of civilization, technical sciences remain decisive. "Growing in the future limitations to the economic growth from the natural-ecological and socio-demographic factors can be overcome only through the development and dissemination of fundamentally new resource-saving technologies. However, the industrial technology mode of production, ensuring a step increase in labor productivity is largely exhausted its growth potential" [13, p. 5]. Following in the mainstream of history

through a sequence of technological orders, education has acquired and retains scientific and technological qualities as characteristic features.

Until now, the socio-economic development of society has been based on the development of science and technology as a social force. In the context of the paradigm of technological paradigms, the new VI technological order is characterized by a shift in content towards socio-humanitarian categories. However, in the conditions of an ever-increasing technicality of society, the strengthening of technical sciences does not give the desired economic result. Obviously, the problem lies in the violation of the integrity of the development of a socio-humanitarian object, which is possible with the appropriate integrity of the scientific content of the core of the technological order. Through the result of socio-economic development, society receives a certain signal about an imbalance in the content of scientific knowledge. This means that the contribution of science and technology in the form of scientific and technological knowledge should be supplemented by the reflection of the human factor involved in the process of social development. Along with the technical sciences, cognitive sciences are coming to the fore. For the further preservation of the scientific and technical direction in the system of knowledge that will shape the future society, it is necessary to include knowledge about the person himself, his intellect. Knowledge about the person creating technological innovations, the natural source of thinking – the intellectual resource of the individual, as well as the ways, methods and technologies of his intellectual development fall into the fundamental scientific core of the new technological order. The orientation of the education system to the emerging new technological order requires specifying the goals of education [14].

The scientific, technological and economic development of society sets a dual goal for education: to reveal more and more the natural nature of man, using new knowledge about man and the development of technologies of self-knowledge, and, secondly, using the natural intellectual abilities of man, to develop new technological ways of developing society. The first direction allows building an individual trajectory of development and actualizing the spiritual formation of a person. The technological direction requires the technologization of education itself. Qualitative development of appropriate educational technologies will serve to unify these goals. New educational

technologies, developed according to the model of an individual development trajectory, are built on the foundation of the existing personality-oriented education paradigm. They can be defined as student-centered education technologies. In the direction of technologization, while remaining on a personality-oriented platform, models of professional self-determination are being developed.

Social and humanitarian aspects hold great promise in the development of educational technologies. The technologization of education is becoming a natural condition for the coordination of an intellectually developing person, his abilities and a society that is at a high level of intellectual and technological development. A person's cognitive development leads him to professional self-determination when choosing an individual trajectory for his own development and education.

Conclusions

The consistent assimilation of the scientific and technological direction by society in the process of its life gives rise to contradictions caused by the violation of the law of the natural integrity of man. In the education of a modern person, the violation of integrity begins with the separation of natural science knowledge from humanitarian. An active search for the fundamental principles of the integrity of human life in nature shows the impossibility of completing the science of nature without taking into account the fact that man is a part of nature.

Recognition of the integrity of man is possible provided that the science of spirit becomes part of the science of nature. The next necessary step to ensure the integrity of the view on scientific research is the methodological convergence of scientific areas: natural science and humanitarian. It is known that the integration of historically separated branches of knowledge is most effective on the basis of scientific methodology. This direction of scientific development means that the methodology of the exact sciences, which is outstripping in its development, is smoothly moving to the sciences of man: the psychology of personality and the science of education.

The emerging third step in the movement towards the integrity of science, as well as towards the integrity of man, reveals and asserts the fundamental role of the subject in the study of man, his education and interaction between man and nature, for understanding that knowledge is a form of human life in nature.

Subject-oriented technologies remain essential for the formation of professional com-

petencies of specialists. Deepening into the competence-based approach can lead to its rejection by the individual's intellectual system, if the development of competencies is not meaningful, but imposed from the outside. Mastering professional competencies can serve the personal development of an individual with a conscious choice of a profession based on the principle of professional self-actualization.

Existing modern technologies provide personal development in the educational process. In such conditions, a conscious choice of profession and the improvement of competence are also aimed at preserving the natural qualities of the individual. Modern socio-economic research shows that the human factor is becoming more and more decisive in scientific and technological projects that determine the future of society. Professional self-determination is a fragment of self-knowledge. Its value for the individual is not only in the fact that the individual studies himself, but also in the lack of alternatives to such a path. The goals formulated within the psychological system of a person, by the subject himself, will be achieved by him more successfully. For society, such a personality-oriented path is important as an additional source of natural energy on the path of its development, achieved as a result of the technologization of society. Despite the fact that the industrial-technological mode of production, providing a stepwise increase in labor productivity, has largely exhausted its growth, the potential and resource for development remains in the individual. Professional self-determination becomes the tool on which the quality of the development of society's humanitarian resource depends.

References

1. Kuznetsova A.Ya. The innovative potential of the cognitive theory of personality in the philosophy of education // *Fundamental research*. 2009. N. 2. pp. 77-78.
2. Kotova S.S., Hasanova I.I. The basic theoretical principles of psychological and pedagogical support of personal professional self-determination // *Modern scientific research and their practical application*. 2014. T. 21408. pp. 150-153.
3. Flerov O.V. Further vocational education role in personality's continuing education // *Pedagogy. Theory & Practice*. 2019. T. 4. N 2. pp. 59-61.
4. Bahor T.A., Kolokolnikova Z.U., Mitrosenko S.V., Zaharova T.V., Kazakova T.V., Pakhirka V.U. Students research activity in the context of professional self-determination // *International Journal of Innovative Technology and Exploring Engineering*. 2019. T. 8. N 9. pp. 308-312.
5. Dovha T., Kotelianets N., Kotelianets Y., Plachynda T. Integration of reflection and self-regulation as factors of personality's self-actualization // *Opcion*. 2019. T. 35. N Special Issue 20. pp. 617-631.
6. Radetskaya I.V., Rudenko I.V., Nikolayuk A.E., Busoe-dov A.A. Educational quest as an innovative form of profes-

sional self-determination of the youth // *International Journal of Applied Exercise Physiology*. 2020. T. 9. N 4. pp. 186-197.

7. Belikova N.Yu., Ponomareva E.U., Kotlyarova V.V., Yushina S.V., Abbasova L.I., Latysheva A.T. Professional and social self-determination of youth under conditions of the modernization of higher education // *Revista Gênero e Direito*. 2020. T. 9. N 4. pp. 846-859.

8. Bespalova T.M., Tenyaeva O.V., Kudinov S.I. Self-assessment of personal civic identity in adolescents // *The European Proceedings of Social & Behavioural Sciences EpSBS*. 2019. pp. 1-8.

9. Lozhechkina A.D., Kozlovskaya G.Yu., Soloveva O.V., Borozinets N.M. Axiological priorities of teacher-speech pathologists' professional and personal orientation // *The European Proceedings of Social and Behavioural Sciences EpSBS*. Cep. "The European Proceedings of Social and Behavioural Sciences EpSBS" Conference Chair(s): Rector Prof Dr Ilshat Gafurov, Kazan Federal University. 2019. pp. 498-505.

10. Gryazeva-Dobshinskaya V.G., Nalivaiko N.E., Maltseva A.S. "Structuring of personality": method of diagnostic personality as a subject of culture // *Bulletin of the South Ural State University. Series: Psychology*. 2009. N. 18 (151). pp. 69-79.

11. Sergushina E.S., Kabanov O.V., Starostina J.E., Dragileva L.L., Everstova V.N., Nikulin A.V., Panova O.S., Bekaliyev T.N., Popkov A.V. Concept and essence of social supply chain and professional self-determination in education system // *International Journal of Supply Chain Management*. 2020. T. 9. N5. pp. 290-293.

12. Kuznetsova A.Ya. The role of natural science education in the spiritual formation of a modern person // *International Journal of Experimental Education*. 2012. N. 10. pp. 65-66.

13. Technological Crisis and Strategy of Innovation Breakthrough // *Partnership of civilizations*. 2013. N. 1-2. pp. 5-17.

14. Kuznetsova A.Ya. Humanization of education and intelligence. Novosibirsk State Pedagogical University. Novosibirsk, 2006. 202 p.

DISABLED CHILDREN AND EDUCATION FOR SUSTAINABLE DEVELOPMENT

Bufalova M.A., Savvateeva O.A.

State budgetary institution of higher education of the Moscow region «University «Dubna» (Dubna State University), Dubna, e-mail: bufalova99@mail.ru, ol_savvateeva@mail.ru

Modern education should be accessible to all categories of students. This article discusses the problem of education for sustainable development of children with disabilities. Among the most common violations of children's health, one can name disorders of psychophysical, speech, hearing, vision and musculoskeletal system, and they are considered by the authors. Children with disabilities are, first of all, young members of society who have the same needs as all other people around them. They should lead a life that is as close as possible to the life of a normal child, be able to learn in a favorable environment for them with the prospect of increasing the effectiveness of learning outcomes. Opportunities for education in children with disabilities are often not lower than ordinary children, but most often they require a special approach and selection of teaching and upbringing methods. The field of education for sustainable development and the natural sciences is very favorable for all children, and health features are unlikely to be an obstacle to the growth of knowledge, skills and abilities among the younger generation.

Keywords: environmental education, teaching of children, health development features, visual impairment, hearing impairment, musculoskeletal system dysfunction

Any person who has a defect in physical development can, under appropriate conditions, become a full-fledged person, develop spiritually and be able to provide for himself independently. A child with health problems is a special person who needs a special approach. Education for sustainable development is one of the blocks of general education, it cannot be an exception in the approaches to its implementation, this is an urgent requirement of today for every person, regardless of his physical condition. When planning upbringing, training and education programs in the field of sustainable development, it is very important to take into account the types of physiological disorders in the development of children and apply appropriate methods and approaches that will greatly increase the effectiveness of the process and its results [1, 2].

The **aim** of this work is to analyse the main types of physical health disorders of children in order to identify key aspects in planning education activities for sustainable development.

The basic **methods and materials** in the preparation of work are a descriptive method, which includes the study of various sources of information; a theoretical method that includes analysis, synthesis and generalization of materials; as well as the results of the authors' practice in 2017-2020, obtained during work with children of different age groups in pre-school educational institutions and secondary schools in Dubna, Moscow region, in the process of conducting classes and science lessons.

Research results and discussion

Modern education should be accessible to all categories of students [3, 4].

A teacher/teacher should not think that he is working with "limited" children.

- psychophysical infantilism (immaturity of the emotional-volition sphere);
- speech disorders (primarily severe);
- visual impairment
- hearing impairment
- impairment of musculoskeletal functions (ODA);
- Down's syndrome.

This paper will look at these groups of violations and approaches to working with children suffering from them [2, 5].

Mental features of children with immaturity of the emotional-volition sphere. Emotional-willed sphere is the properties of a person that characterize the content, quality and dynamics of his emotions and feelings.

Disruption of the emotional-volition sphere is manifested in the increase in emotional excitability, hyperesthesia, increased exhaustion of the nervous system. Younger children may also have disturbed sleep. Such excitability can occur under the influence of tactile, auditory and visual stimuli. Children with emotional and volitional disorders have frequent manifestations of emotions such as anxiety, anxiety, perceived, impressionability and a large number of fears. Such children may experience low self-esteem, as they expect a negative attitude from others. When working with such children, it is important to adjust their self-esteem and create conditions in which the child will not feel pressure. When conducting classes it is desirable to spend with the child games and exercises in which he can draw. It is important to create situations in which the child will be able to cultivate their strong-willed qualities, preferably to use game forms [6].

Currently, the number of children with similar violations is increasing every year. Most likely, the rapid digitization of society,

the growing employment of adults in families, physical factors of the environment and so on have a negative impact here. In conducting classes on natural science, we often use visual methods and techniques, especially for the reflection of preschool children. However, these methods can be considered justified for virtually any age.

Mental features of children with speech impairments. Speech function is directly related to the formation of higher mental functions.

If a child has a lack of visual perception, he has a scant understanding of the world around him and a slow perception of words. It is best for such children to work in private so that they are not distracted.

Phonemastic hearing disorders often have a high degree of sensitivity to different sounds. These children may not even understand their own name. There are times when the child understands the words, but is lost and can not understand them in sentences. It is important for the teacher to explain the material using simple words, simple sentences. It is also necessary to find out from parents how they communicate with the child, and to build classes in a similar way [7].

Psychological features of visually impaired children. Vision is the most powerful source of information about the outside world: through it a person receives up to 90% of information.

It is important to understand that the behavior of a child with visual impairment is very different from the behavior of children with typical developmental disabilities. The American psychologist Robert Plutchik believed that people with vision problems should use protection mechanisms more than ordinary people when conflicts arise. But studies have shown that everything is exactly the opposite: children with visual impairments are more adapted to the social environment.

In these children, involuntarily impaired attention, they can constantly switch their attention to different activities or vice versa, have a low level of attention switching. Also, they are characterized by rapid forgetting of the learned material, so it is necessary to repeat the passed material. In addition, these children are physically unable to memorize large amounts of information, so it is recommended to hold environmental classes lasting 15-20 minutes [1, 8, 9, 10].

Large font and color pictures should be used in presentation materials, as color provides additional information to the shape of the images. To work more effectively with children with such impairments, it is better to use

additional lighting to better see the device on which the material is presented and the items used in the class. Writing assignments should be given more time than you would with ordinary children.

Psychological features of children with hearing impairments. There are two groups with this violation: hard of hearing and inaudible people.

Children with hearing impairments have a peculiar perception of people and the development of attention. Having this violation, people from childhood learn to know the world through vision. That's why you need to use as many visual images as possible when learning. When explaining should make small pauses between sentences and questions, speak slowly and clearly. Presentations recommend duplicating speech and using credits in videos. For such children, tactile, tactile sensations are important, so you should use as much visual and illustrative material as possible. Such children are often closed in themselves, it is difficult for them to communicate with other people, so the teacher needs to be in a good mood and demonstrate benevolence. Visual contact is extremely important when talking. When using game forms, it is important to take into account that children with hearing impairment have reduced feelings of spatial orientation, so you should not play too mobile games (to avoid injury) [1, 4, 11, 12].

Psychological features of people with impaired musculoskeletal function (ODA). In musculoskeletal disorders, children with these disorders may have difficulty manipulative activities and writing. They are characterized by specific abnormalities in mental development, such as impaired active work attention.

Children with ODA disabilities need to create an individual curriculum or study in small groups, taking into account the views of parents and other educators. Sharp movements can cause spasms of different nature, so you should avoid sharp external influences. These children often perform tasks slower than normal children, so games for time and with a competitive component are not always suitable. However, it should be noted that children with ADA disorders may have the most significant differences within their morbidity group from all the physiological abnormalities considered [1, 7, 13].

Psychological features of people with Down syndrome. Down syndrome is a form of genomic pathology. With her, usually the karyotype is represented not by 46 chromosomes, as usual, but by 47. Unfortunately, this

pathology is frequent. The external manifestations of Down syndrome are maxillofacial disorders, dysplastic changes in the skeleton, hypotension, and visual disturbances. Typical developmental features also include impaired perception sensors, delayed motor development, specific thinking patterns, and profound speech underdevelopment. In general, we can say that teaching such children in schools is very difficult. The main problems in training are the following features:

1. imagination. Children can perceive images only visually, it does not appear in their heads. Children are able to correlate parts of a drawing and, however, cannot combine them into a whole image;

2. behavior. The behavior of children with this syndrome is obedient, even a little willing to obey. However, their mood changes rapidly, from lethargic to excited. Various behavioral disorders can also occur;

3. emotions. For children with Down syndrome, basic emotions such as fear, joy, sadness, fear are noted, but complex emotions such as surprise or embarrassment are absent and are difficult to recognize even in other people. They do not know how to envy, be angry for a long time, take revenge. Both adults and children with Down syndrome know how to be happy, they are created that way;

4. personality. Children with Down syndrome are characterized by imitateness and suggestibility. Some children show qualities such as self-centeredness or excessive accuracy. Due to the fact that these children are emotional, communicative, they can be helped if they are persistently and kindly dealt with.

It is important to remember that "syndrome" and "disease" are different things. Children with this syndrome need competent psychological and pedagogical correction and are quite amenable to it. But it is necessary to start the correction as early as possible. In other words, children with Down syndrome can develop and study normally in a regular school, but specialists must prepare them for this.

Distance learning and children with disabilities. In connection with the current epidemiological situation, it is necessary to answer the question whether children with disabilities can engage in distance learning.

Doing tasks with your child at home, it is important to remember that his attention quickly switches and he can not sit for a long time on one case. Every 15-20 minutes it is necessary to carry out charging, small games, make changes. It is necessary to recreate as much as possible for the child school everyday life, that

he did not feel additional stress and pressure. It is also necessary to understand that a child with a disability will not quickly assimilate the material and move forward. Lessons with him at home is better to build so that the child more repeats after the parent, was able to touch objects. In other words, it is necessary to fix the heard material tactilely and visually.

Distance learning and children with disabilities. In view of the current epidemiological situation, the question of whether children with disabilities can be engaged in distance learning needs to be answered. Most children with disabilities do not have this work regimen because they cannot work at the same speed as other children. Also, in such children it is very important in learning live communication, without which the child is lost and can not concentrate. Therefore, during the quarantine period, parents have a very serious responsibility. They will have to act as not only a parent, but a teacher and a friend.

Doing tasks with your child at home, it is important to remember that his attention quickly switches and he can not sit for a long time on one case. Every 15-20 minutes it is necessary to carry out charging, small games, make changes. It is necessary to recreate as much as possible for the child school everyday life, that he did not feel additional stress and pressure. It is also necessary to understand that a child with a disability will not quickly assimilate the material and move forward. Lessons with him at home is better to build so that the child more repeats after the parent, was able to touch objects. In other words, it is necessary to fix the heard material tactilely and visually.

Games for children with disabilities. The game is a very important part of the life of not only the child, but also the adult. Therefore, it is worth resorting to game methods of teaching children with disabilities.

For children of preschool age, the game "zoo" is perfect. It will help not only to learn animals, but also to develop imagination, correct emotional isolation and help the child to be liberated in movements. The essence of the game: the presenter stands in front of a group of children or a child, mentally puzzles the animal and begins to show it, repeating the characteristic movements for him. Once the child guesses, he becomes the leader and will show the animal.

Another interesting game is called "Reincarnation." It is aimed at developing creative thinking, unincoalized movements and can carry a wonderful educational character. The essence of the game: the child is offered to re-

incarnate in some animal or swap roles with someone, for example, to become a mother and lose this role. After playing the role, it is necessary to discuss with the child what he felt, why he behaved like that, whether he liked it, etc.

A game designed to teach a child to get out of conflict situations is called "What are you going to do?". The essence of the game: the presenter comes up with life situations and asks the child what he would do and why. This will help not only teach the child how to act, but also help explain what is good and what is bad. It is better to play such a game individually.

To develop tactile memory, you can play with your child in the game "Guess what the object is." The essence of the game is that the presenter puts in a bag a lot of items. The child should put his hand in the bag, grope one object, describe it and try to guess what it is. If the child is shy, you can help him by asking questions about the shape, structure, size.

These games can be used in between activities or just in everyday life.

Also, for children with health features for normal learning, it is important what kind of environment surrounds them both at home and outside. If the child is stressed, it can aggravate his condition. Therefore, it is important for parents to try to always be friendly, support the child and communicate with him. It is important that the child grows up in a comfortable environment for him and does not experience psychological pressure. Since for such children, any changes can also cause stress and anxiety, it is important to talk with the child about plans not only for the week, but also for the troubled ones. Psychologists have proven that children who feel support and understanding from their parents deal with stress more easily.

Conclusion

Despite some limitations in approaches and methods to engage in sustainable development classes, children with disabilities tend to respond very positively to environmental aspects, absorb knowledge and engage in the mysteries and beauty of nature. In addition, classes of natural science orientation help to develop intelligence, aesthetic taste and creativity, in the presence of motor forms of

training (even small intensity and amplitude) strengthen health, increase self-esteem, promote personality, determination of the life perspective of a small person.

References

1. Mzhavanadze N.S. Psychological and Educational Support for Children with Disabilities and Disabilities. / Guidelines. Syktyvkar, 2013. 90 p.
2. Soldiers D.V., Soldatov S.V. Psychological and Educational Support for Inclusive Vocational Education of Disabled people and persons with HIA / Problems of modern pedagogical education. 2018. No 59-2. P. 466-470.
3. Bondar T.A., Dimenstein R.P., I.Y., Konstantinova I.S., Posezelskaya M.A., Yaremchuk M.V. Preparing children with special needs to study in school / Educational policy. 2010. No11-12 (49).
4. The website of Russia's Leading Educational Portal Infourok / Additional Education Program for Children with Disabilities in the Eco-Biological Direction. "Electronic resource." URL: <https://infourok.ru/programma-dopolnitelnogo-obrazovaniya-dlya-detey-s-ogranichenimi-vozmozhnostyami-zdorovya-po-ekologo-biologicheskomu-napravleniyu-1818014.html> (address date: 15.12.20).
5. Taranets I.P. Educational program on soil organisms for people with disabilities / Role of soils in the biosphere and human life: International Scientific Conference: To the 100th anniversary of the birth of Academician G.V. Dobrovolskiy, to the International Soil Day. M.: Moscow State University named after M.V. Lomonosov, 2015.
6. Avdonina T.B., Guryeva D.H. Innovative methods of teaching children with disabilities / Archivist – 2020. No3 (48). P. 46-51.
7. Department of Education and Science of Moscow. Psychological features of children with severe speech disorders (TNR). – 2020. URL: https://sch514u.mskobr.ru/dou_edu/zdanie_4/obrazovanie/logopedicheskaya_sluzhba/psihologicheskie_osobennosti_detey_s_tyazhelyimi_naruseniyami_rechi_tnr/ (address date: 23.12.2020).
8. Karaush I.S., Dashieva B.A., Kupriyanova I.E., Stoyanova I.Y. Features psychological diagnosis of children with sensory disorders / SSW. 2014. № 51. P. 132-138.
9. Kruzhkov O.V., Shakhmatov O.N. Psychological Protection of the Person. Ekaterinburg: Russian State Profile and Educational University 2006. 153 p.
10. Lebedev A.P., Reunova A.A., Sevastyanov U.Y., Kuftyak E.V. Adaptation Mechanisms in Children with Disabilities / Journal of Kostroma State University. 2017. № 2. P. 169-173.
11. Adapted program for children with HIA. / Website of the Corporation "Russian Textbook" / Articles / Psychology and Pedagogy. URL: <https://rosuchebnik.ru/material/adaptirovannaya-programma-dlya-detey-s-ovz/> (datat appeal: 20.12.20).
12. Bubareva V.E. Problems of psychological readiness for schooling of children with hearing impairments // KemSU Herald. 2014. № 3 (59). P. 118-122.
13. Gimatova R.A. Specificity of corrective work with children in the emotionally – strong-willed sphere / Materials VI of the International Student Scientific Conference "Student Scientific Forum" URL: <https://scienceforum.ru/2014/article/2014002116> (address date: 05.01.2021).

CLINICAL AND MORPHOLOGICAL FEATURES OF GLIOBLASTOMAS

Alaverdyan A.E., Volkova L.V.

Immanuel Kant Baltic Federal University, Kaliningrad, e-mail: arman_alaverdyan001@mail.ru, volkova16@gmail.com

This scientific article is dedicated to a very relevant medical problem, since, in spite of the fact that of modern medicine has great advances and achievements, glioblastomas of the central nervous system are still one of the most dangerous and common primary malignant tumors. Patients with cerebral glioblastomas are characterized by a poor prognosis and a high mortality rate, which also makes this topic relevant. The etiology, risk factors, mechanisms of carcinogenesis of this tumor still are not completely clear. The article considers brief historical data, modern information about the clinical and morphological characteristics of glioblastomas, data on morbidity and mortality, current WHO classifications, known facts about the etiology, pathological anatomy, methods of diagnosing this tumor, a modern molecular classification is given. In addition, the currently known data on the main biomarkers, tumor stem cells, and modern methods of glioblastoma treatment are considered. The article focuses on a detailed macroscopic and microscopic description of this malignant tumor, compares three histological types of glioblastomas: giant cell glioblastoma, epithelioid glioblastoma and gliosarcoma. The newest methods of radiation therapy, chemotherapy, and the possibility of surgical intervention are discussed.

Keywords: glioblastoma, gliosarcoma, epithelioid glioblastoma, classification, etiology, morphology, molecular genetics

Glioblastomas are the most aggressive and common malignant brain tumors and have the lowest survival rate compared to other malignant tumors of the central nervous system [1]. The tumor develops from glial cells of nervous tissue, mainly from astrocytes, is characterized by clinical, morphological, molecular genetic heterogeneity, and constitutes the majority of all primary brain tumors in adults. Glioblastomas can be found in the cerebral hemispheres, in the cerebellum, and in the brainstem. The most common symptoms are seizures, headaches, and neurological disorders associated with the glioblastoma location [2]. Despite the latest advances in medicine, risk factors, etiology and mechanisms of carcinogenesis of glioblastomas have not yet been completely understood. Actual predictive and prognostic markers of the malignancy are currently being investigated, and a search for potential effective biomarkers, new approaches to treatment, targeted drug therapy is very important. These factors, as well as the high mortality rate from this oncological disease, make glioblastomas relevant for research.

The history of glioblastoma

In 1856 – 1865, Rudolf Ludwig Karl Virchow described neuroglia, characterized and divided gliomas into highly differentiated and poorly differentiated tumors. In 1926, Persival Bailey and Harvey Cushing published «A classification of the tumors of the glioma group on a histogenetic basis with a correlated study of prognosis». The authors categorized all studied gliomas into 13 groups based on microscopy and patient survival rate, and for the first time identified spongioblastoma multiforme as a separate tumor due to its specific cellular structure. By the 1940s, it had become better known as glioblastoma multiforme [3].

In 1938, Hans-Joachim Scherer put forward hypothesis according to which glioblastomas were divided into primary and secondary tumors. In 1979, the World Health Organization published the first edition of the «WHO classification of tumors of the central nervous system». 26 centers consisting of 300 pathologists from all over the world took part in preparing this work. The last WHO edition including the modern knowledge about tumors of the central nervous system was published in 2016 [3].

Morbidity and mortality

In 2020 Central Brain Tumor Registry of the United States (CBTRUS) was prepared a report that contains statistical data on primary brain tumors, including glioblastomas.

According to these data, glioblastoma makes up 48.6% of all malignant tumors of the central nervous system and 1.59 times more common among men than women. The survival rate for glioblastoma was 8 months – the lowest rate among primary malignant tumors of the central nervous system [1].

Glioblastoma makes up 57.7% of all gliomas, while the incidence rate is 3.23 cases per 100,000 population. It is more common in older people and is diagnosed at the age of about 65. The tumor is more often detected in urban areas than in rural areas, and the incidence is about 2 times higher in whites than in afro-americans. According to predictions there will be 2,970 people suffering from glioblastoma in the USA by the 2021 year [1].

In addition to the USA, the incidence of glioblastoma is also high in Canada, Australia, Northern and Western Europe [4].

Unfortunately, annual statistics on the incidence of specific types of primary malignant brain tumors is not maintained in the Russian

Federation. According to the statistics of 2000-2011, which was kept in in the Arkhangelsk region, glioblastoma accounted for 26.6% of all primary tumors of the central nervous system in 2000-2011 [5].

It should be taken into account that malignant brain tumors are a significant source of morbidity. Regional differences in the incidence, risk factors and duration of glioblastoma may help to understand the etiology and pathogenesis of the disease.

Classification

All glioblastomas can be divided to groups due to 4 degrees of malignancy. Genetically, according to the mutations in the IDH1 and IDH2 genes, glioblastomas are divided into 3 types. The first type is IDH-wildtype glioblastoma, which occurs in 90% of cases and prevails in patients over 55 years of age. Clinically defined as a primary tumor that can occur de novo. The second type, IDH-mutant glioblastoma, occurs in 10% of cases and predominates in young people. Clinically, IDH-mutant is defined as a secondary tumor, which is usually preceded by a diffuse glioma of lower severity. The third type is NOS glioblastoma. This type is a reserve for those cases when, for certain reasons, studies on the IDH1 and IDH2 genes have not been carried out [6].

Glioblastoma IDH-wildtype is histologically subdivided into 3 subtypes: giant cell glioblastoma, gliosarcoma, and epithelioid glioblastoma. The latter is a relatively new subspecies of glioblastomas. All IDH-wildtype glioblastoma subtypes are characterized by the same approaches for treatment [7].

Etiology

The causes of glioblastomas are not completely studied. The most well-known factor is the effect of ionizing radiation on the central nervous system, and it should taken into account that the disease occurs after several years or decades. Also proven reasons that lead to an increased risk of developing glioblastomas are following: single nucleotide polymorphisms, high growth, high socioeconomic status, mutations in anti-oncogenes [8, 9].

Genetic diseases such as Recklinghausen's disease, Bourneville's disease, Li-Fraumeni syndrome, retinoblastoma and Turco's syndrome increase the risk of glioblastoma formation [8, 10].

There is no precise information, which can prove that smoking, alcohol or drug use, and the use of cell phones increase the risk of developing glioblastomas [8].

Pathomorphology: macroscopy and microscopy

During macroscopical examination we can observe the diffuse location of the glioblastomas in the brain parenchyma. Most of the tumors do not have clear boundaries with normal cerebral tissues. Glioblastomas of IDH-wildtype is characterized by a straw-colored necrotic center, yellowish patches that are connected with myelin breakdown, and hemorrhages. These changes, as a rule, are not typical for IDH-mutant glioblastoma. Sometimes the tumor can cross the corpus callosum, then it takes the shape of a butterfly (so named butterfly glioma). Gliosarcoma has a well-defined border due to the high content of connective tissue [11, 12].

The changeable appearance of glioblastomas is considered to be their peculiarity, since in some areas the tumor is soft and yellow, in other areas it is hard and white. Sometimes areas of cystic degeneration and hemorrhage are detected in the tumor tissue [13].

The main microscopic features of glioblastomas are following: necrosis, mitotic activity, poorly differentiated glial cells, and vascular proliferation. The pathomorphology of glioblastomas is very changeable, therefore, in the literature, one can find the term «glioblastoma multiforme» [11].

Giant cell glioblastoma is characterized by huge multinucleated (from 1 to 20 nuclei per a cell) tumor cells with size up to 400 µm and sometimes by an abundant network of reticular fibers is revealed. The nuclei, as a rule, are angular and contain prominent nucleoli and cytoplasmic inclusions. Perivascular glued lymphocytes are sometimes present. This type of glioblastoma is more limited and is most often localized subcortically in the temporal and parietal lobes. It is the reason why it is sometimes confused with metastases or meningioma, if the tumor is localized on the dura mater. The diagnostic problem is pleomorphic xanthoastrocytoma (RCA), which also contains giant cells and is located peripherally. But it should be remembered that RCA contains eosinophils and a lot of xanthomatous cells [14].

Gliosarcoma contains a «sarcomatous» component. If there is a lot of this component, then the tumor looks like a delimited dense mass with a homogenous contrast. Its distinctive feature is a two-phase structure, consisting of gliomatous and mesenchymal differentiations. The glial part looks like a typical glioblastoma, and the mesenchymal part resembles a fibrosarcoma patterns with densely packed

long bundles of spindle-shaped cells, looking like herringbone structures. The sarcomatous component often is characterized by nuclear atypia and consists of multiple mitoses and necrosis. It is formed by the reticular network, in which the glial elements are clearly delimited from the sarcomatous areas, and can be represented by such additional lines of mesenchymal differentiation as cartilage, bones and muscles. The diagnostic problem is the infiltration of a typical glioblastoma into the soft, arachnoid and dura mater, which can lead to a misconception about gliosarcoma, since the tissue is represented by a large number of collagen elements. Tumors with peripheral adhesion to the dura mater, it is similar to a meningioma, as well as giant cell glioblastoma [14, 15]. Gliosarcoma is more common in the temporal, parietal and frontal lobes of the brain [16].

Epithelioid glioblastoma is characterized by the presence of epithelioid cells, an intermediate neuropil, a clear cell membrane, eosinophilia, Rosenthal fibers, and a laterally located nucleus. Microscopy also shows necrosis, but not of the palisade, but of the zonal type [11].

Morphologically, glioblastomas of the IDH-wildtype and IDH-mutant types are similar. However, in IDH-mutant glioblastoma, areas of ischemic, palisade necrosis are observed much less frequently, and oligodendroglioma-like components are much more frequent, they are mainly located in the frontal lobes of the brain, and glioblastomas with no mutations in the IDH-1 genes are characterized by necrosis without pseudopalisades, vascular in the form of garland-like growths and a large number of necrosis [11, 17].

Neurodiagnostics

On CT and MRI, glioblastomas tend to have large and irregular shape. Central necrosis is well defined. The distinguishing feature of giant cell glioblastoma is its annular appearance. It is easy to confuse it with metastasis. Gliosarcoma is well demarcated and has a dense texture. Epithelioid glioblastoma is characterized by a dense texture and sometimes the presence of cysts, hemorrhages. Central necrosis is not typical for IDH-mutant glioblastoma [11, 18].

Molecular classification

Since glioblastoma is a very aggressive and complex disease, its molecular classification is very important for understanding of carcinogenesis, the search of new approaches for treatment, target therapy possibilities. Histological classification cannot distinguish all characteristics of glioblastomas. Classification based on

gene expression profiling can explain the clinic and help with treatment. Thus, some glioblastomas are sensitive to radiochemotherapy, while others, on the contrary, are resistant [19].

Using a molecular genetic methods for brain tumor examination in 2006, three molecular subtypes of glioblastoma were identified. They were named according to the genes that characterize each group: proneural, proliferative, and mesenchymal. The proliferative subtype exhibited overexpression of proliferation markers, mesenchymal tumors – overexpression of angiogenesis markers, proneural tumors expressed genes associated with the process of neurogenesis. The latter had a higher survival rate compared to other subclasses.

In 2010, a classification was created using unsupervised hierarchical cluster analysis, resulting in four clinically significant subtypes of glioblastomas characterized by abnormalities in the PDGFRA, IDH1, EGFR and NF1 genes. These are proneural, neural, classical and mesenchymal subtypes, respectively. The proneural class consists mainly of oligodendroglial cells and has a better prognosis. Neural glioblastomas show connection with oligodendrocytes and astrocytes. They also contain genes connected with neurons. The classical group demonstrates a connection with the astrocytic line. The mesenchymal class exhibits a mesenchymal phenotype and expresses Schwann cell markers and microglial markers [20].

Major biomarkers for glioblastomas

In modern oncology the different biomarkers are described. They are certain genes, DNA and RNA molecules, proteins, enzymes, antigens, and other cellular and biological products that can be detected at various stages of carcinogenesis, with therapeutic effects. In accordance with the type of biomolecules and methods of their detection, genomic, transcriptomic, and metabolic factors (immunohistochemical, biochemical and others) are distinguished. Biomarkers can be divided into diagnostic and clinical which includes prognostic and predictive. There are factors that can simultaneously have both prognostic and predictive properties. At present the following biomarkers for glioblastomas are known:

1. O6-methylguanine-DNA methyltransferase (MGMT) – encodes proteins that are consumed during DNA repair. It is responsible for the sensitivity of the tumor to temozolomide; therefore, its high activity is the reason for ineffective chemoradiation therapy [21].

2. Epidermal growth factor receptor (EGFR) – controls high tumor proliferation,

converts extracellular signals into cellular responses. It very often undergoes amplification, which leads to its increased expression. It is a hallmark of glioblastomas. Its activation leads to excessive proliferation of tumor cells [22, 23].

3. Platelet-derived growth factor receptor alpha (PDGFR α) – overexpression of this marker leads to abnormal and uncontrolled cell growth [22].

4. Isocitrate dehydrogenase (IDH) is an enzyme whose main function is to catalyze the process of oxidative decarboxylation in the Krebs cycle. Mutations in the IDH1 and IDH2 genes are one of the main prognostic factors in the diagnosis of glioblastomas. They lead to inactivation of some protooncogenes and destabilization of the cell genome [22, 23].

5. Tumor protein P53 – is a tumor suppressor of proteins that regulate apoptosis and participate in some mechanisms of the cell cycle. Performs various functions in suppressing tumor growth. Mutations in the P53 gene play an important role in carcinogenesis [21].

6. MicroRNA (miRNA) is a short non-coding RNA molecule that plays an important role in the development and progression of a tumor. It gives more than 90 % specificity in the detection of glioblastomas [22].

Glioblastoma stem cells

Glioblastoma stem cells maintain its resistance, renewal, and invasion and have a specific set of markers. Research results have shown that CD133, CD95, Sox-2, Nanog, nestin are especially reliable markers. They all have predictive value. Glioblastoma has a heterogeneous structure, which can be divided into a zone of support for proliferation, invasion and hypoxia. It is described that there are 2 populations of glioblastoma stem cells, depending on the zones: supportive and invasive. The supportive population regulates the renewal and proliferation, the invasive one – the progressive growth of the tumor. Zones of population support and invasion can pass into each other, changing the phenotype of glioblastoma stem cells. Further research into glioblastoma stem cells may improve understanding of the mechanisms of tumor progression and develop new effective treatments [24].

Treatment

The standard treatment for patients with glioblastoma consists of surgical removal of the tumor, radiation therapy, and chemotherapy. The key ingredient in the treatment of glioblastomas is surgery. Intraoperative MRI,

neuronavigation, ultrasound and fluorescence surgery provide the safest and greatest surgical resection. Complete resection is possible with fluorescence imaging of the tumor using 5-aminolevulinic acid. Under blue light, the tumor tissue becomes red, but normal tissue does not change color. Also, thanks to ICG angiography, injuries associated with vascular damage can be avoided [25].

If the tumor is inoperable due to certain contraindications, then stereotaxic biopsy may be performed for histological diagnosis, but the risk of a false negative result stands at 25 % [26].

Radiation therapy is one of the main treatments for glioblastomas and is usually given in conjunction with chemotherapy. Thanks to focal, fractional, and brachytherapy treatments have become safer and more effective. Focal radiation therapy consists of irradiation of 2-3 cm covering the tumor. During brachiotherapy, after resection of glioblastoma, a radioactive isotope is inserted into the tumor cavity, which provides minimal radiation to normal brain tissue. Focal radiation therapy consists of irradiation of 2-3 cm covering the tumor. During brachiotherapy, after resection of glioblastoma, a radioactive isotope is inserted into the tumor cavity, which provides minimal radiation to normal brain tissue [27].

The standard of chemotherapy is the use of temozolomide at a dose of 75 mg / m² on an empty stomach 2 hours before radiation therapy and on an empty stomach in the morning without radiation therapy. It causes lymphopenia, increases the number of regulatory T cells, and improves dendritic cell function [28, 29].

In the near future, along with the standard treatment for glioblastomas, it will be possible to use vaccines. The DCVax-L vaccine has passed Phase 3 clinical trials. It is administered 6 times in the first year and 2 times in the second year and can be combined with other drugs. The median overall survival after surgery was 23.1 months, while the median overall survival without vaccine after surgery was 15-17 months. Of 331 patients, side effects were identified only in 7 patients [30].

Supportive care

Glioblastoma patients often have progressive neurologic symptoms due to the tumor itself and difficult treatment. This reduces the standard of living, complicates labor activity.

Seizures occur in up to 80 % of patients during the course of the disease, which requires antiepileptic therapy, while the dosage of drugs must be minimized to avoid side effects. The

use of antiepileptic drugs is not recommended unless the patient has seizures.

Glioblastoma increases the risk of thromboembolism due to increased activation of blood clotting factors. Treatment is usually lifelong with heparin [7].

Conclusion

Thus, modern medicine does not stand still and offers more and more new methods of diagnosis and treatment of such an aggressive and widespread tumor disease as glioblastoma. Scientists have managed to improve the overall survival of patients with glioblastoma, but it still has an extremely low survival rate. The key to the treatment of glioblastomas is maximum tumor removal, made possible by discoveries such as fluorescence imaging of the tumor and ICG angiography. Newer types of radiation therapy such as focal radiation therapy, fractionated radiation therapy and brachiotherapy have increased the life expectancy of patients after surgery. An important role is played by palliative care, with the help of which it is possible to increase the duration and quality of life of patients.

Currently, great progress can be associated with understanding the molecular genetic mechanisms of carcinogenesis during the development of glioblastomas, with the search for effective biomarkers and targeted drugs for their treatment.

References

- Ostrom Q. T., Patil N., Cioffi G., Waite K., Kruchko C., Barnholtz-Sloan J. S. CBTRUS. Statistical Report: Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States in 2013–2017. *Neuro-Oncology*. 2020. vol. 22. no. 1. P. 2, 5, 29. DOI: 10.1093/neuonc/noaa200.
- Kumar V., Abbas A., Aster J. Robbins & Cotran Pathologic Basis Of Disease. Elsevier Science. 2020. 1293-1294.
- Brem S.K., Abdullah K.G. Glioblastoma. Elsevier. 2017. P. 1-2.
- Leece R., Xu J., Ostrom Q.T., Chen Y., Kruchko C., Barnholtz-Sloan J.S. Global incidence of malignant brain and other central nervous system tumors by histology, 2003-2007. *Neuro-Oncology*. 2017. vol. 19. no. 11. P. 1553-1564. DOI: 10.1093/neuonc/nox091.
- Dyachenko A.A., Subbotina A.V., Izmailov T.R., Krasilnikov A.V., Valkov M.Yu. Epidemiology of primary brain tumors (literature review). *Bulletin of the «Russian Scientific Center of Roentgenoradiology»*. 2013. № 1.; URL: http://vestnik.mccr.ru/vestnik/v13/papers/valkov2_v13.htm (дата обращения: 27.01.2021).
- Louis D.N., Perry A., Reifenberger G. et al. The 2016 World Health Organization Classification of Tumors of the Central Nervous System: a summary. *Acta Neuropathologica*. 2016. vol. 131. P. 810. DOI: 10.1007/s00401-016-1545-1.
- Tan A.C., Ashley D.M., Lopez G.Y., Malinzak M., Friedman H.S., Khasraw M. Management of glioblastoma: State of the art and future directions. *CA: A Cancer Journal for Clinicians*. 2020. vol. 70. no. 4. P. 300. DOI: 10.3322/caac.21613.
- J.P. Thakkar, T.A. Dolecek, C. Horbinski, Q.T. Ostrom, D.D. Lightner, J.S. Barnholtz-Sloan and J.L. Villano. Epidemiologic and Molecular Prognostic Review of Glioblastoma. *Cancer Epidemiology, Biomarkers & Prevention*. 2014. vol. 23. no. 10. P. 1987. DOI: 10.1158/1055-9965.EPI-14-0275.
- R.V. Lukas, D.A. Wainwright, E. Ladomersky, S. Sachdev, A.M. Sonabend, R. Stupp. Newly Diagnosed Glioblastoma: A Review on Clinical Management. 2019. *Oncology*. vol. 33. no. 3. P. 93.
- Davis M. E. Glioblastoma: Overview of Disease and Treatment. *Clinical Journal of Oncology Nursing*. vol. 20. no. 5. P. 3. DOI: 10.1188/16.CJON.S1.2-8.
- Louis D.N., Ohgaki H., Wiestler O.D., Cavenee W.K. WHO Classification of Tumours of the Central Nervous System. International Agency for Research on Cancer. 2016. P. 31, 32, 51, 53, 54.
- Ellison D., Love S. Neuropathology: A Reference Text of CNS Pathology. Elsevier MOSBY. 2013. P. 711.
- Hanif F., Muzaffar K., Perveen K., Malhi S.M., Simjee S.U. Glioblastoma Multiforme: A Review of its Epidemiology and Pathogenesis through Clinical Presentation and Treatment. *Asian Pacific Journal of Cancer Prevention*. 2017. vol. 18. no. 1. P. 4. DOI: 10.22034/APJCP.2017.18.1.3.
- Love S., Perry A., Ironside J., Budka H. Greenfield's Neuropathology. Taylor & Francis. 2015. P. 1657-1658.
- Kleinschmidt-DeMasters B.K., Tihan T., Rodriguez F. Diagnostic Pathology: Neuropathology 2nd Edition. Elsevier. 2016. P. 41.
- Anne G. Osborn Gary Hedlund Karen L. Salzman. Osborn's Brain. Elsevier Science. 2017. P. 536.
- Zhetpisbaev B.B., Ryskeldiev N.A., Auezova R.Zh., Kozhakhmetova A.O., Isakhanova B.A. Pathomorphology of glioblastomas depending on the presence of IDH-1 gene mutation. *Neurosurgery and neurology of Kazakhstan*. 2016. vol. 42. no. 1. P. 12.
- Runge V. M., Smoker R. K., Valavanis A. Neuroradiology. The Essentials with MR and CT. Thieme Medical Publishers. 2015. P. 68.
- Soomro S. H., Ting L. R., Qing Y. Y., Ren M. Molecular biology of glioblastoma: Classification and mutational locations. *Journal Of Pakistan Medical Association*. 2017. vol. 67. no. 9. P. 1411.
- Delgado-Martin B., Medina M. A. Advances in the Knowledge of the Molecular Biology of Glioblastoma and Its Impact in Patient Diagnosis, Stratification, and Treatment. *Advanced Science* 2020. vol. 7. no. 9. P. 2-3. DOI: 10.1002/advs.201902971.
- Dzyak L.A., Zorin N.A., Sirko A.G., Shponka V.I., Kozinsky A.V. Molecular biomarkers of prognosis and optimal tactics of glioblastoma treatment. *Ukrainian neurosurgery journal*. 2009. vol. 15. no. 4. P. 5-7.
- Satyarthee G. D., Moscote-Salazar L. R., Agrawal. A. Biomarkers of Glioblastoma Multiforme: Current Update. *Romanian Neurosurgery*. 2018. vol. 32. no. 3. P. 466-467. DOI: 10.2478/romneu-2018-0058.
- Nikitin P.V., Ryzhova M.V., Potapov A.A., Galstyan S.A., Kim D.S., Panina T.N., Shugai S.V., Starovoitov D.V., Khokhlova E.A., Zubova I.V. Glioblastoma molecular and histological heterogeneity. *Clinical and experimental morphology*. 2020. vol. 9. no. 3. P. 246-248 DOI: 10.31088/CEM2020.9.3.5-11.
- Kopylov A.N., Gorelikov P.L., Alekseeva A.I. Stem cells of glioblastoma. *Clinical and experimental morphology*. 2018. vol. 4. no. 28. P. 65. DOI: 10.31088/2226-5988-2018-28-4-61-67.
- Vleeschouwer S. D. Glioblastoma. Codon Publications. 2017. P. 257-258.
- Yakovlenko Yu. G. Glioblastomas: current state of the problem. *Medical Bulletin of the South of Russia*. 2019. vol. 10. no. 4. P. 31. DOI 10.21886/2219-8075-2019-10-4-28-35.
- Jain K. K. A Critical Overview of Targeted Therapies for Glioblastoma. *Frontiers in oncology*. 2018. vol. 8. no. 419. P. 9. DOI: 10.3389/fonc.2018.00419.
- Wick W., Osswald M., Wick A., Winkler F. Treatment of glioblastoma in adults. *Therapeutic advances in neurological disorders*. 2018. vol. 11. no. P. 3. 1756286418790452. DOI: 10.1177/1756286418790452.
- Karachi A., Dastmalchi F., Mitchell D.A., Rahman M. Temozolomide for immunomodulation in the treatment of glioblastoma. *Neuro-Oncology*. 2018. vol. 20. no. 12 P. 1570. DOI: 10.1093/neuonc/noy072.
- Liao L.M., Ashkan K., Tran D.D., Campian J.L., Trusheim J.E., Cobbs C.S., Heth J.A., Salacz M., Taylor S., D'Andre S.D., Iwamoto F. M., Dropcho E. J., Moshel Y. A., Walter K.A., Pillainayagam C.P., Aiken R., Chaudhary R., Goldlust S.A., Bota D. A., Duic P., ... Bosch M. L. First results on survival from a large Phase 3 clinical trial of an autologous dendritic cell vaccine in newly diagnosed glioblastoma. *Journal of translational medicine*. 2018. vol. 16. no. 142. P. 6-7. DOI: 10.1186/s12967-018-1507-6.

ROLE OF HUMAN PAPILLOMAVIRUS IN CARCINOGENESIS OF DIGESTIVE TRACT

^{1,2}Reva G.V., ^{1,2}Tolmachev V.E., ^{1,3}Dynda Yu.V., ^{1,2}Kim A.R.

¹International Medical Education and Research Center, Vladivostok, e-mail: revagal@yandex.ru;

²Far-Eastern State University, Vladivostok, e-mail: tolmachev-ve@mail.ru;

³Pacific State Medical University, Vladivostok, e-mail: dyndaiurii@gmail.com

High risk human papillomavirus infection is the most common sexually transmitted infection due to the latest report of the WHO. About 90% of all cervical cancers are caused by human papillomavirus, meanwhile about 30% of oropharyngeal carcinoma's new cases are presented with HPV-positive status, and its percentage's still growing. The abovementioned facts indicate that in the modern world there is a need for more detailed study on the issue related to the carcinogenic effect of human papillomavirus. This article focuses primarily on the main issues of HPV carcinogenic effect in the mucous membrane of oropharynx, revealing the main characteristic features of immunological landscape, gene expression profile and its significance in the context of 5-years overall survival. These data explains the importance of cellular and humoral immunity in the development of the proinflammatory antitumor environment and suggests information about the influence of the gene expression levels for the long-term prognosis of patients diagnosed with pathology of HPV-positive oropharyngeal squamous cell carcinomas.

Keywords: high risk human papillomavirus, oropharyngeal squamous cell carcinoma, gene expression profile, T cells, myeloid cells, cytokines, IFI16, MHC-II

Contrary to the popular belief of human papillomavirus to be predominantly a lot of marginal segments of population, current research materials have established the opposite. In accordance with the latest statistical reports, more than 12% of the World's population are the carriers of papillomavirus besides more than 3% suffer from HPV-associated cancer pathologies, irrespective of one's gender and age, socio-economic status and ethnicity.

The dominant role of human papillomavirus in cervical cancer is generally recognized and well-known scientific fact, but over the past thirty years, the scientific community has accumulated sufficient information on the subject of HPV's carcinogenic role in alternative anatomical locations.

Due to the statistical data obtained by the European Institute of Oncology (EIO) for the period of 2000-2010, out of 675 patients with confirmed HPV-positive status, 48.1% of patients were diagnosed with cancer of the oral cavity, pharynx and oropharyngeal region (1.8%, 2.2%, 40.4%, respectively) [1]. In accordance with other scholars, the incidence of HPV-positive oropharyngeal cancer in the period of 1988-2004 was increased by 225% and at the present moment constitutes about 90% of all cases of oropharyngeal cancer among American population, and pursuant to Canadian research centers, the frequency of the disease was increased from 40% up to 74% during the period of 2000-2012 [2]. Therefore we have strong statistical evidence that incidence of HPV⁺ oropharyngeal squamous cell carcinoma has been increasing dramatically. Predisposing factors towards HPV-positive OPSCC are alcohol abuse, tobacco smoking and promiscuity, meanwhile the lack of timely

diagnostics leads to the problem of oropharyngeal cancer to be most frequently detected at advanced stages.

This article presents the main current information on the pathological features of high-risk human papillomavirus-induced oropharyngeal squamous cell carcinoma.

Purpose of the study

To study the most informative diagnostic resource of HPV-induced oropharyngeal squamous cell carcinoma in oncological practice.

Materials and research methods

The study was carried out in accordance with the Declaration of Helsinki 2000-2013, with the permission of the Ethics Committee of the FGAOU HE FEFU. The preparations made from biopsies of the oral mucosa of 7 patients were studied according to clinical indications. The biopsy material was obtained in accordance with the order of the Ministry of Healthcare of the Russian Federation dated 04.29.94 N 82 "On the procedure for taking biopsy material", according to the rules of the instructions governing the procedure for laboratory tests in medical institutions. The control group consisted of 3 patients who died as a result of injuries incompatible with life, presumably without somatic pathology at the age from 34 to 46 years. The biopsy material was fixed according to the prescription for preparation for histological examination immediately after collection, and then the sections were stained with hematoxylin and eosin. The presence of HPV in patients with COP papillomas was confirmed by PCR. The method of immunohistochemistry to identify the localization of cells expressing Ki67 and P63 was performed

according to the standard DAKO protocol. The results were analyzed using the standard variation statistics method. The analysis of the preparations was performed using an Olympus microscope with proprietary software. The analysis of the available literature data on the inductive role of human papillomavirus in the carcinogenesis of squamous cell carcinoma of the mucous membranes of the gastrointestinal tract was performed.

Research results and discussion

Human papillomavirus consists of two main groups of proteins presented by Early proteins (E1, E2, E3, E4, E5, E6, E7, E8) and Late proteins (L1 and L2). The mentioned proteins are involved in the metabolism of the epithelial cells of the mucous membrane affected by the papillomavirus as it starts to function in the host-cell.

However, the leading role in carcinogenesis is played by proteins E6 and E7, which is why they are called oncoproteins. They lead to irreversible changes in the histological picture of the tissue, which is expressed in the form of abnormal epithelial proliferation and the development of malignant neoplasia of the mucous membrane. In modern oncological practice, doctors often encounter papillomavirus-induced malignancies, and one of such HPV-induced malignant pathologies is oropharyngeal squamous cell carcinoma.

The evidence of different pathogenesis and prognosis of squamous cell carcinoma of the oropharyngeal region depending on HPV-status has been repeatedly urged in modern scientific literature. This difference is primarily based on distinct immunological characteristics of tumors and notable gene expression patterns of their cells, depending on the presence of papillomavirus infection.

There are a number of publications claiming the HPV-induced oropharyngeal cancer to be much easier to control and to have substantially more promising prognosis in the context of five-year patient's survival. Such feature is explained by the presence of a more functionally active immunocompetent cellular infiltrate, more active accumulation of humoral immunity substances around cancer cells, and special pattern of gene expression profile in the pathological cells themselves.

R. Hewavisenti, A. Ferguson et al. (2020), examining squamous cell carcinoma tissues with HPV-positive status, noted a high level of intratumoral and stromal infiltration by CD103⁺CD8⁺ T cells, which was associated with an improved outcome of HPV-positive cancer compared to HPV-negative (83.6%

and 53.9%, respectively), while CD103⁺CD8⁺ T cells were evenly distributed through the stroma of HPV⁺ tumors and had no prognostic significance [3].

Other researchers (S.J. Santegoets, Ch.L. Durward et al. (2020)) determined a strong cellular infiltration of the tumor by CD14⁺CD33⁺CD163⁺, CD14⁺CD33⁺CD163⁺ and CD14⁺CD33⁺CD163⁺ cells, and, in particular, an increased content of CD14⁺CD33⁺CD163⁺ immature myeloid cells and CD14⁺CD33⁺CD163⁺ cells in the tumor stroma was noted. Thereafter, by studying the correlation between the total number of CD8⁺ cells and CD14⁺CD33⁺CD163⁺ myeloid cells, CD8⁺Foxp3⁺Tbet⁺ and CD8⁺Foxp3⁺Tbet⁺ (CD4) cells, the accumulation of CD14⁺CD33⁺CD163⁺ around tumor cells was found to provide a cancer-specific immune response and, consequently, a positive long-term prognosis.

In another part of the study, the same authors identified the combined stimulating effect of CD14⁺CD163⁺ and CD14⁺CD163⁺ dendritic cells on the proliferation of the T-cellular population and production of first-type cytokines (INF γ , IL-22), while CD14⁺CD163⁺ dendritic cells also had the ability to stimulate the production of cytokines of the second type (IL-9, IL-13). It has been experimentally proven that CD14⁺CD163⁺ cells are able to secrete a large number of pro-inflammatory mediators (IL-12p70, IL-18, IL-10, IL-23, IL-6, IL-1 α , IL-1 β , MIP1 α , MIP3 α , TGF α , TNF α) along with chemokines and cytokines responsible for chemoattraction and activation of immunocompetent cells (IL-1 β , IL-15, IL-16, IL-18). Notably, CD14⁺CD163⁺ expressed the TLR3, CXCR2, and CXCR4 genes more strongly than CD14⁺CD163⁺ [4].

P. Baruah, J. Bullenkamp et al. (2019) conducted the study, which confirmed the presence of PD-L1 and PD-L2 protein expression during pathogenesis of papillomavirus-induced squamous cell carcinoma. These proteins were expressed on fibroblasts and macrophage cells. Subsequently, it was experimentally established that the regulation of PD-L1 and PD-L2 protein expression is controlled directly by affecting TLR9-receptors. The processes in question ensure the presence of the certain microenvironment, predisposing to the development of tumor pathology in the tissue, since it is PD-1 that has the ability to inhibit the activity of T-lymphocytes and, as a result, prevent the development of a robust antitumor response of the body [5].

D. Mytilineos, A. von Witzleben et al. (2020), who studied the peripheral level of cytokines during papillomavirus-positive oropharyngeal squamous cell carcinoma, found a high plasma content of proapoptotic immune

mediators (Granzymes A and B, cytokines IFN γ , GM-CSF, sFasL, TNF α , sCD137, IL-2, IL-4, IL-5, IL-6, IL-10, IL-13, HMGB1), among which sFas-mediators and perforins were the most prevalent ones. Perforins integrated into the cell membrane form pores through which granzymes are transported to the target cells and thereby cytotoxic T cell and NK cell response is provided. Based on the presented data, the authors claim a robust inflammatory phenotype to be present in patients with HPV⁺ cancers of oropharynx, and, in this regard, it is concluded that the course of virus-induced squamous cell oropharyngeal cancer has much more favorable prognosis [6].

At the same time, *M. J. P. Welters et al. (2020)*, considering the question of immunological characteristics of HPV⁺ OPSCC, emphasize the correlation between CD8⁺ and CD4⁺ T cells tumor infiltrations and a long-term favorable prognosis. The authors' material provides information on the subject of an increased level of IFN γ and a reduced content of IL-4 and TGF β in tumor tissue produced by CD8⁺ T cells [7].

The studies presented by *F.O. Gleber-Netto, H.D. Skinner et al. (2019)* indicate that there are some genes, which possess certain predictive significance due to their influence on the pathogenesis of the disease. Among them, IKZF3, ARHGAP26, and CACNA1D are marked as the genes with the highest expression level. The gene of IKZF3 is known to be a lymphocytic transcriptional factor which regulates cellular processes of apoptosis and differentiation, another representative of the cohort CACNA1D is a regulator of calcium CaV1.3 channels, and the last one ARHGAP26 is a gene encoding the Rho GTP-ase protein activation [8].

Altogether, the influence of the factors should lead to the course of cancer tissue metabolism according to the stable scenario. In addition to the abovementioned material, more elaborate information obtained by *R. Alex Harrison et al. (2018)* presents the fact of a direct relationship between somatic mutations in the genes of tumor cells and the probability of recurrence of the pathology. Epigenetic regulation genes (KMT2D), Notch-Signaling Pathway Regulation genes (SPEN), Cell Motility genes (ANK3), Mitogenetic Signaling genes (FGFR3), and the genes of Cellular Differentiation (ZNF750), as well as FGFR3, PTEN, PIK3R1, CYLD were noted as the most susceptible to mutational factor among the total number of all cancer cases, and, in their turn, FTL1, PIK3R6, TSC2, KMT2D, MTOR, ALK, NFE2L2, and FGFR3 were the most suscep-

tible to mutations among the cases of cancer recurrence in particular [9].

According to our data, with HPV-positive status in the oral mucosa, there is an increase in the proliferative activity of keratinocytes, apoptosis in the basal layers and a decrease in the processes of differentiation of the epithelium, which reduces its barrier properties (Figure).

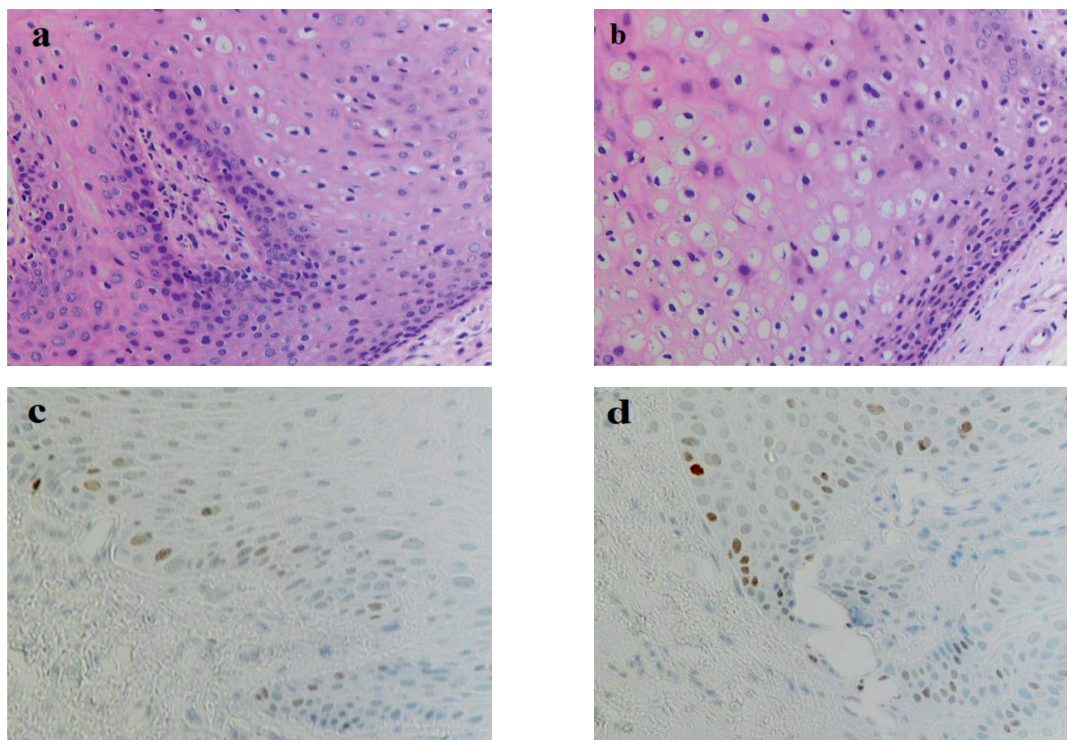
More detailed information, regarding the role of CXCL14 in antigen-specific CD8⁺ T cell activity, was received by American scientists *J.A. Westrich, D.W. Vermeer et al. (2019)* Activation of the gene leads to suppression of tumor cell growth, restoration of MHC-I H-2db on the surface of HPV-infected tumor cells, and better intratumoral infiltration by CD8⁺ T cells [10].

Investigating the role of MHC-II during papillomavirus-induced squamous cell carcinoma, *S.F. Gameiro, F. Ghasemi et al. (2019)* revealed the data of strong expression of HLA-DPA1, -DPB1, -DQA1, -DQA2, -DQB1, -DQB2, -DRA, -DRB1, -DRB5, -DRB6 genes of the α and β chains of the main histocompatibility complex of the second type altogether with a significantly increased level of TNFRSF4, CD132 (and its ligand TNFSF4, CD252) and CD74, the last of which responsible for the antigen presentation [11].

Pursuant to *M.A. Prusinkiewicz, S.F. Gameiro et al. (2020)*, the genes involved in the process of glycolysis were down-regulated in the tumor tissue; meanwhile the genes involved in the oxygen phosphorylation, β -oxidation and tricarboxylic acid cycle were distinctively up-regulated. Besides, a number of genes – SDHC, COX7A1, COX16, COX17, ELOVL6, GOT2, and SLC16A2 – directly correlated with a more favorable long-term prognosis [12].

Another notable study conducted by *E. Reeves, O. Wood et al. (2019)* revealed direct correlation between the level of ERAP1 protein and the amount of CD8⁺ lymphocytic tumor infiltrate. The authors noted that the activity of the ERAP1 protein directly controls the recognition of epitopes derived from papillomavirus proteins, which provokes the emergence of robust anti-tumor T cell response [13].

In turn, *G. Rivo, M. Biolatti et al. (2020)*, defined the role of PYHIN proteins, which perform the function of DNA sensors in the body. Of all PYHIN proteins, the most interesting in the context of the study was IFI16, the protein responsible for the processes of apoptosis, senescence, and cellular response to DNA damage, differentiation, and cell growth. According to the authors' idea, the protein is of the key importance during the processes of limitation viral activity inside the infected cancer cells [14].



COP of a patient with HPV-positive status. (A, B) Staining with hematoxylin and eosin; (C, D) Immunohistochemistry to identify the localization of cells expressing P63. Microphoto. X 200

Conclusion

Summarizing the abovementioned scientific information, one is forced to conclude that in fact, papillomavirus infection has a powerful carcinogenic potential influence on epithelial cells of mucosa membrane and remains to be the problem of the utmost importance in the modern oncological practice. Unfortunately, the latest statistical data indicates a rapid increasing in frequency of HPV-associated malignancies. Therefore a further study of pathogenetic mechanisms of papillomavirus infection is a key task in finding new strategies of prevention and treatment HPV-positive squamous cell carcinoma of the oropharyngeal region.

References

1. Tagliabue M., Mena M., Maffini F., Gheit T., Quirós Blasco B., Holzinger D., Tous S., Scel-si D., Riva D., Grosso E., Chu F., Lucas E., Ridder R., Rrehm S., Bogers J.P., Lepanto D., Lloveras Rubio B., Vijay Kumar R., Gangane N., Clavero O., Pawlita M., Anantharaman D., Radhakrishna Pillai M., Brennan P., Sankaranarayanan R., Arbyn M., Lombardi F., Taberna M., Gandini S., Chiesa F., Ansarin M., Alemany L., Tommasino M., Chiocca S., The HPV-AHEAD Study Group. Role of Human Papillomavirus Infection in Head and Neck Cancer in Italy: The HPV-AHEAD Study. *Cancers* 2020, 12, 3567. DOI: 10.3390/cancers12123567.
2. You E.L., Henry M., Zeitouni A.G. Human papillomavirus-associated oropharyngeal cancer: review of current evidence and management. *Curr Oncol.* 2019 Apr;26(2):119-123. DOI: 10.3747/co.26.4819.
3. Hewavisenti R., Ferguson A., Wang K., et al. CD103+ tumor-resident CD8+ T cell numbers under-ly improved patient survival in oropharyngeal squamous cell carcinoma. *Journal for ImmunoTherapy of Cancer* 2020;8:e000452. DOI: 10.1136/jitc-2019-00045.
4. Santeoets S.J., Duurland C.L., Jordanova E.J., et al. CD163+ cytokine- producing cDC2 stimulate intratumoral type 1 T cell responses in HPV16-induced oropharyngeal cancer. *Journal for ImmunoTherapy of Cancer* 2020;8:e001053. DOI: 10.1136/jitc-2020-001053.
5. Baruah P., Bullenkamp J., Wilson P.O.G., Lee M., Kas-ki J.C., Dumitriu I.E. (2019) TLR9 Mediated Tumor-Stroma Interactions in Human Papilloma Virus (HPV)-Positive Head and Neck Squamous Cell Carcinoma Up-Regulate PD-L1 and PD-L2. *Front. Immunol.* 2019 10:1644. DOI: 10.3389/fimmu.2019.0164.
6. Mytilineos D., Ezić J., von Witzleben A., Mytilineos J., Lotfi R., Fürst D., Tsamadou C., Theodoraki M.N., Oster A., Völkel G., Kestler H.A., Brunner C., Schuler P.J., Doescher J., Hoffmann T.K., Laban S. Peripheral Cytokine Levels Differ by HPV Status and Change Treatment-Dependently in Patients with Head and Neck Squamous Cell Carcinoma. *Int J Mol Sci.* 2020 Aug 20;21(17):5990. doi: 10.3390/ijms21175990. PMID: 32825343; PMCID: PMC7503943.
7. Welters M.J.P., Santeoets S.J. and van der Burg SH (2020) The Tumor Microenvironment and Im-munotherapy of Oropharyngeal Squamous Cell Carcinoma. *Front. Oncol.* 10:545385. DOI: 10.3389/fonc.2020.545385.
8. Gleber-Netto F.O., Rao X., Guo T., Xi Y., Gao M., Shen L., Erikson K., Kalu N.N., Ren S., Xu G., et al. Variations in HPV function are associated with survival in squamous cell carcinoma. *JCI Insight.* 2019;4(1):e124762. DOI: 10.1172/jci.insight.124762.
9. Harrison R.A., Duvuri U., et al. The mutational landscape of recurrent versus nonrecurrent human papillomavirus-related oropharyngeal cancer. *JCI Insight.* 2018;3(14):e99327. DOI: 10.1172/jci.insight.99327.
10. Westrich J.A., Vermeer D.W., Silva A., Bonney S., Berger J.N., Cicchini L., et al. CXCL14 suppresses human papil-

lavirus-associated head and neck cancer through antigen specific CD8+ T cell responses by upregulating MHC-I expression. *Oncogene*. 2019 November ; 38(46): 7166-7180. doi:10.1038/s41388-019-0911-6.

11. Gameiro S.F., Ghasemi F., Barrett J.W., Nichols A.C., Mymryk J.S. High Level Expression of MHC-II in HPV+ Head and Neck Cancers Suggests that Tumor Epithelial Cells Serve an Important Role as Accessory Antigen Presenting Cells. *Cancers* 2019, 11, 1129. DOI: 10.3390/cancers11081129.

12. Prusinkiewicz M.A., Gameiro S.F., Ghasemi F., Dodge M.J., Zeng P.Y.F., Maekebay H., Barrett J.W., Nichols A.C., Mymryk J.S. Survival-Associated Metabolic Genes in

Human Papillomavirus-Positive Head and Neck Cancers. *Cancers* 2020, 12, 253. DOI: 10.3390/cancers12010253.

13. Reeves E., Wood O., Ottensmeier C.H., King E.V., Thomas G.J., Elliott T. and James E. HPV Epitope Processing Differences Correlate with ERAP1 Allotype and Extent of CD8+ T-cell Tumor Infiltration in OPSCC. *Cancer Immunol Res* July 1 2019 (7) (7) 1202-1213. DOI: 10.1158/2326-6066.CIR-18-0498.

14. Giuseppe Riva, Matteo Biolatti, Giancarlo Pecorari, Valentina Dell'Oste, Santo Landolfo *Micro-organisms*. 2020 Jan; 8(1): 14. Published online 2019 Dec 20. DOI: 10.3390/microorganisms8010014.

RESULTS OF A MULTICENTER STUDY OF THE REASONS FOR THE TRANSFER OF 1-YEAR-OLD CHILDREN FROM BREASTFEEDING TO OTHER TYPES OF NUTRITION

Shtykova O.N., Legonkova T.I., Bobrick M.N., Kuzmenok E.A., Budina D.V.

Smolensk State Medical University, Smolensk, e-mail: adm@smolgm.ru

The study involved 106 mothers and their children of the Central Federal District of the Russian Federation (the city of Smolensk, Bryansk, Kaluga, and Moscow). For the evaluation of children's nutrition, we held an online questionnaire through the service survio.com and analysis of medical records, to study the reasons for switching to artificial or mixed feeding. Data collection was conducted with a detailed assessment of feeding of children in the first year of life. The study revealed that 59% of children were breastfed before the age of 1, 18% were artificially fed, and 23% were mixed – fed. The analysis of the obtained data showed that one of the main reasons for the transfer of children to artificial and mixed feeding was hypogalactia, while secondary hypogalactia was observed by 7 times more often than primary (67% and 9% of mothers, respectively). The most common causes of hypogalactia were cracked nipples, late first application of the baby to the breast, long breaks between feedings, “sluggish sucking” of the baby during feeding and exacerbation of chronic diseases in the mother. It was found that the most commonly used ways to increase lactation in women with hypogalactia were an increase in the volume of fluid consumed, the use of lactogenic teas, specialized nutrition for nursing mothers and more frequent application of the baby to the breast. It was revealed that nursing mothers rarely used drug therapy for the treatment of hypogalactia.

Keywords: hypogalactia, breast feeding, artificial feeding, mixed feeding, breast milk, lactation, lactogenic agents

Age appropriate nutrition of children in the first year of life ensures normal morphological and functional maturation of the child's internal organs, as well as harmonious physical and neuropsychological development [1, 2, 3]. The special importance of the nutritional factor in infancy is due to the rapid processes of growth and development of the child, the formation and development of the structure of organs and systems and the improvement of their functions [4, 5].

It is known that only mother's milk is the best nutrition, optimal for a baby of 1 year of life, created by nature itself in the course of thousands of years of evolution. It is the only type of food that is fully adapted to the limited possibilities of the infant's digestive functions and other systems [6, 7]. Globally, only about 35% of children below than 6 months of age are exclusively breastfed [7]. According to the Federal State Statistics Service of the Ministry of Health of Russia (2019), breastfeeding among children from 3 to 6 months amounted to 43.2%, from 6 to 12 months – to 40.4%. [5]. These data indicate that the problem of breastfeeding has not only medical but also social significance.

With the clear and proven benefits of breastfeeding for both the baby and the mother, healthcare providers continue to fight to improve breastfeeding rates. According to the literature, one of the most common reasons for refusing breastfeeding is the lack of breast milk [8, 9].

Hypogalactia is a decrease in the functions of the mammary glands, which can manifest itself in a violation of the processes of lactopoiesis, lactogenesis or milk flow, as well as

in a reduction in lactation in time (less than 5 months) [10].

According to the conclusion of WHO experts, hypogalactia is one of the most complex problems, which covers not only biomedical, but also social issues. Its frequency ranges from 6.4 to 30% of cases among all breastfeeding mothers [11]. As an independent violation of lactation, hypogalactia is the reason for the transfer of up to 30% of children to artificial feeding [10].

The physiological manifestations of a decrease in lactation include lactation crises, which are manifested in a temporary decrease in the amount of milk produced by a woman. This is due to periodic physiological rises and decreases in the level of hormones in the woman's blood. Lactation crises more often occur at 3–6 weeks, 3–4 months, and 7–8 months of breastfeeding [9].

So, the issues related to the prevalence of hypogalactia, the reasons for its development and measures to overcome it remain relevant.

Aim. To study the reasons for transferring a child to artificial and mixed feeding, methods for increasing lactation used by mothers in the Central Federal District.

Materials and research methods

The research was carried out by interviewing mothers in an online form using the survio.com service and analyzing medical records (out-patient child development card, form 112 / y). Data collection included a detailed assessment of infant feeding in the first year of life.

The study involved 106 mothers and their children from the cities of Smolensk, Bryansk, Kaluga and Moscow. The average age

of mothers was 25.2 ± 1.98 years, and their children – 1.09 ± 0.37 years.

According to the results of the survey, the respondents were divided into three groups:

– Group 1 consisted of mothers and their children who are breastfed (HB) up to 1 year (63 mother-child pairs);

– Group 2 – women and their children who are bottle-fed (IV) (19 mother-child pairs);

– Group 3 – mothers and their children on mixed feeding (SV) (24 mother-child pairs).

Statistical processing of the obtained data was carried out using the standard package of statistical programs Microsoft Excel 2016, Statistica 2016. The Pison test (χ^2) and Student's t-test for independent variables were used for statistical evaluation of the level of validity of the difference in the values of the parameters in the groups. The Fisher's test in the package for statistical data processing (Fisher's Exact Test) was used to test the statistical hypothesis

about the average value and the calculation of the confidence interval. The differences were considered significant at $p < 0.05$.

Research results and discussion

As a result of the study, we found that in the Federal Central District 59% of children were breastfed up to 1-year-old, artificial – 18%, mixed feeding – 23% of children.

In general, in the Russian Federation in 2018, the number of children who are breastfed from 6 months to 1 year is 40.3% (table) [12].

The main reasons for the transfer of a child from breastfeeding to artificial or mixed feeding were: hypogalactia in 76% of mothers in group 2 and in 68% of women in group 3 ($p > 0.05$), the need to take antibiotics due to exacerbation of chronic diseases in 5% of group 2 and 18% of group 3 ($p < 0.05$), lack of time to breastfeed – in 11% of group 2 and 4% of group 3 ($p < 0.05$) (Fig. 1).

Prevalence of breastfeeding in children of 1 year of age in the Russian Federation

The number of children who were breastfed	2005	2010	2015	2016	2017	2018
At the age of 3-6 months Thousand people	544,7	647,9	750,9	757,8	737,1	690,4
At the age of 3-6 months as a percentage of the number of children who reached 1 year in the reported year	40,1	39,9	42,5	43,4	43,2	44,4
from 6 months to 1 year thousand people	487,5	655,5	708,1	719,3	689,4	627,2
from 6 months to 1 year as a percentage of the number of children who reached 1 year in the reported year	35,9	40,4	40,1	41,2	40,4	40,3

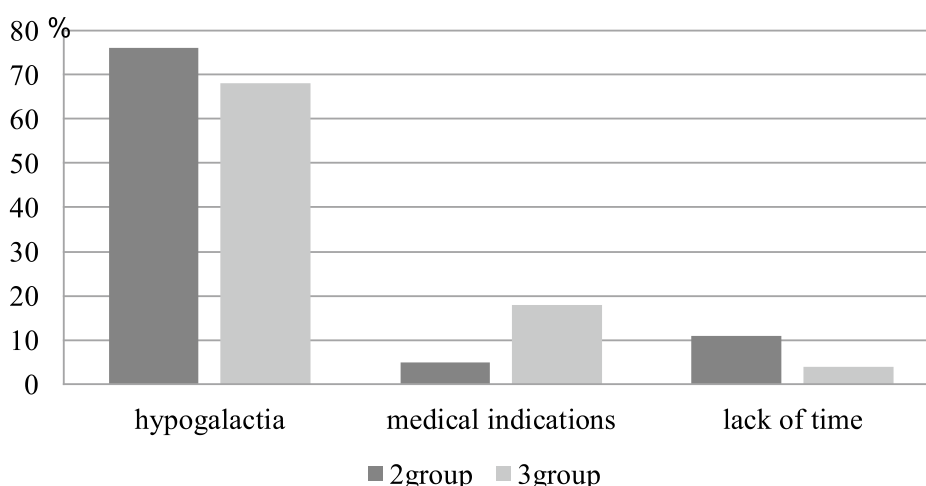


Fig. 1. Reasons for transferring a child to artificial or mixed feeding

It was revealed that primary hypogalactia was observed in 9% of women whose children were artificially fed. All women with primary hypogalactia had endocrine system pathology (infantilism, diabetes mellitus, or diffuse toxic goiter). Secondary hypogalactia among respondents from groups 2 and 3 was by 7 times more common – in 67% ($p < 0.05$), which indicates the urgency of the problem of maintaining lactation in the modern world and is consistent with the literature [6, 7, 8].

In 49% of lactating women whose children were breastfed up to 1-year-old, lactation crises were observed, which occurred at 3 weeks, 3, 4 and 7 months of lactation.

The study found that 51% of mothers of group 1 experienced difficulties in breastfeeding only after childbirth as a result of incorrect position of the baby at the breast (“propeller” syndrome) and improper grip of the nipple – the baby was “hanging on the nipple”, as well as intermittent feeding compared with mothers of groups 2 and 3, who had no difficulty in breastfeeding only in 8% of cases ($p < 0.05$).

Analysis of the data obtained showed that the most common difficulties in breastfeeding that became the causes of hypogalactia (Fig. 2) were nipple cracks in 1/2 mothers of groups 2 and 3 and in 1/4 mothers of group 1, resulting from a violation of the technique of attaching the baby to the mother’s breast. Late first attachment of the child to the breast (on day 2) was detected in 3% of women in group 1 and in 36% in groups 2 and 3 ($p < 0.05$). Rare attachment of the baby to the breast, long breaks between feedings as a result of taking antibiot-

ics during lactation were detected in anamnesis in 2% of cases in mothers of group 1 and in 6% of cases of women in groups 2 and 3 ($p > 0.05$). Violation of the feeding regimen as a result of acute (ARVI, influenza) or exacerbation of chronic diseases of the mother caused hypogalactia in 14% of mothers of group 3 ($p > 0.05$).

“Sluggish sucking”, which leads to insufficient irritation of the receptors of the mammary gland and inhibition of lactation was detected in 9% of breastfed children, 23% of mixed-fed children and 19% of children transferred to artificial feeding ($p < 0.05$). Stomatitis, thrush was observed in 3% of children in group 2 and 10% in group 3 ($p > 0.05$).

It was found during the analysis of the survey data that the most frequently used way to increase the lactation was the increase in the volume of fluid consumed (additional drinking in the amount of 1 liter per day), including the use of lactogonous teas (Babushkino Lukoshko, Laktafitol, Laktogon, “Lactavit”, “Lactamama”, “Mother’s tea”, “Milky Way”, “Hipp”), in 39% of mothers in group 1, 35% in group 2 and 55% of women in group 3 ($p < 0.05$) (Fig. 3).

An increase in lactation after more frequent breastfeeding was observed in 30% of lactating women whose children were breastfed, 18% and 41% of mothers whose children were transferred to artificial and mixed feeding (groups 2 and 3, respectively) ($p < 0.05$).

Specially developed protein-vitamin nutrition for nursing mothers in order to increase lactation (Lactamil, Femilak, BellaktMama, Mom and Me) was used by 10% of mothers in group 1 and 18% of women in groups 2 and 3 (Fig. 3).

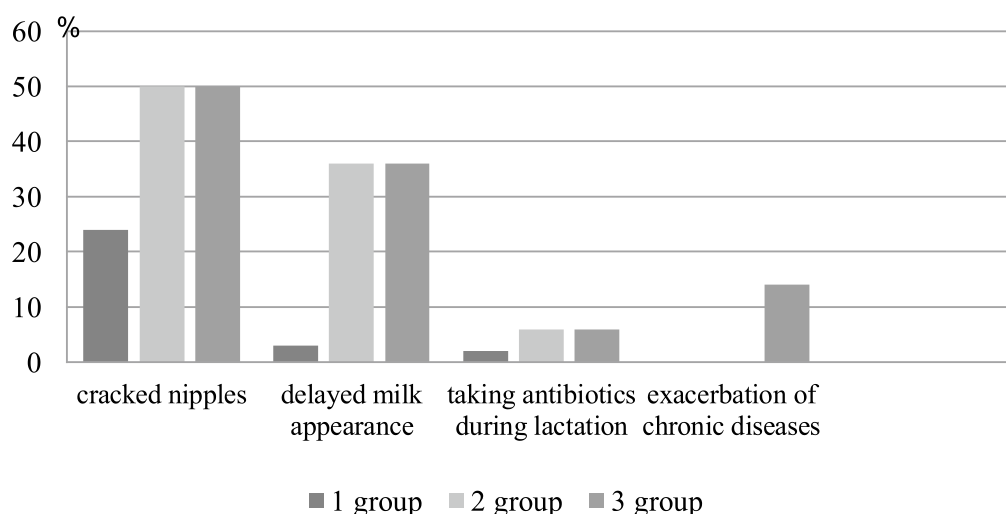


Fig. 2. Causes of hypogalactia

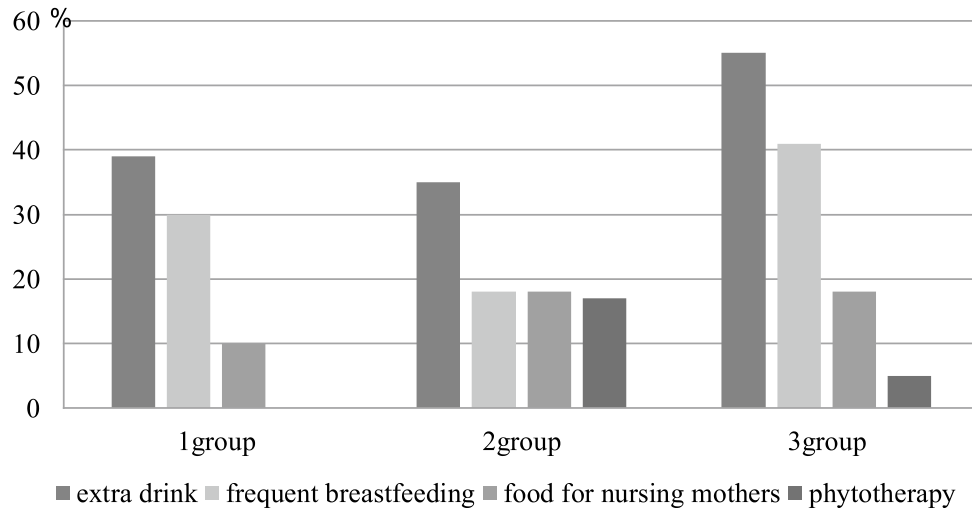


Fig. 3. Methods used to increase lactation in hypogalactia

In the first group an increase in the volume of fluid intake, the use of lactogonic teas, additional nutrition for nursing mothers and more frequent latching of the baby to the breast was in almost 100 % of cases sufficient to overcome lactation crises.

Herbal medicine in the form of decoctions and infusions from plants with lactogonic properties (stinging nettle leaves, caraway seeds, fennel and anise fruits containing anethole, which increases prolactin due to competition with dopamine for receptors) was used only by 17% of mothers in group 2 and 5% of mothers 3 groups, the rest considered this method of treating hypogalactia outdated, time-consuming and ineffective ($p < 0.05$).

Physiotherapy for the breast with Bioptron (Zepton, Switzerland, based on the use of polarized light), ultrasound, electromagnetic vibration massage of the mammary gland) contributed to an increase in lactation in 12% of mothers whose children were on mixed feeding.

Drug therapy in the treatment of hypogalactia, which included taking the drug "Apilak", vitamin E, nicotinic acid, homeopathic drug "Mlekoin", was prescribed to only 5% of mothers of group 3.

Almost all women who kept breastfeeding for up to 1 year (group 1) in 98.6% passed the "School of expectant mothers" in the antenatal clinic and the "School for young mothers" (in the children's polyclinic). At the same time, mothers whose children were transferred to mixed or artificial feeding (in 79.3%) either completely ignored these schools and did not go to classes or did not go regularly. They in

contradistinction to mothers, who kept lactation for a long time, did not believe that the child's contact with the mother, mother with the baby stay and "free feeding", when the frequency and duration of feeding is determined by the newborns are important for the prevention of hypogalactia and the formation of lactation. Feeding on demand – the main factor in the prevention of hypogalactia was considered in 99.2% of women in group 1, 64.3% and 34.7% of mothers in groups 2 and 3, respectively ($p < 0.05$).

Conclusions

So, one of the main reasons for transferring a child to mixed and artificial feeding is hypogalactia. In most cases, nursing mothers have secondary hypogalactia.

The most common reasons of hypogalactia are cracked nipples, late first attachment to the breast, long breaks between feeds as a result of the mother's medication and "sluggish suckling", when the baby is latching on to the breast.

The most common methods of combating hypogalactia are the use of additional drinks by lactating women, including lactogone teas, special food for nursing mothers and more frequent latching of the baby to the breast. Drug therapy for the treatment of hypogalactia is rare.

For a sufficient production of breast milk, it is advisable to practice early first attachment of the baby to the breast, feeding the baby on demand; to increase lactation, it is necessary to use additional drinks in the form of lactogonous teas and specialized products for lactating

women. For the treatment of hypogalactia, it is necessary to use medications more often.

Helping mothers to maintain natural feeding is one of the most important tasks of a pediatrician.

References

1. Borovik T.E. Pediatric Clinical Dietetics: A Guide for Physicians. 2nd ed. / ed. T.E. Borovik, K.S. Ladodo. M.: MIA, 2015. 718 p.
2. Gurieva V.A., Nelyubova A.B. The risk of hypogalactia and measures to optimize breastfeeding // Medical Sciences. 2015. No. 11 (42). P. 21-26.
3. Legonkova T.I., Matveeva E.V. Influence of different types of feeding on the physical and neuropsychic development of children in the first year of life: the results of 12-month follow-up. // Questions of modern pediatrics. 2011. No. 10 (1). P. 22-27.
4. Borovik T.E., Borovik O.L., Lukyanova V.A. Breast milk composition and maternal nutrition: is there a connection? // Pediatrics. 2018. No. 97 (4). P. 160-167.
5. National program of optimization of feeding of children of the first year of life in the Russian Federation // Union of Pediatricians of Russia. Moscow, 2019. 207 p.
6. Zakharova I.N., Machneva E.B. Breastfeeding: answers to some difficult questions of lactating women // Medical Council. Neonatology. 2017. No. 1. P. 60-65.
7. Kildiyarova R.R. Healthy baby food. Moscow: GEOTAR-Media, 2011. 224 p.
8. Gmshinskaya M.V., Abramova T.V., Safronova A.I., Pyreva E.A., Kilinsky P.N. Lack of milk is the main reason for stopping breastfeeding: how to maintain lactation // Questions of Pediatric Dietetics. 2017. Vol. 15. No. 6. P.5-10.
9. Kashirskaya E.I., Ozornina U.A., Snitko E.I., Lebedeva O.V., Vyazovaya I.V. Ways to solve the problem of preserving and supporting breastfeeding // Astrakhan medical journal. 2019. Vol. 14. No. 2. P. 15-24.
10. Barabash N.A., Melnikova U.V., Pozhenko V.V. Hypogalactia. Modern methods of correction and prevention: guidelines. Tomsk: OffsetCenter, 2016. 28 p.
11. Zhilyakova O.V., Zakharova I.V., Gabidulina T.V. Influence of ethylmethylhydroxypyridine succinate ("mexidol") on the incidence of hypogalactia in postpartum women with physiological pregnancy during pregnancy complicated by iron deficiency conditions // Fundamental Research. Medical sciences. 2015. No. 1. P. 79-82.
12. Healthcare in Russia. 2019: Statistical collection / Rosstat. M., 2019. 170 p.

EFFECTIVE ORGANIZATION OF THE EDUCATIONAL PROCESS AS ONE OF THE MOST TOPICAL ISSUES IN THE MODERN TEACHING METHODS OF FOREIGN LANGUAGES

An Y.D., Zhdanova E.A., Alken S.H., Rakhmetova G.Sh.

Karaganda Technical University, Karaganda, email: yekaterina.an@gmail.com

The long standing practice of educational work shows the importance of not sidestepping educational issues in the organization of educational activities, as well as the use of effective methods of teaching foreign languages, both traditional and intensive. The rational organization of the content of the educational process is based on the technology of teaching spoken language in a foreign language directly on the material of informative texts for reading and applying active methodical and psychological learning techniques, which create a favourable environment for the management of educational activities: allow for close interaction with students, which contributes to the achievement of accelerated development of communication skills in a foreign language, developing skills in prepared and unprepared monologue and dialogue speech, as well as at the level of polylogue. Foremost teaching of reading, a priority in relation to speaking, the use of thematically related informative texts and an analytical-synthetic method of work on them, as well as a certain system of presentation of study material (sequence of actions, their goals), its strengthening (training), providing multiple encounters with the text, imprinting it in memory, keeping it in it, and the use of the textual material in communication practice, allow to ensure the interconnected nature of teaching the main types of speech activity and, most importantly, provide an opportunity for the accelerated developing speaking skills.

Keywords: intensive, strengthening, skimming, introducing, practice in communication

The achievements of recent years in the development of modern technologies and, at the same time, the development of intellectual programs for independent study of languages, of course, cannot fully replace the teacher, who is the central figure of any educational process. The success of training and, ultimately, the solution of the problems facing the education system and society largely depends on his/her qualifications and professionalism.

As is known, the new requirements of society for education and personal development, new living conditions are changing both teaching methods and the content of pedagogical practice. [1,2]. In this regard, the development of innovative teaching methods that correspond to the current goals of education, aimed at intensifying and optimizing the educational process as the most important principles of the scientific organization of labor, is not only a pedagogical, but also a social task [3].

The currently increased need for teachers to clarify many specific provisions of existing methodological systems, in particular, intensive methods of teaching foreign languages, dictated the need to describe certain aspects of the theory and practice of communicative teaching of foreign languages, which cause difficulties in understanding and interpretation, especially among teachers, beginners in teaching at the university.

Unfortunately, the problem of organizing the content of spoken language on the basis of reading texts has not yet been sufficiently solved and adequate attention is not paid to such a type of speech activity as an analytical-synthetic work, which involves the implementation of a communicative inten-

tion due to mastering linguistic material, skills and abilities to operate it. Learning to read is mainly designed to extract information, which is achieved through the development of differentiated reading skills (by scanning, skimming and reading comprehension). It is known that with the development of the ability to read with the direct extraction of information, the transition to independent reading is carried out: informative reading by its nature is close to authentic reading [4].

However, no less important is the function of reading as an effective tool for developing speaking skills.

Research Objective: Based on the specific conditions of communicative teaching of a foreign language in a non-linguistic university, the main goal is to develop and implement an effective technology of teaching a foreign language, which allows to optimize the educational process, namely: to strengthen the motivation of learning and to ensure the acceleration of the pace of educational actions, to intensify learning activities.

Materials and methods of research

The current stage of the methodology of teaching foreign languages is characterized by a communicative orientation, when it is not the memorization of vocabulary and grammatical rules that becomes decisive in the learning process, but the implementation by students of their own communicative intentions. Communication-oriented learning, accordingly, should be determined by the appropriate content of the learning process, as well as by a certain system of interaction between the teacher and students [5].

Thus, efficiency in the organization of the educational process can be achieved through its intensification by strengthening the motivation of learning, by maximizing the joint efforts of the teacher and students involved in the educational process, thanks to the activation of their psychological potential, the product of which is the formation of foreign language skills [6, 7].

Certainly, intensification aimed at improving the educational process of teaching a foreign language can be achieved methodically based on a special organization of educational material, its concentration and clear distribution, as well as through specific forms and active teaching methods.

Inappropriate selection and organization (volume, distribution, structure) of educational material significantly hinder the implementation of the set goals. Therefore, for the successful management of educational activities, the teacher needs to decide, firstly, on the basis of what material he plans to implement the set goals and, secondly, with the help of what means he can intensify the process of mastering the communicative function of the target language.

Results of the study and their discussion

The work practices according to the intensive methodology shows the relevance of the parallel development of all types of speech activity, based on their integration and interrelation both in one lesson and in the system of lessons.

It is also important to take into account the corresponding hierarchical subordination of learning goals and types of speech activity. At the same time, the primary role here is given to reading. The formation and development of communicative competence can be accelerated to a large extent due to such a reading function as serving as an effective means for developing speaking skills.

The teaching comprehension ahead of speaking provides a real opportunity to accelerate the formation of speaking skills. The selection and rational organization of educational material according to a thematic principle in the system of classes – system of interrelated classes, representing a holistic unity in terms of structure and content to a greater extent – contribute to the optimization of the educational process. However, it is important to remember that each lesson in the system of thematically united lessons has its own characteristics and specificity: purpose, content, structure and logic of construction.

When planning and methodological development of training sessions on a specific topic, it is also important to rationally distribute the material intended for active assimilation (common to all types of speech activity) and the material that will be assimilated passively [8]. It should be considered that the “spoken” text (text-dialogue) that is used to develop the skills of prepared speech is fundamentally different in character from the texts used in reading teaching, written speech with all its features (syntax complexity, etc.). In this connection, the *Speech Learning Technology* proposed by the author of this work is based on *two techniques*, namely, the intensive method of strengthening the psychological reserves of the individual and the team [9] as well as

the analytical-synthetic method of scientific word processing based on scanning, skimming, reading comprehension of informative texts and following them abstracting, annotating, structural and semantic transformation of sentences etc. in order to prepare practical material for monologues and dialogues. The proposed technology makes it possible to increase the pace of training by means of an agreed joint activity and a specific system for supplying training material (introducing), fixing it through a repeated meeting with the text in memory and retaining it therein (activation and training) and the practical application of the material in communication.

Thematically grouped texts provide a structured framework for developing the skills of both prepared and untrained students. These texts are being incorporated into the training process to deal with them in the context of the proposed situations.

Acquaintance, activation and application of the learned text material are assisted by a system of techniques that should be aimed at solving specific problems. For example, the formation of the skills of text compression, the extraction of basic ideas, the skills of semantic transformation and the structural design of statements based on the material of the text, etc. ensure the effectiveness of the educational process, is fertile ground for the formation of skills not only in speaking, but also in all types of speech activity. However, it should be emphasized that the effectiveness of training depends not only on what forms and methodological methods of working on textual material are used, but also on whether or not the nature of the texts and the structural and compositional characteristics of texts-description, texts-message, texts-reasoning are taken into account etc.

The strong assimilation of thematic vocabulary can be facilitated not only by special exercises for recognition, linguistic guessing and other tasks when presenting lexical material both in general and in isolation, but also by the nature of the presentation or introduction of the text. When introducing a teaching text, particular mention should be made of the role of the mother tongue, which is useful only to the extent that it is necessary to understand what has been said. It helps students navigate the content of what they hear and helps the teacher monitor understanding. If the teaching material is a high-level or voluminous text, it should be divided into parts or pieces of meaning and introduced separately. A clear dismemberment and coherence of material are essential for effective memory. A work on a single piece of text can be done, including a series of pre- and speech exercises prior to students performing communicative tasks at the training and speech practice stage. When teaching material is introduced it should be especially noted the role of the native language, which is advisable to use only to the extent that it is necessary for comprehending what was heard. It helps students to correctly navigate the content of what they have heard, and the teacher to control understanding. At this stage, it is advisable for the teacher to present the text repeatedly: without relying on the text, phrase by phrase, to acquaint the learners with the contents of the new text with an understanding of its main contents, and translate, if necessary, individual words and sentences in the mother tongue.

Multiple presentation of the text based on the choral pronunciation of the text material by the students following the teacher without relying on the text allows the connection of articulatory-motor memory, which ensures better memorization of the material. After all, assimilation is achieved, as is known, with the help of imitation. Also, reading the text aloud: reading the text independently or in groups helps to memorize it better.

Efficiency and method of synchronous translation of text from a foreign language into a native language and vice versa should be noted, which also significantly stimulates the active thinking activity of the student. At the same time, in order to help students to remember and focus on language material, emphasis should be placed on the intonation that has been tested in the practice of psychotherapy.

The next step after the introduction of the text is the intensification of the text in order to develop the skills of prepared monologue as

well as dialogue speech within the studied text. It is good practice to retell the text with a verbatim transmission of its content or close to it during the assimilation of the text [10].

Preparatory work for retelling the text may include working out the phonetic side (sounds, intonation, melodic speech, syntagmatic division of sentences, rhythm and etc. The text is subject to a number of transformations: the length of the retelling may be less than the original text; complex grammatical constructions are replaced, as well as purely textual words typical of writing, by simpler spoken language. It is possible to use colloquial constructions included in the source text; to replace direct speech with indirect speech and etc.

Work to prepare material for the recitation of a large text may include elements of abstracting. It should be borne in mind that abstraction is not only a reduction in the length of the original text, combined with the conversion of direct speech into indirect speech. The abstract may also include a statement of one's own attitude to the events described in the text.

It is very important to note that a retelling of a text as a way of developing monological speech should not be seen only as an outcome in the development of this form of speech. Monologues could and should be included, motivated and therefore communicatively colored [11].

At the stage of training in communication it is necessary to formulate such communicative tasks, which can stimulate, "compel" students to use certain linguistic and speech models of activated educational material. In short, it is very important to formulate a study assignment in a such way as to provide an incentive for speech action [12].

The practice of communicating promotes the development of untrained speech, and encourages the independent choice and use of language and speech by students. It may be proposed to find a problem situation (the theme of the game), move from reporting to discussing material, that is not just to ask a question and answer the material studied, but to find issues of interest for discussion, exchange of views within the known knowledge [13].

Conclusions

Practice shows that organized student cooperation in the stages of communication, training and practice in various forms of interaction (in pairs, threes, groups, teams) creates favorable conditions for the formation of communication skills (monological, dialogue and polylogical speech) through the development

of interpersonal relations. The chosen form of organization of the educational process based on a combination of traditional and intensive methods of teaching foreign language speaking on the basis of the principles of the correlation of teaching and educational systems, has increased the effectiveness of teaching activities. The knowledge levels and language skills have been improved in almost all areas of speech and so the speed of responses to questions, the number of individual statements and the use of complex phrases have been increased; the depth and subject area of students' questions have been changed.

Furthermore not only the students develop the skills to communicate, but also they are able to keep up the conversation doing, lead the communication and direct it to a certain subject (so-called "idea generators").

Some of the significant practical benefits of this technology include: the opportunity to organize students into a group in a short time; to help them to adapt easily to the learning environment and teaching style; to help students to perform tasks that are seemingly impossible in terms of content and subject area from the first point of view; to be able to complete tasks from prepared to untrained speech successfully, and to enjoy and be satisfied with their own achievements. Certainly it encourages learners to achieve success, to get new knowledge and skills in learning a foreign language [14,15].

Intensive method is a field of extensive activity, because it is a flexible system that allows to vary the content of the subject and the educational process according to different conditions and requirements for communicative learning.

The experience has shown that the development of the communication skills has been improved due to the method of strengthening the psychological potential of the individual and the team, the active methods of teaching speaking and the use of scientifically processed text materials. The proposed foreign language teaching intensive technology allows to accelerate the process of achieving the practical results.

References

1. Lomakina E.A. Personality-oriented approach in teaching a foreign language // Modern methods and technologies of teaching foreign languages: collection of works. Magnitogorsk State Technical University. G.I. Nosova, 2019. P. 46-50. (in Russian).
2. Volkova E.G. On the question of linguistic aspects of intercultural communication // Man and culture. 2015. No. 1. P. 42-71. (in Russian).
3. Belyakova E.M., Prokopyev A.V. Innovative teaching methods in education // Modern problems of science and education. 2015. No. 2 (part 1). 2015. URL: <http://science-education.ru/ru/article/view?id=18898> (in Russian).
4. Serova T.S. Characteristics and functions of professionally oriented reading in educational and research activities of students, graduate students and university teachers // Bulletin of the Perm National Research Polytechnic University. Problems of linguistics and pedagogy. 2013. No. 7 (49). P. 3-12. (in Russian).
5. Zhilenko N.V. Personality-oriented technologies in teaching a foreign language // Lingua mobilis. 2011. No. 6 (32). P. 119-124. (in Russian).
6. Serostanova N.N. Intensification of the process of teaching a foreign language in a non-linguistic university through the use of interactive technologies. // Modern problems of science and education. 2015. No. 6. URL: <http://science-education.ru/ru/article/view?id=23597> (in Russian).
7. Rasulova M.Zh. Intensification of learning as a factor in improving the quality of education // Education throughout life: lifelong education for sustainable development. 2015. P. 299-302. (in Russian).
8. Matukhin D.L. Professionally oriented teaching of a foreign language to students of non-linguistic specialties // Language and culture. Linguistics. 2011. No. 2. P. 121-129. (in Russian).
9. Kitaygorodskaya G.A. Methodology for intensive teaching of foreign languages. Moscow: Ed. Moscow University, 1986. 302 p. (in Russian).
10. Sokolova O.L., Skopova L.V. Organization of independent work on a foreign language at a university as a way of individualization of training // Nizhniy Novgorod education. 2016. No. 4. P. 65-72. (in Russian).
11. Sergeeva N.N. Foreign language communicative competence in the field of professional activity: model and methodology // Pedagogical education in Russia. 2014. No. 6. P. 147-150. (in Russian).
12. Erofeeva E.V. French language. Practical course on the development of oral speech skills: Uch. manual for stud. II course Ying-that in. lang. // Ural. state ped. un-t. Ekaterinburg, 2014. 211 p. (in Russian).
13. Shaimova G.A. Formation of communicative competence by means of the "role play" method // Young scientist. 2012. No. 8 (43). P. 382-383. URL: <https://moluch.ru/archive/43/5168/> (date of access: 21.01.2021). (in Russian).
14. Yastrebova L.N. Principles of teaching a second foreign language as a specialty in a language university // Bulletin of the Tomsk State. ped. un-that. 2014. No. 8 (149). P. 75-79. (in Russian).
15. Flerov O.V. Features of teaching a second foreign language in a non-linguistic university // Modern education. 2015. No. 1. P. 1-25. (in Russian).

TECHNOLOGIES FOR FORMING PROFESSIONALLY IMPORTANT QUALITIES IN FULL MILITARY-SPECIAL TRAINING OF FUTURE OFFICERS

Popova Yu.N., Mukhtarov S.A., Kuznetsov A.A., Blazomirskaya A.I.

Krasnodar Higher Military Orders of Zhukov and the October Revolution Red Banner School named after General of the Army S.M. Shtemenko, Krasnodar; e-mail: birj@bk.ru

The article reveals the need to define and substantiate the technology of forming professionally important qualities of a future officer in the process of full-fledged military-special training. The purpose of the article was to substantiate the use of pedagogical technologies for the formation of professionally important qualities. The authors of the article substantiate the need for modeling modern technologies in the educational process, and also describe the technology for the formation of professionally important qualities of a future officer in the process of passing full-fledged military special training and reveal the implementation of its phased application in educational activities. The main key task of full-fledged military special training in the universities of the Ministry of Defense of the Russian Federation is the use of effective pedagogical teaching technologies and the creation of an appropriate educational environment that contributes to the motivated mastery of professional and military professional knowledge, skills and abilities by future officers, as well as improving the abilities for professional activity. The authors concretize the features of the application of the technology for the formation of professionally important qualities of a future officer in the training of military specialists in information protection in a specially created competence educational environment, these technologies contribute to the development of educational motivation, activation of military professional interest, deepening of professional knowledge, and the development of a set of professionally important qualities of an officer ...

Keywords: professionally important qualities, the learning process, learning technologies, pedagogical technologies, competence-based educational environment, future officer, full military special training

The relevance of the article is due to the need to determine and substantiate the technology for the formation of professionally important qualities in future officers in a modern military educational organization of higher professional education, which today are the subject of a number of special studies devoted to the process of formation of professionally important qualities, psychological and pedagogical patterns of their formation in a competence-based educational environment.

Purpose of the study: Theoretically substantiate technologies for the formation of professionally important qualities with a full military-special training of future officers.

Materials and research methods

The term “technology” is widespread in the industrial sphere, pedagogical, educational, scientific, creative activities, etc. According to the definition set forth in the Great Soviet Encyclopedia, “technology is a set of techniques and methods for obtaining, processing or processing raw materials, materials, semi-finished products or products carried out in various industries” [1].

The main feature of the technology for the formation of professionally important qualities is to highlight a clear planning of the result, as well as highlight the stages of its achievement, which is the main advantage of the technologization of education. The technology allows you to create a scientifically and practically grounded system of activities used by a person

to influence the environment in order to produce material values or spiritual growth [2 p. 45].

There are various approaches of scientists to understanding pedagogical technology. According to V.P. Bespalko, “pedagogical technology is a project of a certain pedagogical system, implemented in practice” [3, p. 12]. V.V. Serikova gives the following definition of pedagogical technology – it is “law-based activity leading to a law-like result” [4 p. 113].

I.A. Alekhin, V.V. Tinyan, T.I. Shamov and others identify three incentive reasons for the emergence and practical use of pedagogical technologies [5]:

- the need to introduce an activity approach into the pedagogical system;
- the need for motivation and activation of educational and cognitive activities;
- the possibility of expert design of the technological chain of procedures, methods, organizational forms of interaction between students and teachers, ensuring guaranteed learning outcomes and reducing the negative consequences of the teacher’s work.

Therefore, the important features of learning technology should be highlighted:

1. adaptability of the content of training or education (the ability to undergo coding without losing its teaching or educational capabilities);
2. pedagogical foundations and practical conclusions, as a result of which each technological link in an integral system achieves high efficiency.

It follows from this that pedagogical technology is not a mechanical, once and for all given process with an invariable final result, but an organizational-content structure, a core that determines the direction of interaction between a teacher and a student with an infinite variety of approaches and relationships.

Research results and discussion

Pedagogical technology must be analyzed as rational planning of the system and the implementation of continuous, consistent pedagogical actions in the educational process to coordinate the training activities of the future officer. It is necessary to highlight the following signs of pedagogical technology in this case:

- the goal of the educational process is specific, its achievement is guaranteed as a result of the implementation of all planned procedures of the technology;
- the developed technology should have diagnostic tools that will enable the teacher to evaluate all stages of implementation and adjust the educational process if necessary;
- activity modeling – the use of a well-grounded logic of impact and a clearly defined set of applied techniques and methods;
- justify the applications of the technology, outlining the range of conditions that determine the boundaries of application and affect the performance: individual and social criteria, material and technical support.

Under the pedagogical technology of the formation of professionally important qualities in cadets, one can distinguish the design of an effective pedagogical system, embodied in the course of full military-special training, aimed at the planned result – the formation of professionally important qualities of an officer.

Based on the work of G.K. Selevko [6, P. 45], it is necessary to designate the pedagogical technology, which must be directed to the formation of professionally important qualities of an officer in the course of full military-special training in a competence-based educational environment, implemented in stages in the educational process:

The initial stage of work should be aimed at familiarizing future officers with the content, tasks and meaning of professional interaction, with the essence of their future professional activities, with its types and methods of individual professional self-realization, etc.; to include its content in the educational process. An important aspect is the diagnosis of professionally important qualities of future officers and their validity.

At the second stage, it is necessary to highlight the disciplines that should be included in the program for the formation of professionally important qualities of future officers and implement it continuously in each semester, using modeling technology for the formation of professionally important qualities, which will include corrected forms of interaction, such as lectures, seminars and practical classes, correctional and developmental exercises, command and staff exercises, role-playing, business and military-special games, individual and group counseling. It is important to discuss the forms of organization of training and the conditions for their implementation with teachers leading disciplines.

At the third stage of modeling the technology for the formation of professionally important qualities of a future officer, it is useful to determine the means and methods of training that contribute to the formation of professionally important qualities, forms of organizing of the educational process in a competence-based educational environment. At the same time, it should be borne in mind that the level of formation of professionally important qualities largely depends on the use of context-simulation learning technologies in the educational process.

To date, the key task of full military-special training in the universities of the Ministry of Defense of the Russian Federation is the use of effective pedagogical technologies of training and the creation of an appropriate educational environment that contribute to the motivated mastering by future officers of professional and military-professional knowledge, skills, and improvement of abilities for the professional activity.

M.M. Levin argued that learning technologies, first of all, provide a reflection of the process of control and self-regulation of learning activities. As a result of technologization of the educational process, the necessary organizational and pedagogical conditions are created for its individualization and subjectivation of students, ensuring the activity of all participants, awareness of their performance of cognitive actions.

Pedagogical technologies are currently being rapidly updated, in connection with which it is necessary to be able to navigate the information flow, which is important for any professional.

For our study, the main element in the technology for the formation of professionally important qualities of a future officer is contextual training, focused on the fact that knowledge,

skills and abilities do not act as a subject to which the activity of a future officer should be directed, but as a means of solving problems of professional activity of a military specialist. The main characteristic of the educational process of a contextual type, implemented with the help of a system of new and traditional forms and methods of teaching, is the modeling of the subject and socially significant content of future military professional activities. When studying general professional, special and specialization disciplines, real professional situations and fragments of service relations of people employed in it are recreated. Consequently, the outlines of his professional labor (military labor) are given to the future officer. It is during the analysis of situations, business and educational games that the future officer is formed as a military specialist and a member of the future military collective.

Contextual learning technology is formed by three basic forms of activity: educational activity with the leading role of seminars and lectures; quasi-professional, embodied in games, special courses, special seminars; educational and professional, represented by research work, industrial practice, course and diploma design.

Contextual training significantly changes the position of a future officer in a competence-based educational environment: from a consumer of educational information, he becomes the creator of his professionally important qualities. This main feature of contextual learning, in our opinion, allows us to correlate it with active learning technologies.

G.V. Lavrentiev, N.B. Lavrentieva, N.A. Neudakhin divide all active learning technologies into non-imitation and imitation ones used in the educational process on the basis of recreation (imitation) of the context of professional activity in training [7].

In the process of implementing non-imitation technologies in a competence-based educational environment, the activation of the learning process is achieved through the selection of problematic learning content, the use of an organizational procedure for conducting a lesson in a special way, the use of technical teaching aids, an organizational procedure for conducting a lesson, as well as technical means and ensuring dialogical interactions between the teacher and the future officer.

The authors (G.V. Lavrentiev, N.B. Lavrentieva, N.A. Neudakhina) include a problem lecture, a seminar-discussion with or without a brainstorming, an offsite practical lesson, pro-

grammed training, coursework, thesis, internship without performing an official role [7]. It is obvious that the above training technologies create opportunities not only to transfer certain information to future officers, but also to create prerequisites for the development of some general and professional skills and abilities in a competence-based educational environment. So, non-imitative forms and methods are primarily based on the ideas of problem learning.

The theoretical substantiation of problem learning is associated with the idea of S.L. Rubinstein that thinking always begins with a problem situation. "Problem, wrote S.L. Rubinstein is an integral feature of cognition, it expresses not only the subjective state of the knower, it naturally follows from the objective relationship of cognition to being, its object and from the nature of this latter. The presence of a problem, problem situations is objectively due to the infinity of existence and the interconnection of all phenomena in the world" [8]. It should be borne in mind that the problem of the formation of a creative personality is solved not only in the course of the problem learning itself, but also on the basis of the direct influence of the creative leader, interpersonal contacts, competition and play, fantasizing and improvisation, in which a problem is connected with imagery, with immersion. into the world of new relationships for a person and other factors.

Problem-based learning realizes two goals, one of them, according to P.G. Kravtsova, V.N. Mikhelkevich, V.M. Nesterenko, forms the necessary system of knowledge, abilities and skills among students, which contribute to the development of a high level of self-study and self-education. This is the result of the fact that in problem-based learning the assimilation of educational material is in the form of active educational activities, including in the process of solving professional problem problems. Another goal of problem learning is the formation of active mental activity, research independence [9].

Problem-based learning also contributes to the formation of professionally important qualities in a competence-based educational environment in the course of full military special training. A high level of problematicity is achieved through the organization of dialogical forms of work. They can be realized both during classroom sessions at lectures, seminars, practical exercises, and during extracurricular hours at consultations, meetings of the military scientific society, at extracurricular workshops.

The future officer's own positions are revealed, the personal meaning of the acquired knowledge is acquired, the future officer is being prepared for independent activity.

The implementation of problem-based learning in a competence-based educational environment in the formation of professionally important qualities in future officers can be carried out by various methods.

1. Statement of the problem before the presentation of the educational material of a professional orientation. Demonstrating to the cadets the logic of mental activity, the teacher involves them in a joint scientific search for a solution to the problem.

2. A partial search method for solving a problematic problem of a professional nature. Involvement of cadets in the step-by-step solution of the problem under the guidance of a teacher.

3. Independent solution of the problem task by the students, based on the knowledge, skills and abilities they have acquired in a military orientation.

4. The method of "brainstorming", which consists in the collective solution of a complex problem based on the generation of diverse ideas.

5. A situational method focused on identifying a problem, analyzing it, finding solutions.

The use of problem-based learning in the educational process of a competence-based educational environment contributes to the formation of key and important qualities necessary for military professional activity in future officers: productive and analytical thinking, professional imagination, communication skills, military professional logic, and also activates the cognitive properties of the individual.

At the same time, gaming technologies should be highlighted as effective technologies used in teaching. So G.K. Selevko believes that "play is a type of activity in situations aimed at recreating and assimilating social experience, in which self-management of behavior is formed and improved" [6].

In the works of A.P. Panfilova, "every game, exercise, situation, training should be aimed at achieving educational or organizational and personal developmental goals, at acquiring knowledge, skills and abilities of a professional, managerial, psychological nature, that is, at developing professionally important qualities in a particular area human relations" [10].

Game technologies solve pedagogical tasks: teaching, educational and developmen-

tal, in which the functions of a competence-based educational environment are implemented: stimulating, developing, adaptive and communicative. Applying these technologies in specialized disciplines, the emphasis should be on role-playing games: demonstration role-playing games; role-playing games for the whole group; exchange of roles; spontaneous role-playing games that contribute to the development of important personality traits, such as emotional-volitional, communicative and managerial qualities, manifested in the awareness of options for evaluating the same subject, the ability to take into account different opinions and reasonably defend their views, as well as the ability to consciously observe combat, moral-political and moral-ethical norms, attunement of consciousness to certain attitudes through argumentation. Consequently, the implementation of gaming technologies in the educational process contributes to the formation of professionally important qualities in future officers. The format of the games used is optimal for planning and monitoring the behavior of future officers in the expected military-professional situations, training and adapting them to military-professional activities.

Conclusions

In conclusion, it should be noted that the productivity of the integration of various technologies is obvious when students receive a choice of various technological tools for obtaining relevant information, analyzing it and synthesizing a new set of educational and professional information. The use of technology for the formation of professionally important qualities of a future officer contributes to the development of his educational motivation, activation of military professional interest, deepening professional knowledge and skills, as well as the formation and development of a set of professionally important qualities of an officer.

References

1. Great Soviet Encyclopedia [Electronic resource]. URL: <https://bse.slovaronline.com/> (date accessed: 16.01.2021).
2. Sivashinskaya, E.F. Pedagogical systems and technologies [Text]: a course of lectures / E.F. Sivashinskaya, V.N. Punchy; under total. ed. E.F. Sivashinskaya. Minsk: Ecoperspectiva, 2012. 196 p.
3. Alexandrov E.P. Components of pedagogical technology // Bulletin of the Taganrog Institute of Management and Economics. 2013. URL: <https://cyberleninka.ru/article/n/slagaemye-pedagogicheskoy-tehnologii/viewer> (date accessed: 16.01.2021).
4. Serikov, V.V. Education and personality. Theory and practice of designing pedagogical systems [Text] / V.V. Serikov. M.: Logos, 2010. 272 p.

5. Alekhin I.A. Military pedagogy: history, theory and development paths / I.A. Alekhin et al. // Collective monograph. M., 2017.
6. Selevko G.K. Pedagogical technologies on the basis of didactic and methodical improvement of educational institutions [Text] / G.K. Selevko. M.: Research Institute School. technologies, 2005. 288 p.
7. Lavrent'ev, G.V. Innovative teaching technologies in the professional training of a specialist. Part 2 / G.V. Lavrent'ev, N.B. Lavrent'eva, N. A. Neudakhina. Barnaul, 2005.
8. Rubinstein, S.L. Fundamentals of General Psychology / S.L. Rubinstein. SPb.: Peter, 2010. 770 p.
9. Mikhelkevich V.N., Kravtsov P.G. Organizational and methodological foundations of functionally oriented training of specialists in the structure of the regional educational cluster // Bulletin of the Samara State Technical University. Series: Psychological and pedagogical sciences. 2015. URL: <https://cyberleninka.ru/article/n/organizatsionno-metodicheskie-osnovy-funktsional-no-orientirovannoy-podgotovki-spetsialistov-v-strukture-regionalnogo/viewer> (date accessed: 16.01.2021).
10. Panfilova A.P. Interaction of participants in the educational process: textbook and workshop for academic bachelor's degree / A.P. Panfilova, A.V. Dolmatov; ed. A.P. Panfilova. M.: Yurayt. 2017. 487 p.

NON-CLASSICAL PROBABILISTIC-STATISTICAL METHOD OF SCIENTIFIC RESEARCH AND ITS APPLICATION IN PEDAGOGY

Romanov V.P., Shiryayeva N.A.

National Research University "MIET", Moscow, e-mail: romanov.valeri@gmail.com,
shiryayeva.nataliya@gmail.com

The article considers the fundamentals of non-classical probabilistic-statistical research method and its application in developing the mathematical model of a student, according to which a student is identified with a distribution function in the information space. This is due to the fact that the student's knowledge is a product of consciousness, the determinism of which is realized through chance, due to the inherent random nature of the mental and somatic states of the individual. For the experimental finding of the individual distribution functions of students, probabilistic-statistical scaling was used, in accordance with which the experimental distribution functions of students are mapped onto a number space. The moments of the experimental distribution functions of students can be used to rank them according to the level of knowledge. Recommendations on optimization of a baccalaureate structure for the higher education system are made, that are based on the analysis of the evolution of experimental distribution functions of a student batch and on the use of the principal of staged education with branching. It is shown that after two years of bachelor's degree course it is reasonable to perform branching, according to which "weak" students should be taken out of a bachelor's program to continue education on a specialist training program, that corresponds to a secondary professional education.

Keywords: probabilistic-statistical method, student, distribution function, scaling, staged education with branching, optimization of the baccalaureate structure

Probabilistic-statistical methods are widely used, when conducting a scientific research. There are classical probabilistic-statistical method (CPS-method) and non-classical probabilistic-statistical method (NPS-method) [1]. CPS-method, based on the use of theory of probability and mathematical statistics, has wide application in the analysis of mass phenomena of a random nature [2]. The NPS-method of scientific research in contrast to the CPS-method could be used to study each particular event of a random nature.

Non-classical probabilistic-statistical method can be used to analyze human behavior in the process of an activity. Here we consider the use of the NPS-method for studying student behavior in the process of gaining knowledge.

Materials and research methods

In the process of learning individual moves in the information space, which represents the results of human semantic activity. Knowledge, that student acquire, has a random factor, since it is a product of consciousness, which determinism is realized through randomness [3]. This behavior of the student is a reflection of the internal properties, specific for each indi-

vidual and conditioned by the random character of his mental and somatic state. This, for example, was the reason for the refusal from a deterministic dynamical model in favor of a random dynamical system in the modeling of human cognitive processes [4].

Since the process of assimilating knowledge involves a random factor, it is impossible to specify student's precise position in the information space, we can only talk about the probability of its location in a specific area of space. This means that to describe student behavior in the process of assimilating knowledge, the non-classical probabilistic-statistical method can be applied. According to this method a student is identified with a distribution function in the information space, namely, with a probability density, which defines the probability to find an individual in a unit area of the information space.

The work [3] presents a system of continuity equations, associating partial time derivative of the probability density with the divergence of the probability density flow:

$$\frac{\partial \Psi(\sigma; t)}{\partial t} + \text{div} [\langle \dot{\sigma} \rangle \Psi(\sigma; t)] = 0,$$

$$\frac{\partial \Psi(\sigma, \dot{\sigma}; t)}{\partial t} + \text{div}_{\sigma} [\dot{\sigma} \Psi(\sigma, \dot{\sigma}; t)] + \text{div}_{\dot{\sigma}} [\langle \ddot{\sigma} \rangle \Psi(\sigma, \dot{\sigma}; t)] = 0,$$

$$\frac{\partial \Psi(\sigma, \dot{\sigma}, \ddot{\sigma}; t)}{\partial t} + \text{div}_{\sigma} [\dot{\sigma} \Psi(\sigma, \dot{\sigma}, \ddot{\sigma}; t)] + \text{div}_{\dot{\sigma}} [\ddot{\sigma} \Psi(\sigma, \dot{\sigma}, \ddot{\sigma}; t)] + \\ + \text{div}_{\ddot{\sigma}} [\langle \ddot{\sigma} \rangle \Psi(\sigma, \dot{\sigma}, \ddot{\sigma}; t)] = 0,$$

.....,

where $\Psi(\sigma; t)$, $\Psi(\sigma, \dot{\sigma}; t)$ and $\Psi(\sigma, \dot{\sigma}, \ddot{\sigma}; t)$ are distribution functions, which identify a student in the information space; σ , $\dot{\sigma}$, $\langle \dot{\sigma} \rangle$, $\ddot{\sigma}$, $\langle \ddot{\sigma} \rangle$ and $\langle \ddot{\sigma} \rangle$ are coordinate, velocity, average velocity, acceleration of the first order, average acceleration of the first order and average acceleration of the second order respectively; t is time.

This system consists of an infinite number of differential equations. To solve them one needs to have data on the average values of velocity and accelerations of various orders. The first and second equations from the above system of differential equations allow to find analytically from the known initial and boundary conditions the explicit form of the distribution function for any moment of time. Differential equations of higher orders can, possibly, be solved only by a numerical method.

It is notable that the random character of human behavior when he performs any activity to some extent is identical to the behavior of microparticles (for example, electrons, atoms, molecules etc.). Specifically, according to the Copenhagen interpretation of quantum mechanics the non-classical probabilistic-statistical method is also used to describe the behavior of microparticles. Microparticle is identified with a wave function, that is a solution of the Schrödinger equation. The wave function itself doesn't have physical sense, but the square of the wave function does have and defines, under normalization condition, the probability density of finding a microparticle in the targeted area of the information space. It should also be noted, that the Schrödinger equation could be transformed to the continuity equation [5], which is similar to the first equation from the above system of differential equations.

Quantum-mechanical description of a microparticle system behavior is based on the principle of "indistinguishability", all particles (for example, electrons) are identical and cannot be distinguished from each other. However, in case of describing the behavior of a student system it is necessary to use the principle of "distinguishability", whereby each student has individual properties, that distinguish him from each other. In addition, the above system of equations allows taking into account the random location of the individual not only in the coordinate space, but also in the spaces of velocities and accelerations of various orders. Hence, the concerned NPS-method opens opportunities for the study of human behavior in various contexts.

When carrying out pedagogical measurements, scaling is of great importance. It is notable, that classical scaling methods cannot be used for measuring the completeness of a student's knowledge, since they do not take into account the probabilistic-statistical character of student behavior. This problem can be solved by applying the non-classical probabilistic-statistical scaling method. According to this method the measurement scale is an ordered system $\langle A; L_\psi, F, G; f, M \rangle$, where

A is some ordered set of objects (students), that have characteristics of interest to us (empirical system); L_ψ – functional space (space of distribution functions); F is mapping of A to a subsystem L_ψ ; G is a group of admissible transformations; f is mapping of distribution functions from the subsystem L_ψ to the numeric systems with relations of n -dimensional space M .

This measurement scale allows, when assessing the completeness of student's knowledge, to pass from the functional space to the numeric space. For this purpose, student's empirical distribution functions, received from the results of a review work, for example, an examination, are mapped onto the numeric space in the form of moments of different orders of these functions, obtained by calculation. Mostly it is enough to calculate the moments of the first, second and third orders, which characterize the mathematical expectation, dispersion and asymmetry of the distribution functions respectively.

Comparison of the moments of different orders of students' individual distribution functions allows to rank students by the level of knowledge. The matter of the application of probabilistic-statistical scaling to measurements in pedagogy and to the assessment of student's knowledge completeness, as well as student ranking by the level of knowledge, is clarified in [3]. Let us analyze some features of the experimental distribution functions.

Research results and discussion

In some cases the use of traditional five-point measurement scale for finding the experimental distribution function, identifying student, is not practical, since due to the large error of $\pm 0,5$ points and narrow scale range it is impossible to observe the true form of the individual distribution function (its fine structure is masked by an error). However, in some cases, when it is necessary to analyze simultaneously a large number of students, for example, a student batch, a five-point measurement system can be used, and in this case the true individual distribution function can be approximated by a rectangular distribution function, which width is equal to 1 point. This wouldn't significantly affect the structure of the distribution function, that characterize the behavior of the student batch as a whole.

The use of point grading scales of higher orders, for example, a 20-point or a 100-point scale, allows to recognize specifics of the structure of individual distribution functions. So, fig. 1 shows typical individual distribution functions, obtained experimentally using a 20-point scale.

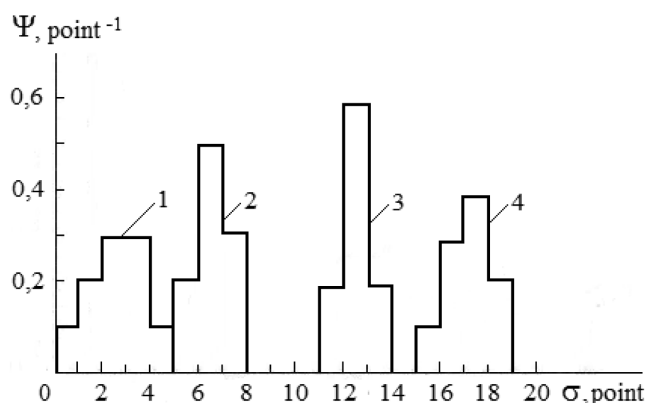


Fig. 1. Typical individual distribution functions of students, who have received in the physics exam traditional grades: 1 – “2” (unsatisfactory); 2 – “3” (satisfactory); 3 – “4” (good); 4 – “5” (excellent)

Individual distribution functions, shown in fig. 1, are in fact histograms, that can hardly be approximated with smooth lines. However, this can easily be done when statistically processing a large number of individual distribution functions, especially, using a 100-point measurement system. It is notable that the area under each individual distribution function is equal to one, since it corresponds to the probability to find a student in the entire information space.

As the order of measurement scale tends to infinity the individual distribution functions will come close to the true functions. However, none of the “true” individual distribution functions will be exactly identic to any other function in form and position in the information space, even for the student “clones”, that have completely the same initial properties. This due to the fact that the behavior of each individual student in the process of assimilating knowledge involves random factor. Here we find an analogy with the behavior of quantum microparticles, “clones”, that are prepared hypothetically in completely the same way. In quantum mechanics it is shown, that such microparticles, when passing, for example, through a slit, will with a certain probability fall into some or other area of the screen, and the probability of microparticles hitting one and the same point on the screen is zero.

On the basis of statistical processing of students' individual distribution functions, distribution functions of the student batch were built (fig. 2). Individual distribution functions were rectangular functions with a width of 1 point, that were obtained experimentally using a five-point measuring system. It follows from the analysis of evolution of distribution functions, shown in fig. 2, that as functions move through the information space their dispersion increases and mathematical expectation shifts from

the left bound towards the center. Over time, this leads to overlapping of the distribution functions, which becomes notably significant in senior years. This means, that the amount of knowledge of a strong junior student, can actually exceed that of a weak senior student. The overlapping of functions already becomes significant for the distribution functions, corresponding to the second and third course years. Thus, starting from the third year of study, student batch becomes markedly heterogeneous in terms of the level of knowledge, and learning efficiency in such groups decreases.

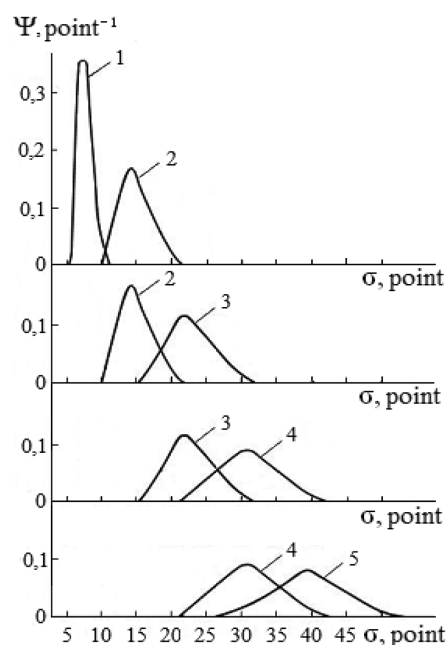


Fig. 2. Experimental distribution function of the student batch, found after the first year of study (curve 1), second year (curve 2), third year (curve 3), fourth year (curve 4), fifth year (curve 5)

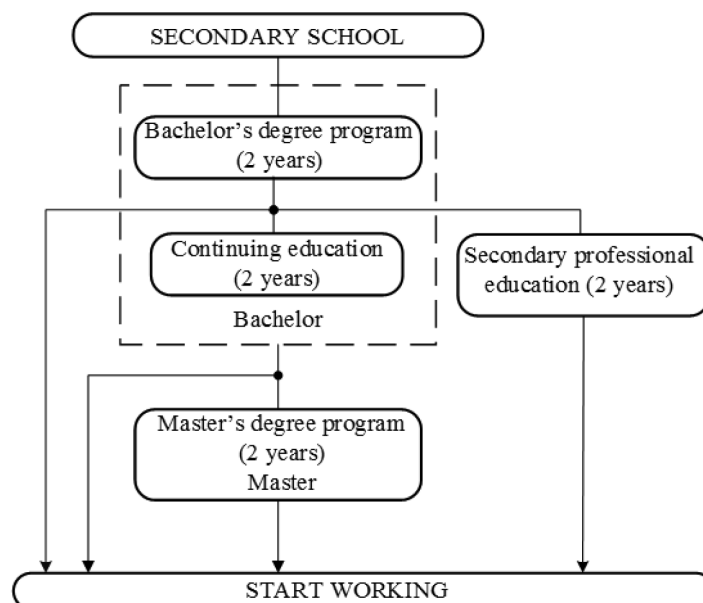


Fig. 3. An alternative structure of the higher education system, which takes into account the principal of staged education with branching in the structure of baccalaureate

Teachers, who conduct classes for the large student groups, in this case have to orient towards “average” students, this negatively affect the study of “weak” and “strong” students: weak students cannot sufficiently learn the material, and the potential of the strong students is not fully utilized. This leads to the increase in heterogeneity of student body and, therefore, to a reduction of the requirements for student attestation, which inevitably leads to the overall decrease in qualification of the intended specialists. In this context it is reasonable to move to the staged education with branching to enhance the efficiency of the educational process. This principle can be used for the optimization of the structure of higher educational system.

In Russian Federation the two-tier system of higher education actually takes place: bachelor's degree (four years of study) and master's degree (two years of study), while maintaining the specialist program. Such structure of the higher education system undoubtedly improves the quality of student education. At the same time, it involves internal conflicts, conditioned by high heterogeneity of students in terms of the level of knowledge, that already appears after the second year of study (distribution function, identifying a student batch, already have high dispersion). The above analysis of the evolution of the distribution function of the student batch (fig. 2) showed significant overlapping of the distribution functions after

the second and the third years of study. Hence, a stage of education should not last more than two years. This means, that bachelor's program should be carried out in two stages with the allocation of quasi-homogeneous (in terms of the level of knowledge) student subsystems on each stage followed by branching with the aim of their separate study [6]. The principal of staged education with branching could be implemented in the structure of bachelor's program in the following form (fig. 3).

It is hoped, that the proposed structure of the baccalaureate will allow to enhance the efficiency of the educational process, since after the first two years branching should take place, according to which only average and strong students will be able to continue study on the bachelor program, whereas weak students should be taken out of the bachelor's program to continue study during 1,5-2 years on the specialist program, that corresponds to the secondary professional education (accountant, nurse, technician and etc.). It is supposed that on the first stage of education students should study fundamental and general disciplines and, upon successful completion, obtain a certificate, confirming of the stage completion. Such baccalaureate structure offers additional opportunities for student mobility, for example, to complete education after the first stage of baccalaureate and start working, to continue education on a bachelor's program or program

of specialist with a secondary professional education, as well as to pass to another higher educational institution and continue education there. After graduation from the bachelor's degree the second branching takes place, according to which a graduate can start working or continue education in a master's degree for 2 years.

Conclusion

In conclusion, we note that non-classical probabilistic-statistical method of scientific research takes into account the properties, specific for each individual and conditioned by random character of mental and physical state, and allows build a mathematical student model, according to which he is identified with a distribution function, that moves in the information space, and the analysis of experimental distribution functions makes it possible to

rank students by the level of knowledge and to formulate the proposals for optimization of the educational process.

References

1. Romanov V.P., Sokolova N.A. Comparative analysis of classical and non-classical probabilistic-statistical methods of psycho-pedagogical research // International journal of experimental education. 2013. № 10. P. 42–46.
2. Borytko N.M., Molozhavenko I.A., Solovtsova A.V. Methodology and methods of psychologic-pedagogical researches: training book for students of higher educational establishments. M.: Akademija, 2009. 320 p.
3. Romanov V.P., Shiryayeva N.A. Non-classical probabilistic-statistical method of scientific research: Application in psychological pedagogy. M.: De'Libri, 2018. 136 p.
4. Khrennikov A.Yu. Mental modeling in p-adic systems of coordinates. M.: Fizmatlit, 2004. 296 p.
5. Blokhintsev D.I. Principals of quantum mechanics. M.: URSS. 2015. 672 p.
6. Sokolova N.A. Propositions for optimization of higher education structure // Fundamental research. 2011. № 12. P. 58–62.

МАТЕРИАЛЫ XIII МЕЖДУНАРОДНОЙ СТУДЕНЧЕСКОЙ НАУЧНОЙ КОНФЕРЕНЦИИ
«СТУДЕНЧЕСКИЙ НАУЧНЫЙ ФОРУМ 2021»**ЭФИРНЫЕ МАСЛА В ТЕРАПИИ ОНКОЛОГИЧЕСКИХ ЗАБОЛЕВАНИЙ,
ВОЗМОЖНЫЕ БИОХИМИЧЕСКИЕ МЕХАНИЗМЫ****Ихсанова А.И., Князева О.А.***ФГБОУ ВО «Башкирский государственный медицинский университет»,
Уфа, e-mail: ixsalina@mail.ru*

Цель данного исследования – оценка возможности использования терапии природными антиоксидантами (эфирные масла лаванды, шалфея и эвкалипта) при экспериментальной миеломе на линейных мышках. Исследование проводили на мышках линии BALB/c ($n = 36$), у которых индуцировали асцит путем внутрибрюшинного введения клеток миеломы Sp 2/0 Ag14 (10^6 / мышь). В качестве антиоксидантной терапии применяли ингаляционное введение эфирных масел (ИЭМ), произведенных в Научно-производственной фирме «Царство ароматов» (г. Судак, Крым), проявляющих, по ранее полученным данным, иммунокорректирующие, антиоксидантные и антиканцерогенные свойства. ИЭМ проводили в течение двух недель, по 45 минут, начиная со второго дня после внутрибрюшинного введения миеломных клеток, методом аэрофитотерапии эфирными маслами в парах воды при 80°C до концентрации в воздухе $4-5 \text{ мг/м}^3$. Противоопухолевые свойства эфирных масел исследовали на 16-е сутки по торможению развития асцита (ТРА), снижению прироста массы тела (СПМТ), медиане – средней продолжительности жизни (МПЖ) и увеличению продолжительности жизни (УПЖ). Сравнивали показатели в трех группах: 1 – контроль (мышь с индуцированной миеломой); 2 – «миелома + ИЭМ₁» (смесь эфирных масел лаванды настоящей и шалфея мускатного в соотношении 2:1) и 3 – «миелома + ИЭМ₂» (эфирное масло эвкалипта шаровидного). Результаты статистически обрабатывались с помощью программы STATISTICA 10.0. Полученные результаты свидетельствуют о том, что проведение ИЭМ₁ и ИЭМ₂ приводит к торможению развития асцита у миеломных мышей, что может быть использовано в профилактических целях и комплексной терапии неопластических процессов.

Ключевые слова: антиоксиданты, эфирные масла, линейные мыши, миелома, рак**ESSENTIAL OILS IN THE TREATMENT OF ONCOLOGICAL DISEASES,
POSSIBLE BIOCHEMICAL MECHANISMS****Ikhsanova A.I., Knyazeva O.A.***Bashkir state medical university, Ufa, e-mail: ixsalina@mail.ru*

The purpose of this study is to evaluate the possibility of using natural antioxidant therapy (essential oils of lavender, sage and eucalyptus) in experimental myeloma in linear mice. The study was performed on BALB/c ($n = 36$) mice in which ascites were induced by intraperitoneal injection of myeloma cells Sp 2/0 Ag14 (10^6 / mouse). As an antioxidant therapy, inhalation administration of essential oils (IEM) produced in the research and production company «Kingdom of aromas» (Moscow) was used. Sudak, Crimea), showing, according to previously obtained data, immunocorrective, antioxidant and anti-carcinogenic properties. IEM was performed for two weeks, for 45 minutes, starting from the second day after intraperitoneal injection of myeloma cells, by the method of aerial phytotherapy with essential oils in water vapor at 80°C to a concentration in the air of $4-5 \text{ mg/m}^3$. Antitumor properties of essential oils were studied on the 16th day for inhibiting the development of ascites (TRA), reducing body weight gain (SPMT), median – average life expectancy (MPW) and increasing life expectancy (UPW). We compared the indicators in three groups: 1 – control (mice with induced myeloma); 2 – «myeloma + IEM1» (a mixture of essential oils of real lavender and Clary sage in a ratio of 2:1) and 3 – «myeloma + IEM2» (eucalyptus globulus essential oil). The results were statistically processed using the STATISTICA 10.0 program. The obtained results indicate that iem1 and IEM2 leads to inhibition of ascites development in myeloma mice, which can be used for preventive purposes and complex therapy of neoplastic processes.

Keywords: active oxygen species (ROS), antioxidants, anticancer therapy

На протяжении десятилетий проводились научные дискуссии об использовании антиоксидантов для лечения рака человека, но, чтобы сделать какой-либо вывод, количества проведенных исследований недостаточно. Изучение свойств эфирных масел в модельных системах и на живых организмах представляет значительный научно-практический интерес, который может позволить выявить связи между составом масел и их антиоксидантными свойствами, изучить возможные биохимические механизмы действия.

В настоящее время для лечения различных видов рака широко используются (по отдельности и в сочетании) три вида

терапии: химиотерапия, лучевая терапия и иммунотерапия. Одним из последствий химиотерапии и лучевой терапии является генерация реактивных форм кислорода (ROS), которые посредством прямого и косвенного воздействия на опухолевые клетки индуцируют повреждение ДНК и влияют на механизмы репликации ДНК, что приводит к отклонениям в сигнальных путях [1]. Большинство из этих методов не считается эффективным вариантом лечения рака в прогрессирующей стадии с метастазами, что возможно связано с приобретением резистентности к опухоли и развитием локальной токсичности, приводящим к уменьшению чувствитель-

ности или рецидиву заболевания. Следовательно, потенциально новые терапевтические подходы и агенты, проявляющие антиканцерогенные свойства, потенцирующие апоптоз опухолевых клеток необходимы для продления жизни больных с онкопатологией [2].

Из данных литературы известно об альтернативном лечении онкологических больных с использованием ароматерапии эфирными маслами растений.

Эфирные масла растений представлены преимущественно веществами изопреновой природы, терпеноидами, многокомпонентными системами. Основными их компонентами являются монотерпеновые спирты и их сложные эфиры, к которым относятся линалоол и линалилацетат. Так в эфирном масле лаванды на линалилацетат приходится до 17 % и на линалоол – до 61 %. В эфирном масле шалфея мускатного, напротив, больше линалилацетата (до 63 %), а линалоола – до 23 % [3].

Показано преимущество применения ароматерапии в комплексе с лекарственной терапией. Это основано на том, что у пациентов происходит снижение уровня тревоги, эмоционального стресса, боли, мышечного напряжения, усталости, что способствует достижению положительных результатов проводимого лечения [4].

Экспериментально доказано антиканцерогенное действие эфирного масла лаванды и его основных компонентов, которое проявлялось в ингибировании пролиферации клеточных линий рака простаты человека PC-3 и DU145 и индукции апоптоза в опухолевых клетках [5].

Цель исследования: оценить возможность использования терапии природными антиоксидантами (эфирные масла лаванды настоящей, шалфея мускатного и эвкалипта шаровидного) при экспериментальной миеломе на линейных мышах.

Материалы и методы исследования

Исследование проводили на линейных 3-х месячных мышах – самцах BALB/c (n = 36), у которых моделировали миеломную болезнь путем внутрибрюшинного введения клеток Sp 2/0 Ag14 из расчета 10^6 клеток на мышь. В качестве антиоксидантной терапии применяли ингаляционное введение эфирных масел (ИЭМ): эвкалипта шаровидного (*Eucalyptus globules*), лаванды настоящей (*Lavandula vera*) и шалфея мускатного (*Salvia sclarea*), полученных из Крыма (Научно-производственная фирма «Царство ароматов», г. Судак), по результатам предыдущих исследований, обладающих не только иммунокорригиру-

ющими и антиоксидантными свойствами, но и антиканцерогенными [6].

Проводили ИЭМ, начиная со второго дня после внутрибрюшинной инъекции миеломных клеток. Метод ИЭМ представлял собой аэрофитотерапию эфирными маслами в парах воды около 80 °С до примерной концентрации в воздухе 4-5 мг/м³. Терапия длилась две недели, по 45 минут в день.

Исследование противоопухолевых свойств эфирных масел проводили по таким показателям, как торможение прироста массы тела (ТПМ), торможение развития асцита (ТРА), средняя продолжительность жизни или медиана (МПЖ), а также по показателю увеличения продолжительности жизни (УПЖ).

Животных разделяли на три группы: 1 – контроль (мыши с индуцированной миеломой); 2 – «миелома + ИЭМ₁» (смесь эфирных масел лаванды настоящей и шалфея мускатного в соотношении 2:1) и 3 – «миелома + ИЭМ₂» (эфирное масло эвкалипта шаровидного). Во 2 и 3 группах животных с привитой миеломой одновременно проводили ИЭМ. Асцит у мышей развивался к концу первой недели. Показатели противоопухолевой активности оценивали на 16-е сутки от начала эксперимента.

Величину ТПМ определяли, используя формулу:

$$\text{ТПМ} = [(\Delta\text{к}-\Delta\text{о})/\Delta\text{к}] \cdot 100 \%,$$

где $\Delta\text{к}$ – прирост массы тела в группе «контроль», г

$\Delta\text{о}$ – прирост массы тела в группе «опыт», г
ТРА рассчитывали по следующей формуле:

$$\text{ТРА} = [(АЖ\text{к}-АЖ\text{о})/АЖ\text{к}] \cdot 100 \%,$$

где АЖк – количество асцитической жидкости в группе «контроль», мл

АЖо – количество асцитической жидкости в группе «опыт», мл

УПЖ определяли, используя формулу:

$$\text{УПЖ} = [(\text{МПЖ}\text{о} - \text{МПЖ}\text{к})/\text{МПЖ}\text{к}] \cdot 100 \%,$$

где МПЖк – средняя продолжительность жизни в группе «контроль» (дни);

МПЖо – средняя продолжительность жизни в группе «опыт» (дни).

При оценке значений МПЖ за 100 % принимали средний показатель в группе животных после применения ИЭМ₁.

Для сравнения данных эксперимента проводили анализ зарубежной и отечественной литературы о возможности применения эфирных масел растений или их компонентов в противоопухолевой терапии.

Результаты были обчислены с использованием статистической программы STATISTICA 10.0.

Изменение показателей развития асцитной опухоли и продолжительности жизни мышей с индуцированной миеломой под действием аэрофитотерапии смесью эфирных масел *Lavandula vera* и *Salvia sclarea* (ИЭМ₁), *Eucalyptus globulus* (ИЭМ₂)

Показатель роста асцитной опухоли	Группа лабораторных мышей		
	1	2	3
	«Контроль-миелома»	«Миелома + ИЭМ ₁ »	«Миелома + ИЭМ ₂ »
Исходная масса тела, г Me [Q ₁ -Q ₃]	28,5 [27,7-29,2]	28,6 [28,4-29,4]	28,8 [28,0-29,5]
Увеличение массы тела, г Me [Q ₁ -Q ₃]	17,1 [16,3-18,2]	8,2 [7,7-8,8] p₁₋₂ = 0,001	9,7 [9,1-10,4] p₁₋₃ = 0,001
Торможение прироста массы тела (ТПМ), %	0	52,3	43,4
Объем асцитической жидкости, мл Me [Q ₁ -Q ₃]	9,9 [9,1-10,6]	4,5 [4,1-5,1] p₁₋₂ = 0,001	5,2 [4,8-5,9] p₁₋₃ = 0,001
Торможение развития асцита (ТРА), %	0	54,3	47,5
Медиана продолжительности жизни (МПЖ), дни	24,2 [20-30]	84,7 [39-182]	73,8 [31-182]
Увеличение продолжительности жизни (УПЖ), %	15,8	305,3	253,1

Результаты исследования и их обсуждение

Результаты данного исследования представлены в таблице (таблица).

Если принять за 100 % прирост массы тела мышей контрольной группы без лечения, то видно, что у животных, получавших терапию ИЭМ₁ прирост массы тела снизился на 52,3 %, а после применения ИЭМ₂ – на 43,4 %. Наибольшее значение ТРА наблюдалось у животных после применения ИЭМ₁ и составляло 54,3 %, что на 6,8 % выше по сравнению с группой животных, получавших ИЭМ₂.

Использование эфирных масел вызвало увеличение МПЖ на 71,4 % после ИЭМ₁ и 58,5 % – после ИЭМ₂. Возрастал при этом также и показатель УПЖ: после ИЭМ₁ на 289,5 %, после ИЭМ₂ – на 237,3 % (рисунок). Оставшиеся в живых подопытные животных были здоровы и активны в течение полугода наблюдений.

Из литературных данных известно, что антиоксиданты оказывают влияние на распределение клеток по фазам клеточного цикла, что в перспективе может позволить разработать методы таргетной

терапии и диагностики онкологических заболеваний. Проксиданты, к которым относятся АФК, продуцируемые в различных метаболических реакциях, происходящих, главным образом, в митохондриях, пероксисомах и эндоплазматическом ретикулуле, могут быть вовлечены в опухолегенез, прогрессирование опухоли и метастазирование [7]. Семейство ферментов НАДН-оксидаз, являющихся наиболее распространенными внутриклеточными источниками генерации АФК, имеют ведущее значение для облегчения перикеллолярного протеолиза, что указывает на их роль в уменьшении метастазов [8]. Понимание роли АФК в пролиферации, прогрессировании и метастазировании опухолей может помочь в разработке комбинированных методов лечения.

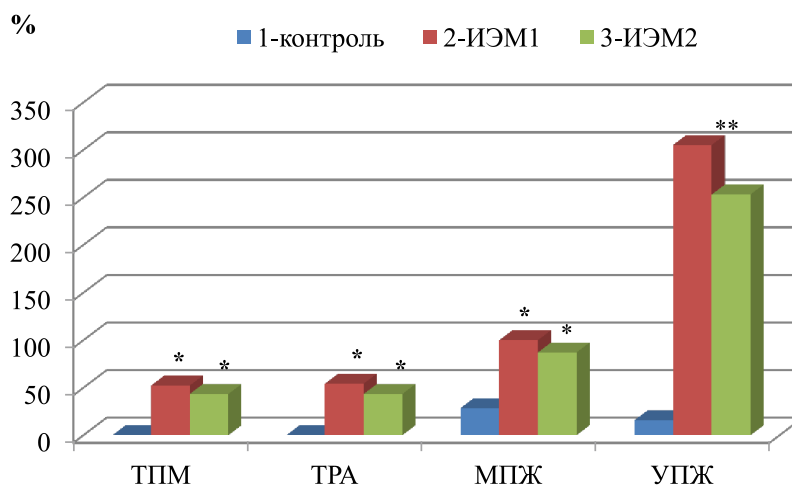
Результаты нашего исследования согласуются с данными литературы. По [9] некоторые из компонентов эфирных масел (п-цимен, гамма-терпинен) оказывают ингибирующее действие на жизнеспособность раковых клеток без какого-либо значительного влияния на нормальные клетки, индуцируя апоптоз за счет генерации АФК, разрушения митохондриального мембранного потенциала, активации каспазы-3 и повреж-

дения ДНК. Показано, что под действием эфирного масла из растения тысячелистника обыкновенного (*Achillea millefolium*) снижалась пролиферация раковых клеток HeLa (CCL-2) [10]. Исследование влияния антиоксиданта изомелаваонового компонента генистеина сои на рак предстательной железы, показало, что как соя, так и генистеин ингибировали рост клеток рака предстательной железы человека PC-3 in vitro и ортотопических опухолей PC-3 in vivo, причем эти эффекты усиливались, их введение сочеталось с проведением лучевой терапии [11]. Обнаружено также, что природный антиоксидант куркумин оказывает подавляющее действие на апоптоз и ингибирование иммуносупрессии Т-клеток [12].

Основной функцией антиоксидантов является нейтрализация образующихся свободных радикалов и ингибирование повреждающих эффектов АФК. Показано, что при начальных стадиях рака достигается более значительный эффект антиоксидантной терапии [13].

Установлена глубокая, до конца не понятая связь между обонятельной и иммунной системами [14]. Можно проследить ее, опираясь на некоторые известные факты. Так проведение обонятельного стимула начинается с того, что пахучие вещества, в данном случае компоненты эфирных масел (ЭМ) взаимодействуют с рецептором мембраны обонятельной клетки. В результате этого происходит активация обонятельного рецептора, соединенного с G-белком

(англ. G protein coupled receptor). Связывание ЭМ с рецептором приводит к активации G-белка, который вызывает активацию аденилатциклазы, в результате которой от ГТФ отщепляется молекула фосфата и он превращается в ГДФ. Активированный фермент катализирует реакцию превращения АТФ в циклическую АМФ (цАМФ), которая взаимодействует с цАМФ-зависимым катионным каналом в мембране, что приводит к открытию потока ионов Na^+ и Ca^{2+} в обонятельную клетку, и запускает потенциал действия в этой клетке, что вызывает передачу сигнала на афферентные нейроны. В некоторых случаях обонятельные рецепторы активируют фосфолипазу, и тогда вторичными посредниками выступают инозитолтрифосфат и диацилглицерол. Возможно также, что в обонятельных клетках из-за активации ионами кальция NO-синтазы образуется оксид азота, вызывающий образование цГМФ. Т.е. мы видим, что действие эфирных масел можно сравнить с действием гормонов. Нервные импульсы запускают синтез клетками гипоталамуса нейропептидов, контролирующих выброс гормонов гипофиза, вызывающих, в свою очередь, синтез гормонов в периферических железах, оказывая влияние на все системы организма, в том числе, иммунную. Результатом может быть стимуляция фиксации активированных компонентов комплемента на опухолевых клетках, аккумуляция нейтрофилов и проявление их киллерного эффекта в отношении асцитных опухолевых клеток [15].



Оценка противоопухолевой активности терапии с использованием ингаляционного введения эфирных масел (ИЭМ) у лабораторных мышей линии BALB/c с индуцированной миеломой Sp 2/0 Ag14 по показателям противоопухолевой активности: ТПМ – торможение прироста массы тела, ТРА – торможение развития асцита, МПЖ – медиана продолжительности жизни, УПЖ – увеличение продолжительности жизни в группах животных: 1 – контроль без лечения, 2 – после применения ИЭМ₁, 3 – после применения ИЭМ₂.

Примечание. * – отличия статистически значимы по сравнению с группой «контроль», ** – отличия статистически значимы по сравнению с группами 1 и между 2 и 3 ($p < 0,05$)

Заключение

Таким образом, полученные результаты свидетельствуют о том, что проведение терапии эфирными маслами *Eucalyptus globulus* и *Lavandula vera* в смеси с *Salvia sclarea* замедляет развитие асцита у мышей с привитой миеломой Sp 2/0 Ag14, что выражалось в увеличении показателей торможения прироста массы тела и развития асцита. При этом также наблюдалось увеличение продолжительности жизни животных, в большей степени, после применения смеси эфирных масел лаванды и шалфея. После дальнейших исследований проведение такого вида терапии может быть рекомендовано для профилактики и повышения эффективности лечения онкологических заболеваний.

Список литературы

1. Oyewole A.O. Mitochondria-targeted antioxidants / A.O. Oyewole, M.A. Birch-Machin // Journal of FASEB. 2015. Vol. 29. P. 4766–4771.
2. Bhatia A. Cancer stem cells and tumour immunoediting: putting two and two together / A. Bhatia, Y. Kumar // Journal of Expert Rev Clin Immunol. 2016. Vol. 12. P. 605–607.
3. Пономарева Е.И. Применение эфирных масел в фармации / Е.И. Пономарева, Е.И. Молохова, А.К. Холов // Современные проблемы науки и образования. 2015. № 4. [Электронный ресурс]. URL: <https://www.science-education.ru/ru/article/view?id=21156> (дата обращения: 12.01.2021).
4. Boehm K., Büssing A., Ostermann T. Aromatherapy as an Adjuvant Treatment in Cancer Care a Descriptive Systematic Review Afr J Tradit Complement Altern Med. 2012. Vol. 9(4). P. 503–518. DOI: 10.4314/ajtcam.v9i4.7 503.
5. Goepfert M., Liebl P., Herth N. Aroma oil therapy in palliative care: a pilot study with physiological parameters in conscious as well as unconscious patients // Journal of Cancer Research and Clinical Oncology. 2017. V. 143 (10). P. 2123–2129.
6. Князева О.А., Уразова А.И. Влияние хронического стресса на развитие привитой миеломы Sp 2/0 Ag 14 у мышей BALB/c на фоне ингаляционного введения эфирных масел // Журнал научных статей Здоровье и образование в XXI веке. 2016. Т. 18. № 4. С. 83–87.
7. Jones L.M. STAT3 establishes an immunosuppressive microenvironment during the early stages of breast carcinogenesis to promote tumor growth and metastasis / L.M. Jones, M.L. Broz, J.J. Ranger // Journal of Cancer Res. 2016. Vol. 76. P. 1416–1428.
8. Roy K. NADPH oxidases and cancer / K. Roy, Y. Wu, J.L. Meitzler, A. Juhasz, H. Liu, G. Jiang, J. Lu, S. Antony // Journal of Clinical Sci. (Lond.). 2015. Vol. 128 (12). P. 863–875.
9. Jamali, Tahereh; Kavoosi, Gholamreza; Ardestani, Susan K. *In-vitro* and *in-vivo* anti-breast cancer activity of OEO (*Oliveria decumbens vent* essential oil) through promoting the apoptosis and immunomodulatory effects // Journal of Ethnopharmacology. 2020. P. 248.
10. Acar, Mustafa Burak; Ibis, Ebru Karadas; Simsek, Ahmet. Evaluation of Achillea millefolium essential oil compounds and biological effects on cervix cancer HeLa cell line // Eurobiotech Journal. 2020. V. 4, 1. P. 17–24.
11. Yang W.H. Imipramine blue halts head and neck cancer invasion through promoting F-box and leucine-rich repeat protein 14-mediated Twist1 degradation / W.H. Yang, Y.H. Su, W.H. Hsu, C.C. Wang, J.L. Arbiser, M.H. Yang // Journal of Oncogene. 2016. Vol. 35 (18). P. 2287–2298.
12. Hijaz M. Folic acid tagged nanoceria as a novel therapeutic agent in ovarian cancer / M. Hijaz, S. Das, I. Mert, A. Gupta, Z. Al-Wahab, C. Tebbe, S. Dar, J. Chhina, S. Giri, A. Munkarah, S. Seal, R. Rattan // Journal of BMC Cancer. 2016. Vol. 16. P. 220.
13. Tibullo I. Heme oxygenase-1 nuclear instability in myeloma cells / I. Tibullo, C. Barbagallo // Journal of Oncotarget. 2016. Vol. 7. P. 28868–28880.
14. Марков А.В., Эволюция человека. М.: «Corpus», 2011. С. 278–280.
15. Князева О.А., Камиллов Ф.Х. Комплемент и антитела при онкологических заболеваниях. Результаты исследований. Германия: LAP LAMBERT Academic Publishing, 2011. 284 с.

РОЛЬ ГЕНЕТИЧЕСКИХ МАРКЕРОВ В ПАТОГЕНЕЗЕ АРТЕРИАЛЬНОЙ ГИПЕРТЕНЗИИ

Чазова Д.А., Сивакова Л.В.

ФГБОУ ВО «Пермский государственный медицинский университет имени академика
Е.А. Вагнера» Министерства здравоохранения Российской Федерации, Пермь,
e-mail: aldarchik888@yandex.ru

В настоящее время главной причиной смерти во всем мире являются сердечно-сосудистые заболевания, так как именно сердце и сосуды первыми принимают на себя удар от действия различных факторов: стресс, нездоровый образ жизни, недостаточный сон, вредные привычки. Однако у части пациентов их основной формой является наследственный компонент. Данный обзор посвящен рассмотрению вопросов участия генетических факторов в развитии артериальной гипертензии. Диагноз артериальной гипертензии присутствует практически при всех сердечно-сосудистых заболеваниях у лиц старше 65 лет. Генетическая предрасположенность к данному заболеванию встречается более чем у 30% пациентов. Важная роль генов заключается в том, что они участвуют в регуляции сосудистого тонуса, кровотока и артериального давления, а при мутации, изменении генотипа, их функциональные особенности значительно изменяются. Так большинство мутаций, приводящих к гипертензии, модифицируют многие системы организма, тем самым увеличивая объем циркулирующей крови, следовательно, увеличивается минутный объем сердца и повышается артериальное давление. Однако, кроме генетических факторов, существуют и средовые факторы, которые в совокупности оказывают значительное влияние на развитие артериальной гипертензии. Еще с давних времен и до сих пор широко обсуждаются генетические аспекты в развитии мультифакториальных заболеваний. Для выявления наследственной предрасположенности возможно проведение генетического анализа на основе генетических маркеров с целью оценки риска возникновения артериальной гипертензии и диагностики на ранней стадии данного заболевания.

Ключевые слова: артериальная гипертензия, наследственность, полиморфизм, генотип, мутация

THE ROLE OF GENETIC MARKERS IN THE PATHOGENESIS OF ARTERIAL HYPERTENSION

Chazova D.A., Sivakova L.V.

Federal state budgetary educational institution of higher education «Perm state medical University
named after academician E. A. Wagner» of the Ministry of health of the Russian Federation,
Perm, e-mail: aldarchik888@yandex.ru

Currently, the main cause of death worldwide is cardiovascular diseases, as it is the heart and blood vessels that first take the hit from the action of various factors: stress, unhealthy lifestyle, insufficient sleep, bad habits. However, in some patients, their formation is based on the hereditary component. This review is devoted to the consideration of the participation of genetic factors in the development of arterial hypertension. The diagnosis of arterial hypertension is present in almost all cardiovascular diseases in people over 65 years of age. Genetic predisposition to this disease occurs in more than 30% of patients. An important role of genes is that they are involved in the regulation of vascular tone, blood flow and blood pressure, and when mutated, changing the genotype, their functional features change significantly. So most of the mutations that can lead to hypertension, a modified system of the body, thereby increasing blood volume, therefore, increases cardiac output and increased blood pressure. However, in addition to genetic factors, there are also environmental factors that together have a significant impact on the development of arterial hypertension. Genetic aspects in the development of multifactorial diseases have been widely discussed since ancient times and still are. To identify a hereditary predisposition, it is possible to conduct a genetic analysis based on genetic markers in order to assess the risk of hypertension and diagnose it at an early stage of this disease.

Keywords: arterial hypertension, heredity, polymorphism, genotype, mutation

Болезни сердца и сосудов широко распространены и являются одними из главных причин инвалидизации, заболеваемости населения, преждевременной смертности во всем мире. Распространенность артериальной гипертензии не имеет тенденции к снижению. По данным ВОЗ, уровень распространенности повышенного кровяного давления в мире среди лиц в возрасте 18 лет и старше в 2014 году составлял около 22%. Ежегодно от сердечно – сосудистых заболеваний умирает 17,9 миллионов человек [1]. Артериальная гипертензия относится к мультифакториальным сердечно – сосуди-

стым заболеваниям. Причина может быть не известна (в этом случае говорят об эссенциальной артериальной гипертензии), либо артериальная гипертензия развивается вторично (то есть является симптомом другого заболевания). Под артериальной гипертензией понимают стойкое повышение артериального давления более 140/90 мм. рт. ст. Повышение артериального давления может длительное время являться единственным симптомом [2, с. 717].

В последнее время большая роль отводится изучению в патогенезе генетических аспектов. Многочисленное количество ис-

следований с каждым днем доказывают значимость генетики в развитии артериальной гипертензии. Сведения о роли наследственного фактора в развитии артериальной гипертензии накапливаются достаточно давно. Так, средовые факторы именно на фоне генетической предрасположенности оказывают более выраженное влияние на развитие данного заболевания.

В участии пациентов с артериальной гипертензией подтверждается наличие наследственного компонента в патогенезе. Для оценки риска развития данного заболевания возможно проведение генетического анализа. При эссенциальной артериальной гипертензии в ряде случаев выявляются дефекты в различных генах.

Одним из них является наличие полиморфизма гена α -аддуцина. Аддуцин – это гетеродимерный белок цитоскелета клеточных мембран, обеспечивающий формирование комплексов спектрин – актин. Является субстратом для протеинкиназ C и A.

Маркер связан с процессами транспорта ионов натрия в клетках, участвуя в регуляции активности Na^+/K^+ -АТФазы. В результате мутации гена α – аддуцина усиливается реабсорбция натрия через мембрану канальцев почек. Основная задача молекулярно-генетического типирования локуса гена α -аддуцина I – это определение единичной нуклеотидной замены в гене, которая вызывает замену аминокислоты глицина на триптофан в 460-м кодоне молекулы полипептида.

Полиморфизм G460W гена ADD1 может рассматриваться в качестве гена предрасположенности к гипертонической болезни [3, с. 38]. Исследование данного генетического маркера может быть необходимым для выявления, в частности, предрасположенности к солечувствительной гипертензии. Однако генетическая предрасположенность чаще реализуется в комплексе с воздействием различных средовых факторов. Кроме этого, выявление носительства генотипа 460WW гена α -аддуцина I ADD1 G460W может иметь значение в патогенезе артериальной гипертензии при беременности.

Известно, что в регуляции артериального давления участвует ренин-ангиотензин-альдостероновая система. Поэтому обнаружение генетических дефектов в ренин-ангиотензин-альдостероновой системе играет большую роль в развитии артериальной гипертензии. Так, например, большое значение имеет выявление мутации гена ангиотензиногена.

Ген ангиотензиногена расположен в локусе 1q42-q43. В настоящее время большая часть выявленных мутаций этого гена при-

водит к замене аминокислот. Например, выявлены варианты мутаций, связанные с заменами метионина на треонин в 235 кодоне (Met235RThr или M235T) и треонина на метионин в 174 кодоне (Thr174Met или T174M). В результате мутаций возможно выраженное повышение содержания ангиотензина II, что может проявляться клинически выраженной артериальной гипертензией. Ангиотензин II действует через ангиотензиновые рецепторы клеток и оказывает сосудосуживающее влияние. Ангиотензин II – это мощный вазоконстриктор. Благодаря связыванию с ангиотензиновыми рецепторами (AT1 – продукт гена aGtR1; AT2 – продукт гена aGtR2), ангиотензин II вызывает сужение сосудов, что способствует повышению артериального давления [4].

Следовательно, данная генетическая предрасположенность играет большое значение в развитии артериальной гипертензии. Важно отметить, что исследование мутаций гена ангиотензиногена может иметь значение при заболеваниях почек, сопровождающихся артериальной гипертензией, с целью прогнозирования хронической почечной недостаточности.

Следующим маркером является ген ангиотензинпревращающего фермента (АПФ), который локализован в локусе 17q23. Ангиотензинпревращающий фермент кодирует два изозима: соматический ACE, который экспрессируется в эндотелии, эпителии почек и других органов, и тестикулярный – только в семенниках [5, с. 85]. Ангиотензинпревращающий фермент участвует в расщеплении ангиотензин-I до ангиотензина-II, является катализатором этого процесса. А ангиотензин II является вазоконстриктором, тем самым способствует повышению уровня артериального давления. Кроме этого, участвует в поддержании электролитного баланса, влияет на фибринолиз, активацию и агрегацию тромбоцитов, то есть участвует в регуляции системы гемостаза. Функционально наиболее значимым полиморфным вариантом данного гена является инсерционно-делеционный полиморфизм в 16-м интроне (I/D), который обусловлен наличием или отсутствием *alu*-повтора; инсерция *alu*-повтора приводит к пониженной экспрессии гена АПФ [5, с. 85]. Выявление полиморфизма гена АПФ может быть связано с высоким риском развития эссенциальной артериальной гипертензии, инфарктом миокарда, гипертрофическими изменениями левых отделов сердца, а также заболеваниями почек, сопровождающимися артериальной гипертензией.

Также относится к маркерам оценки риска развития артериальной гипертензии ген рецептора 1 типа к ангиотензину II (AGTR1), который локализован на длинном плече 3-й хромосомы. Здесь опять следует заметить, что ангиотензин II является одним из самых мощных вазоконстрикторов. Среди мутаций гена рецептора 1 типа к ангиотензину II наиболее изучена A1166C мутация AGTR1. Замена А на С в локусе 1166 (A1166C) скажется на функциональной активности рецептора и осуществлении эффектов ангиотензина II [6]. Полиморфизм гена рецептора 1 типа к ангиотензину II может приводить не только к изменению регуляции сосудистого тонуса, но и к пролиферации элементов сосудистой стенки.

Еще одним маркером является ген рецептора 2-го типа к ангиотензину II (AGTR2), который локализован в локусе Xq22-q23. Известно, что ген AGTR2 экспрессируется под контролем эстрогенов, контролирует вазодилатирующие функции. Таким образом, эффекты ангиотензина II на сердечно-сосудистую систему, опосредованные рецепторами 2 типа к ангиотензину II, будут противоположны эффектам, опосредованным рецепторами 1 типа. Описано 5 полиморфных вариантов гена AGTR2, но наиболее изученной является мутация G1675A, в результате которой гуанин (G) заменяется на аденин (A) в позиции 1675. Это в свою очередь изменяет характер регуляции экспрессии гена.

Данные маркеры (гены рецептора к ангиотензину II 1 и 2 типа) могут быть использованы при обследовании пациентов не только с эссенциальной, но и с ренальной артериальной гипертензией.

Еще одним важным фактором является эндотелиальная синтаза оксида азота (NOS3). Это фермент клеток эндотелиоцитов и кардиомиоцитов, синтезирующий оксид азота. Фермент кодируется геном NOS3. Синтезируемый эндотелием оксид азота (NO) вызывает расслабление гладкомышечных клеток и вазодилатацию, что обеспечивает регуляцию артериального давления, общего периферического сопротивления сосудов [7, с. 9]. Оксид азота снижает уровень вазоконстрикторов, таких как эндотелины, ангиотензин II, тромбосан A2. Важно заметить, что оксид азота выступает в роли не только вазодилатора, но и антиагреганта. Однако в случае мутаций функциональные свойства могут изменяться. Наиболее часто встречаются и более полно изучены мутации T(-786)C и G894T (Glu298Asp). Это маркеры, связанные с изменением продукции оксида азота (NO). Они расположены на хромосоме

7q36. Мутация G894T (Glu298Asp) связана с заменой азотистого основания гуанина (G) на тимин (T) в позиции 894 последовательности ДНК гена NOS3. В результате такого замещения в аминокислотной последовательности белка глутаминовая аминокислота в позиции 298 заменяется на аспарагиновую (Glu298Asp). Мутация T(-786)C связана с заменой азотистого основания тимина (T) на цитозин (C) в регуляторной области последовательности ДНК гена NOS3. Таким образом, обе мутации эндотелиальной синтазы оксида азота приводят к снижению экспрессии генов, спазму кровеносных сосудов, увеличению артериального давления, тем самым повышая риск возникновения артериальной гипертензии. Таким образом, выявление мутаций T(-786)C и G894T (Glu298Asp) как генетических маркеров может быть информативным в определении риска развития инфаркта миокарда, ишемического инсульта.

Следующим маркером является ген альдостеронсинтазы (CYP11B2), который расположен в области g21 8-й хромосомы. Альдостеронсинтаза катализирует реакции, обеспечивающие синтез альдостерона. Под влиянием альдостерона увеличивается канальцевая реабсорбция натрия и воды, увеличивается объем циркулирующей крови, а следовательно, и уровень артериального давления. Кроме этого, альдостерон усиливает чувствительность к вазоконстрикторам гладких мышц сосудов. Изучены несколько мутаций гена альдостеронсинтазы. Наиболее важное значение имеет мутация C(-344)T. Проявляется заменой цитозина на тимин в 344-м положении нуклеотидной последовательности [5, с. 86]. Вследствие этого возможно повышение уровня альдостерона. Избыток альдостерона влияет на увеличение продукции коллагена 1 и 3 типов, повышение выработки провоспалительных цитокинов, что ведет к повреждению сосудов, нарушению коронарного кровоснабжения, снижению диастолической функции миокарда, развитию гипертрофии левого желудочка, дилатации полостей сердца и возникновению аритмий [8, с. 73].

При наличии дефектов в генах, отвечающих за процесс обмена гомоцистеина, возможна гипергомоцистеинемия. Гипергомоцистеинемия также ассоциирована с высоким риском артериальной гипертензии и других сердечно-сосудистых заболеваний. Гомоцистеин оказывает атерогенное и тромбоваскулярное действие. Гипергомоцистеинемия приводит к повреждению и активации эндотелиальных клеток, что значительно повышает риск развития

тромбозов [9, с. 90]. Кроме этого, это оказывает влияние и на чувствительность тканей к оксиду азота, который является вазодилататором. Изучено большое количество генетических нарушений, но наиболее известным является мутация C677T, в котором происходит замена основания цитозина на тимидин в позиции 677. Таким образом, увеличение концентрации гомоцистеина в крови является также фактором риска развития сердечно-сосудистых заболеваний.

Кроме того, к маркерам оценки риска развития артериальной гипертензии относятся гуанин нуклеотидсвязывающий белок бета-3 (GNB3). Известно, что в клетках организма присутствуют гуанин связывающие G-белки. G-белки выступают в роли ферментов, которые связывают и гидролизуют гуанозинтрифосфат. G-белок, кодируемый геном GNB3, опосредует передачу сигналов внутрь клеток, контролируя тонус сосудов и клеточную пролиферацию [10, с. 67]. Известно несколько мутаций данного гена, но наиболее известна мутация C825T. Нарушение передачи сигналов внутрь клеток приводит в результате к сужению сосудов, что существенно повышает риск артериальной гипертензии. Носительство аллели T полиморфного маркера C825T гена GNB3 ассоциировано с повышенной массой тела [10, с. 69]. Избыточная масса тела также является фактором риска сердечно-сосудистых заболеваний и фактором риска развития сахарного диабета.

Многие показатели, определяющие уровень артериального давления, находятся под влиянием различных факторов. В ходе комплексного изучения патогенеза заболеваний появились направления по идентификации генов, ответственных за регуляцию артериального давления, обуславливающих наследственную предрасположенность. На фоне наследственной предрасположенности внешние, средовые факторы проявляют себя в большей степени на риск возникновения артериальной гипертензии. Таким образом, артериальная гипертензия имеет мультифакториальную природу, обусловленную полиморфизмом генов различных систем организма: гомоцистеиновой, ренин-ангиотензин-альдостероновой и других. Так с помощью исследования генетических маркеров можно более достоверно оценить риск воз-

никновения артериальной гипертензии, чем при оценке только средовых факторов. С целью своевременной диагностики и для предупреждения осложнений необходимо регулярно контролировать артериальное давление.

Список литературы

1. Сердечно-сосудистые заболевания. [Электронный ресурс]. URL: [https://www.who.int/ru/news-room/factsheets/detail/cardiovascular-diseases-\(cvds\)](https://www.who.int/ru/news-room/factsheets/detail/cardiovascular-diseases-(cvds)) (дата обращения: 18.01.2021).
2. Болезни сердца и сосудов. Руководство Европейского общества кардиологов / под ред. А. Джона Кэмма, Томаса Ф. Люшера, Патрика В. Серруиса; пер. с англ. под ред. Е.В. Шляхто. М.: ГЭОТАР-Медиа, 2011. 1480 с.
3. Полоников А.В., Ушачев Д.В., Шестаков А.М., Иванов В.П., Солодилова М.А., Вялых Е.К., Кожухов М.А., Колесникова О.Е., Ивакин В.Е., Катаргина Л.Н., Кабанина В.А., Куприянова Я.С., Тевс Д.С. Полиморфизм Gly460Trp гена альфа-аддуцина и предрасположенность к гипертонической болезни. Значение гено-средовых взаимодействий для возникновения заболевания в русской популяции // Кардиология. 2011. № 10. С. 33-39.
4. Rupert J.L., Kidd K.K., Norman L.E. Genetic polymorphisms in the Renin-Angiotensin system in high-altitude and low-altitude Native American population // Ann. Hum. Genet. 2003. Vol. 67, № 1. P. 17-25.
5. Шевченко О.В., Свистунов А.А., Бородулин В.Б., Рута А.В., Бычков Е.Н. Генетические основы патогенеза эссенциальной артериальной гипертензии (обзор) // Саратовский научно-медицинский журнал. 2011. Т. 7. № 1. С. 83-87.
6. Муженя Д.В., Ашканова Т.М., Калакуток К.Б., Бжецов К.З., Тугуз А.Р., Иваненко Т.А., Тлиш Э.Х., Алдонина Л.Д. Ассоциация MET235TNR полиморфизма гена ангиотензиногена (AGT) и A1166C аллели гена рецептора I типа ангиотензиногена-2 (AGT2R1) с сердечно-сосудистыми заболеваниями (ССЗ) у жителей Республики Адыгея // Вестник Адыгейского государственного университета. Серия 4: Естественно-математические и технические науки. 2010. № 3. С. 85-94.
7. Курданова М.Х., Бесланев И.А., Батырбекова Л.М., Прокопец Е.Н., Эльбаева Р.Н., Курданов Х.А. Оксид азота и ремоделирование миокарда у больных артериальной гипертензией в условиях высокогорья // Кардиоваскулярная терапия и профилактика. 2015. Т. 14. № 5. С. 8-12.
8. Михина М.С., Платонова Н.М., Молашенко Н.В., Трошина Е.А. Диагностика и лечение первичного гиперальдостеронизма // Лечение и профилактика. 2015. № 2(14). С. 72-78.
9. Полушин А.Ю., Одинак М.М., Янишевский С.Н., Голохвастов С.Ю., Цыган Н.В. Гипергомоцистеинемия – предиктор тяжести инсульта на фоне обширности повреждения мозгового вещества // Вестник Российской военно-медицинской академии. 2013. № 4 (44). С. 89-94.
10. Арутюнян Л.В., Дробот Н.В., Пироженов А.А., Торосян С.С., Калтыкова В.В. Особенности течения артериальной гипертензии, связанные с распределением аллелей и генотипов полиморфного маркера C825T гена GNB3 среди больных, проживающих в Ростовской области // Вестник Национального медико-хирургического центра им. Н.И. Пирогова. 2017. Т. 12. № 1. С. 66-69.

МЕТОД И ПЕРЕНОСНОЙ КОМПЛЕКС ЭКСПРЕСС-АНАЛИЗА БУТИЛИРОВАННОЙ ВОДЫ

Мартынов В.В., Белозеров В.В.

*Донской государственный технический университет, Ростов-на-Дону,
e-mail: 89054516201@mail.ru*

В статье представлен анализ методов и средств сравнительного анализа жидкостей, показаны их достоинства и недостатки. В связи с тем, что методы и средства контроля должны быть использованы и на предприятии (интегрированы в автоматизированные линии), и непосредственно в точках сбыта (имеют мобильность), предложена модель переносного автоматизированного комплекса, которая базируется на методе весовой импедансной электрометрии (ВИЭМ), что даст возможность без вскрытия тары и отбора пробы производить анализ жидкости, сравнивая «образ» исследуемой жидкости с эталонным «образом». Как показали наши исследования ЖФПП (алкогольные и безалкогольные напитки, в том числе питьевая бутилированная вода, растительные масла, молочные продукты и т.д.) реализуются в различной таре (стеклянной, полимерной и т.д.), розлив в которую, как правило, осуществляют автоматизированные линии и установки, а их соответствие и качество, помимо определения химических свойств, можно идентифицировать по ряду физических параметров (плотности, кинематической и динамической вязкости, диэлектрической проницаемости, проводимости и критериям подобия). Применение подобной системы может полностью ликвидировать контрафакт ЖФПП, а также стать соответствующей подсистемой в «Национальной системе управления качеством пищевой продукции».

Ключевые слова: сравнительный анализ, экспресс-идентификация, автоматизированный комплекс, параметры жидкости, образ продукта

METHOD AND PORTABLE COMPLEX FOR RAPID ANALYSIS OF BOTTLED WATER

Belozarov V.V., Martynov V.V.

Don state technical University, Rostov-on-Don, e-mail: 89054516201@mail.ru

The article presents an analysis of methods and tools for comparative analysis of liquids, showing their advantages and disadvantages. Due to the fact that the methods and controls must be used both at the enterprise (integrated into automated lines) and directly at sales points (have mobility), a model of a portable automated complex is proposed, which is based on the method of weight impedance Electrometry (VEM), which will make it possible to analyze the liquid without opening the container and sampling, comparing the «image» of the liquid under study with the reference «image». As our research has shown, liquid and non-ALCOHOLIC beverages (including bottled drinking water, vegetable oils, dairy products, etc.) are sold in various containers (glass, polymer, etc.), which are usually filled by automated lines and installations, and their compliance and quality, in addition to determining chemical properties, can be identified by a number of criteria.

Keywords: comparative analysis, rapid identification, automated system, the parameters of the liquid, the image of the product

Актуальность предлагаемого подхода и его востребованность обоснована решением Госсовета от 28.08.2017 по вопросу «О национальной системе защиты прав потребителей» и «Стратегией повышения качества пищевой продукции в Российской Федерации до 2030 года», утвержденных Правительством РФ, из которых следует необходимость реализации следующих задач [1, 2]: совершенствование и развитие методологической базы для оценки соответствия показателей качества пищевой продукции; обеспечение мониторинга качества пищевой продукции; создание единой информационной системы отслеживания пищевой продукции; разработка и внедрение системы управления качеством пищевой продукции.

В данной статье речь пойдет о принципиально новом подходе в реализации указанных выше задач, применительно

к жидким фасованным пищевым продуктам (ЖФПП) с помощью метода весовой импедансной электрометрии [3] и переносного автоматизированного комплекса (ПАК), его реализующего, защищенных патентом РФ [4], применение которых может полностью ликвидировать контрафакт ЖФПП, а также стать соответствующей подсистемой в «Национальной системе управления качеством пищевой продукции» [5].

Как показали наши исследования ЖФПП реализуются в различной таре, розлив в которую, как правило, осуществляют автоматизированные линии и установки, а их соответствие и качество, помимо определения химических свойств, можно идентифицировать по ряду физических параметров (плотности, кинематической и динамической вязкости, диэлектрической проницаемости, проводимости и критериям подобия) [6].

Методы и средства по контролю качества и безопасности алкогольной и безалкогольной продукции, в т.ч. питьевой бутилированной воды, изложенные в технических регламентах и стандартах, достаточно строгие, трудоемкие и затратные (оборудование, персонал), а также требуют периодического изъятия продукции из оборота для отбора проб [3, 5]. Очевидно поэтому, всю большую популярность приобретают готовые решения, основанные на компаративном анализе ЖФПП, т.е. использующие метод сравнения «образов» (акустических, электрических, механических и т.д.) эталона и произведенного продукта, или/и нахождения взаимосвязей между различными параметрами ЖФПП [4, 7].

Среди большого перечня средств измерений наиболее точным среди «дистанционных» методов, не требующих отбора проб, является ИК-спектрометрия [8].

В ИК-спектрометре с Фурье-преобразованием, при пропускании излучения через жидкость происходит возбуждение колебательных движений молекул (отдельных фрагментов молекул), а также ослабление интенсивности излучения при тех длинах волн, энергия которых соответствует энергиям возбуждения колебаний в излучаемых молекулах [8]. Эта особенность используется для качественной идентификации жидко-

сти при помощи ИК-спектрометра, который позволяет снять ИК-спектр вещества, а, благодаря наличию большой базы спектров эталонов, становится возможным оценить степень соответствия эталону при помощи сравнительного корреляционного анализа или выполнить библиотечный поиск [8].

В ИК-спектрометрах блок прибора, ответственный за разложение спектра по частотам, называется анализатор частоты, который может выполнять физическое (дисперсионная ИК-спектроскопия) или математическое разложение длин волн (ИК-спектроскопия с Фурье-преобразованием). Однако, в связи с тем, что физическое разложение длин волн очень продолжительный процесс, ИК-спектроскопия с Фурье-преобразованием на данный момент вытеснила дисперсионную ИК-спектроскопию [8].

В схеме луч падает на светоделитель, из-за чего получается два луча примерно одинаковой интенсивности. Далее, каждый из этих лучей отражается от своего зеркала и возвращается на светоделитель, где лучи объединяются, создают интерференцию и попадают на детектор. Одно из зеркал в интерферометре является подвижным: его положение постоянно меняется, за счет чего возникает меняющаяся разность хода, что приводит к положительной или отрицательной интерференции [8].

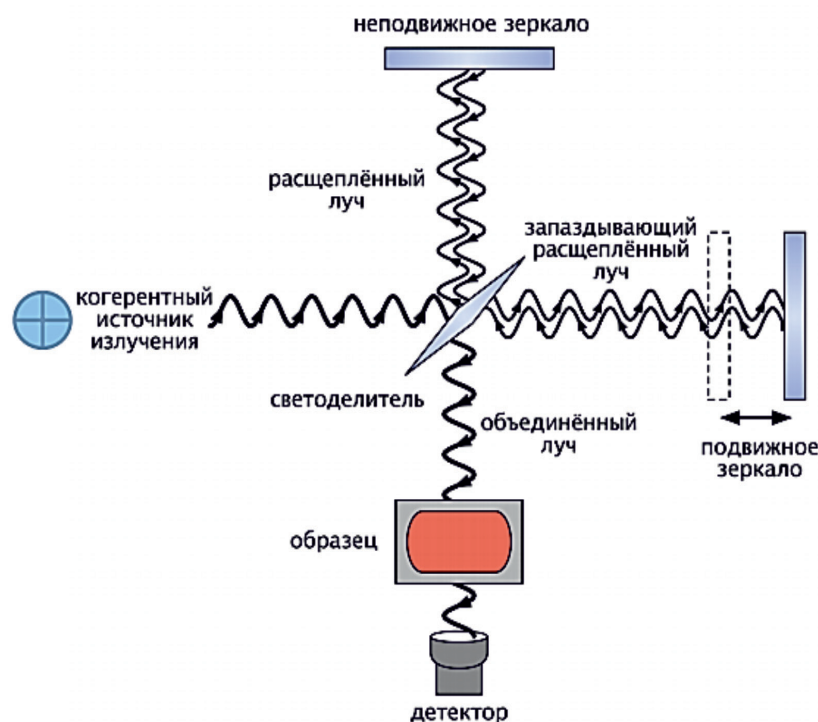


Рис. 1. Схема интерферометра



Рис. 2. ИК-Фурье спектрометр (FT-IR)

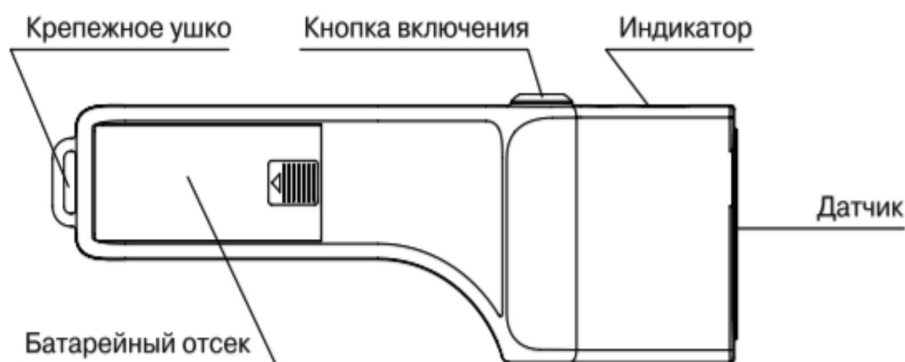


Рис. 3. Общий вид прибора с указанием основных конструктивных элементов

В настоящее время ИК-спектрометры широко используются в фармацевтической и пищевой промышленности, на предприятиях по производству полимеров и композитов, топлив и масел, однако метод не чувствителен к примесям, если они не превышают 1 %. Другое ограничение заключается в том, что многие жидкости и газы, вода и углекислый газ в частности, имеют в ИК-области очень сильное поглощение [8, 9].

Наиболее интересным, с точки зрения «бесконтактности и быстроты» идентификации, является «Ручной прибор для обнаружения огнеопасных жидкостей в закрытых сосудах (ППБ)», позволяющий оценивать пространственное распределение электрических свойств среды и определять характеристики жидкости независимо от размеров контейнера, толщины его стенок или наличия воздушных зазоров между прибором и сосудом. На измери-

тельных электродах устройства наводятся потенциалы, величина которых зависит от источника напряжения, расстояния между активным электродом и измерительными электродами и комплексной диэлектрической проницаемости среды. В свою очередь, электрические свойства жидкости (диэлектрическая проницаемость и проводимость) позволяют однозначно оценить ее опасность. С другой стороны, прототип поставляется уже со стандартным программным обеспечением и не может быть перепрограммирован, так как не имеет разъема подключения [10].

Время обследования емкости с жидкостью составляет несколько секунд, а, благодаря малым габаритам, LQtest 2.8 имеет высокую мобильность.

Общим «недостатком» указанных средств является их высокая стоимость, а ИК Фурье-спектрометр требует ещё высококвалифицированного специалиста.

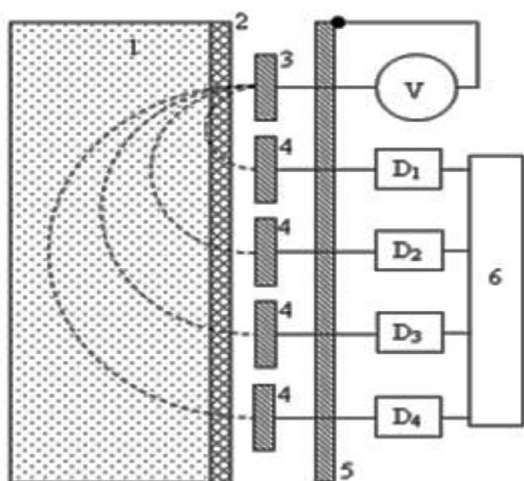


Рис. 4. Полевая структура LQtest 2.8:
1 – проверяемая жидкость, 2 – стенка сосуда и воздушный зазор, 3 – активный электрод, 4 – измерительные электроды, 5 – металлический экран, 6 – вычислительное устройство, V – источник переменного напряжения, Dn – измерители

Именно поэтому, для обеспечения сплошного контроля наиболее «контрафактно-опасных» жидких фасованных

пищевых продуктов, которыми оказались бутилированная вода и спиртоводочная продукция, был разработан и защищен патентом РФ на изобретение, метод весовой импедансной электрометрии и переносной комплекс, его реализующий [4].

Переносной автоматизированный комплекс

Метод весовой импедансной электрометрии (ВИЭМ) с емкостным датчиком-крышкой был опробован на различных фасованных жидких продуктах (масло, алкогольная и безалкогольная продукция) и показал достаточную точность их идентификации без вскрытия тары и отбора проб.

Сущность метода ВИЭМ заключается в том, что, из-за внедрения на этапе фасовки датчика-крышки, появляется возможность измерить указанные выше электрофизические параметры жидкости, без нарушения герметичности упаковки, т.е. определить «образ» исследуемой жидкости, сравнить его с «образом эталона» и вычислить критерии подобия (электродинамический, электромагнитный, диэлектрический, электроиндуктивный и электроемкостный) [3, 4].

Для реализации такого компаративного анализа ЖФПП был разработан переносной автоматизированный комплекс (ПАК).

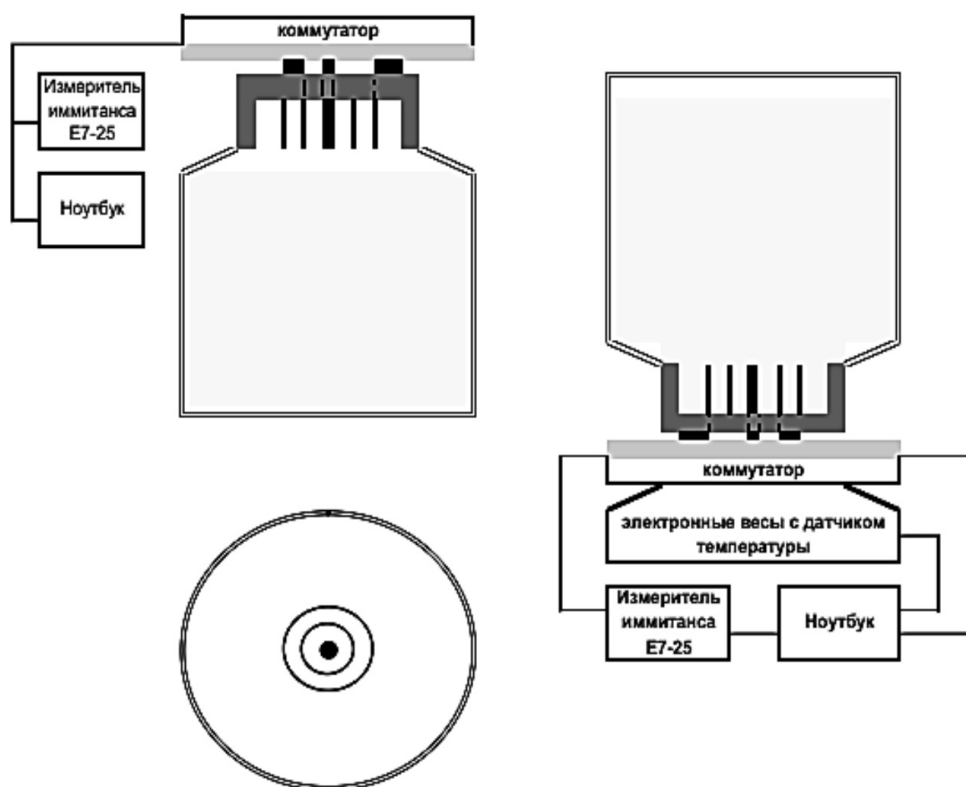


Рис. 5. Структурная схема ПАК

Установка для осуществления способа экспресс-анализа ЖФПП состоит из компьютера с подключением к нему через соответствующие интерфейсы электронных весов и измерителя иммитанса, который соединен с емкостным датчиком-крышкой, опускаемым в исследуемый жидкий продукт, через отверстие в таре, куда тот расфасован, а с помощью соответствующего программного обеспечения, управляемого компьютером, осуществляющая в течение десятка секунд идентификацию жидкого продукта и определение его качества путем сравнения измеренных и вычисленных параметров с введенными/хранящимися в памяти параметрами эталонов [5].

«Образы» эталонов, например, бутилированной питьевой воды, которые вводятся и хранятся в памяти компьютера, состоят из двух групп характеристик: первая – характеристики жидкого продукта, расфасованного в тару; вторая – характеристики тары, в которую расфасован жидкий продукт (тип и вес тары, тип и вес крышки тары, объем тары) [4, 5].

Измерение температуры окружающей среды и массы продукта является стартовым этапом идентификации. Компьютер, получив данные с электронных весов и датчика температуры, приступает к расчету плотности жидкого продукта по соответствующей формуле (требуются данные эталонных масс тары, объема тары, масс крышки), а также производит расчет плот-

ностей при стандартных положительных и отрицательных температурах.

Далее, компьютер управляет измерителем иммитанса Е7-25, на предмет проведения измерений значений электропроводностей (G), сопротивлений (R), емкостей (C), тангенсов углов потерь ($\text{tg}\delta$) и токов утечки (I), на фиксированных значениях частот измерений из диапазона от 10 Гц до 1 МГц, которые записаны в управляющей программе компьютера. При этом, полученные данные образуют спектры значений, записываемые компьютером и используются для последующих вычислений относительной диэлектрической проницаемости (ϵ) воды, ее динамической вязкости (η_0), для чего вычисляются макро- (τ) и микроскопические времена (τ_0) релаксации [3, 4]. Кинематическая вязкость жидкости (ν), расфасованной в емкости, изменяется в зависимости от температуры: для идентификации жидких и вязких продуктов по температуре застывания используются формулы Вальтера, при значении кинематической вязкости 10000 мм²/с [3]. Соответственно, совокупность параметров идентифицируемого продукта, формирующая «образ» продукта приведена в таблице.

Таким образом, совокупность измеренных и вычисленных параметров при помощи переносного автоматизированного комплекса формирует «образ» исследуемой жидкости.

Номенклатура параметров «образа»

№	Наименование параметра	Обозначение	Размерность	Диапазон изменения
1	Масса продукта	m	кг	0,25 – 20
2	Объем продукта	V	м ³	(0,25 – 20) × 10 ⁻³
3	Плотность продукта	ρ	кг/м ³	990-1000
4	Электропроводность	G	См (1/Ом)	0,000001-0,2
5	Сопротивление	R	Ом	5 – 10 ⁶
6	Ток утечки	I	А	10 ⁻⁶ -0,2
7	Емкость (при емкостном датчике)	C	пФ	10 ⁻³ – 10 ¹²
8	Температура	T	°C	1 – 50
9	Фактор потерь	$\text{tg}\delta$	б/р	10 ⁻⁶ -10 ⁻³
10	Удельная электропроводность	σ	мкСм/см	50-1500
11	Магнитная проницаемость	m	Гн/м	(8 – 9) × 10 ⁶
12	Модуль комплексного сопротивления	Z	Ом	900 – 9500
13	Угол сдвига ком-плексн.сопр.	ϕ	градус	минус 180° – плюс 180°
14	Кинематическая вязкость	ν	м ² /с	(0,3 – 1,8) × 10 ⁻⁶
15	Динамическая вязкость	η	Н×с/м ²	(0,3 – 1,8) × 10 ⁻³
16	Частота	f	Гц	10 – 10 ⁶
17	Диэлектрическая проницаемость	ϵ	Ф/м	60-90

Окончательная идентификация бутилированной воды, а также соответствие ее установленным параметрам качества и количества, осуществляется с учетом допустимых отклонений, установленными соответствующими стандартами и техническими условиями на расфасованные жидкие продукты и их тары.

Заключение

Переносной автоматизированный комплекс, базирующийся на методе весовой импедансной электрометрии, имеет большой потенциал в области экспресс-идентификации ЖФПП, и может быть задействован при реализации национальной системы защиты прав потребителей, а также в повышении качества пищевой продукции в Российской Федерации.

Список литературы

1. Об утверждении Стратегии повышения качества пищевой продукции в Российской Федерации до 2030 года: распоряжение Правительства от 29 июня 2016 г. № 1364-р. 17 с.
2. О национальной системе защиты прав потребителей: постановление Совета федерации Федерального собрания РФ от 23 октября 2019 г. № 468-СФ. 10 с.
3. Белозеров В.В. Метод экспресс-анализа жидких фасованных продуктов // Электроника и электротехника. 2018. № 2. С. 1-31. DOI: 10.7256/2453 8884.2018.2.25998.
4. Способ экспресс-анализа жидких фасованных продуктов и установка для его осуществления / В.В. Белозеров, А.Д. Лукьянов, П.С. Обухов, Д.В. Абросимов, А.Ю. Любавский, Вл. В. Белозеров // Патент на изобретение RU 2696810, опубл. 06.08.2019, Бюл. № 22.
5. Мартынов, В.В., Белозеров В.В. Об экспресс-методе и переносном автоматизированном комплексе идентификации и контроля качества бутилированной воды // EUROPEAN JOURNAL OF NATURAL HISTORY. 2020. № 1. С. 61-71.
6. Кречетов А.Л. Об экспресс-методе и переносном автоматизированном комплексе идентификации и контроля качества фасованных пивных продуктов // Материалы XI Международной студенческой научной конференции «Студенческий научный форум» URL: <http://scienceforum.ru/2019/article/2018013598> (дата обращения: 25.01.2021).
7. Ергалиев, Д.С. Сравнительный анализ методов распознавания образов // Труды Международного симпозиума «Надежность и качество». 2011. № 1. С. 1-5.
8. Колесник И.В. Инфракрасная спектроскопия: методическая разработка / И.В. Колесник, Н.А. Саполетова. М.: МГУ им М.В. Ломоносова, 2011. 88 с.
9. Смит А. Прикладная ИК-спектроскопия; пер. с англ. Б.Н. Тарасевича, науч. Ред. А.А. Мальцева. Москва: МИР, 1982. 328 с.
10. Ручной прибор для обнаружения огнеопасных жидкостей в закрытых сосудах «LQtest 2.8». Руководство по эксплуатации [Электронный ресурс]. URL: https://sao96.ru/f/lqtest-28_rukovodstvo.pdf (дата обращения: 25.01.2021).

ОСОБЕННОСТИ УПРАВЛЕНИЯ КАПИТАЛОМ КОМПАНИИ В ПЕРИОД ЭКОНОМИЧЕСКОГО КРИЗИСА И ИСПОЛЬЗОВАНИЕ ИНСТРУМЕНТОВ УПРАВЛЕНИЯ ДЕНЕЖНЫМИ СРЕДСТВАМИ НА РАСЧЕТНЫХ СЧЕТАХ КРУПНЫХ КОМПАНИЙ

Батуринская О.А., Лунина Т.А.

*Сибирский государственный университет путей сообщения, Новосибирск,
e-mail: baturinskay@yandex.ru*

В статье рассматриваются основные факторы, влияющие на формирование структуры капитала компании, влияние экономических кризисов на источники формирования собственных и заемных средств, рассмотрены возможные риски и взаимосвязи при использовании различных инструментов, формирование денежных потоков, целесообразные пути привлечения заемных средств и их влияние на развитие и деятельность предприятия, расчет оптимального остатка денежных средств на расчетных счетах предприятия, использование приемлемых инструментов казначейского контроля и предоставляемых банковских продуктов с возможными путями минимизации остатков денежных средств на расчетных счетах крупных вертикально интегрированных предприятий, применение механизма «Красное сальдо», использование различных финансовых инструментов в том числе договоров факторинга, цессии и прочих инструментов для управления остатками на расчетных счетах и недопущения кассовых разрывов в финансовой деятельности предприятий. Проведен анализ структуры капитала ОАО «РЖД» за период с 2011 по 2019 годы в части формирования активов и пассивов предприятия, изменения уровня финансового левериджа, чистого оборотного капитала. Материалами для статьи послужили научные статьи и учебная литература за период с 2010 по 2020 годы.

Ключевые слова: собственный капитал, заемный капитал, остатки на расчетном счете, «Красное сальдо», капитал компании, леверидж, факторинг, цессия

FEATURES OF THE COMPANY'S CAPITAL MANAGEMENT DURING THE ECONOMIC CRISIS AND THE CASH MANAGEMENT USE TOOLS ON THE LARGE COMPANIES CURRENT ACCOUNTS

Baturinskaya O.A., Lunina T.A.

Siberian Transport University, Novosibirsk, e-mail: baturinskay@yandex

The article considers the main factors affecting the company's capital structure formation, the economic crises impact on the own and borrowed funds formation sources, possible risks and relationships when using various tools, the cash flows formation, appropriate ways to attract borrowed funds, and their impact on the development and the enterprise operation, the fund's optimal balance calculation on the company's current accounts, acceptable Treasury control use tools and banking products provided with possible ways to minimize cash balances on the large vertically integrated enterprises settlement accounts, the «Red balance» mechanism use, factoring agreements use, cession agreements and other financial instruments to prevent cash gaps in the enterprise's financial activities. The JSC «Russian Railways» capital structure analysis for the period from 2011 to the 2nd quarter of 2020 in the company assets and liabilities formation terms, changes in the leverage ratio, net working capital, the tax shield, and changes use in profit per 1 share of the company. The materials for the article were scientific articles and educational literature for the last ten years.

Keywords: equity, debt capital, current account balances, «Red balance», company capital, leverage, factoring, assignment

Кризисное состояние экономики явление не редкое во всех странах мира. Как правило, после стремительного роста экономики обязательно наступают экономические спады, которые заставляют предприятия пересматривать свои бизнес процессы, в том числе и связанные с политикой управления капиталом компании. Обычно во время экономического кризиса снижается объем предлагаемых финансовых займов либо увеличивается стоимость его привлечения.

Один из экономических кризисов происходит в настоящий момент. Так, в связи с объявленной всемирной организацией здравоохранения в январе 2020 года пандемией новой корона вирусной инфекции – COVID-19, практически все страны столкнулись с необходимостью использова-

ния жестких профилактических мер, которые приводят к ограничениям в работе разных отраслей экономики и как следствие, снижение экономической активности. В данной статье рассмотрены возможности оптимизации структуры капитала в управлении финансами предприятия.

Целью исследования является изучение структуры капитала компании, анализ влияния экономического кризиса на формирование капитала, предложение некоторых инструментов, которые может использовать предприятие для эффективного использования денежных потоков, возникающих в процессе хозяйственной деятельности фирмы.

Материалы и методы исследования

Материалами для исследования послужили научные статьи и учебная литература,

отчетные данные ОАО «РЖД» за период с 2011 по 2019 годы, в работе применялись теоретические методы исследований (анализ, обобщение, прогнозирование).

Результаты исследования и их обсуждения

«Финансы организации представляют собой совокупность денежных отношений, возникающих в процессе формирования, распределения и использования капитала и фондов денежных средств в соответствии с целями и задачами деятельности организации» [1].

Для поддержания финансовых отношений, предприятию необходимо определить структуру капитала, основанную на стоимости его элементов, определить приемлемую и предельную величину затрат на обслуживание капитала. Важно учитывать отраслевые особенности предприятия, уровень его поддержки государством, взаимоотношения с кредиторами, финансовую и дивидендную политику и т.п.

оно имеет наивысшую финансовую устойчивость, но при этом не использует финансовые возможности прироста прибыли на вложенный капитал, не использует «налоговый щит», и как следствие ограничивает темп своего роста.

С другой стороны, при использовании заемного капитала, предприятие обеспечивает более высокий потенциал развития и расширение масштабов финансово – хозяйственной деятельности, увеличение рентабельности капитала, однако финансовые риски при этом для предприятия возрастают.

Формирование оптимальной структуры капитала должно быть направлено на решение следующих задач: формирование достаточного объема капитала, обеспечивающего необходимый темп экономического развития предприятия; обеспечение условий достижения желаемой доходности при допустимом уровне финансового риска; обеспечение необходимой финансовой гибкости предприятия; обеспечение удовлетворения потребности в капитале; и т.д.

Таблица 1

Положительные и отрицательные последствия использования собственного и заемного капитала предприятием

Использование собственного капитала	
Преимущества	Недостатки
1. Простота привлечения 2. Обеспечение финансовой устойчивости компании и платежеспособностью в долгосрочном периоде, снижение риска банкротства. 3. Более высокая способность генерирования прибыли, нет необходимости уплачивать ссудный процент	1. Ограниченность объема привлечения. 2. Более высокая стоимость привлечения чем заемный капитал. 3. Исключение возможности роста рентабельности капитала за счет привлеченных заемных средств
Использование заемного капитала	
Преимущества	Недостатки
1. Большие объемы привлечения, необходимо наличие залога или гарантийных обязательств, влияние кредитного рейтинга компании. 2. Возможность увеличения финансового потенциала компании в связи с необходимостью роста масштаба хозяйственной деятельности. 3. Стоимость заемного капитала ниже стоимости собственного капитала за счет «Налогового щита». 4. Генерирование роста коэффициента рентабельности собственного капитала за счет финансового левериджа	1. Снижение финансовой устойчивости предприятия и потере платежеспособности. 2. При неуплате долгов возможно банкротство предприятия. 3. Снижение величины прибыли в связи с необходимостью выплачивать процентов по кредитам. 4. Достаточно сложная процедура привлечения заемного капитала

Поведя PEST-анализ предприятие может определить приемлемую политику формирования финансовых ресурсов опираясь на финансовые риски, преимущества и недостатки при использовании собственного и заемного капитала.

Из проведенного в таблице сравнения можно сделать вывод, что, если предприятие опирается в своей хозяйственной деятельности только на собственный капитал,

Модель оптимизации структуры капитала предприятия в общем виде представлена на рисунке [2].

В зависимости от изменения факторов, принимаются решения об источниках финансирования, которые базируются на следующих важнейших аспектах:

– Уровень процентных ставок (в период кризиса банки поднимают процентные ставки, страхуясь от финансовых рисков);

– Текущее состояние рынка акций (в период экономического кризиса наблюдается спад фондового рынка, так в марте 2020 года стоимость акций многих крупных предприятий России упала в среднем на 20% от стоимости на 31.12.2019 г. В этот период выпуск облигаций может становиться более привлекательней, чем выпуск акций;

– Круг инвесторов, привлекательных для фирмы.

В силу сложности точной оценки многих факторов, оказывающих влияние на оптимальную структуру капитала фирмы, целевое соотношение разных видов финансирования может находиться в определенном диапазоне. При этом параметры могут меняться, в зависимости от ситуации.

Стратегия оптимизации структуры капитала в условиях кризиса предполагает два направления: прирост собственного капитала и сокращение оттока собственного капитала.

Как уже описывалось ранее, одной из групп отношений предприятия являются отношения с банковскими институтами, при использовании предлагаемых банков продуктов и грамотном управлении денежными потоками возможно эффективное использовать ресурсы, поддерживать

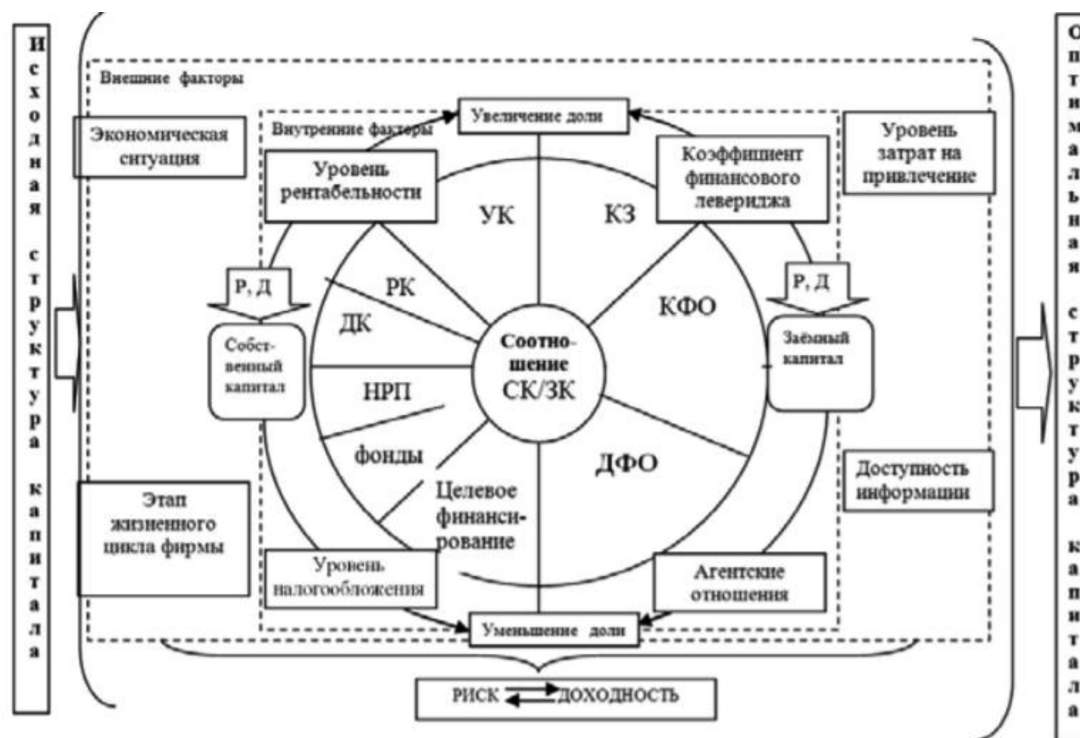
платежеспособность предприятия и получать дополнительный доход от финансовых вложений.

На практике предприятие может определить допустимый остаток денежной наличности на расчетных счетах в зависимости от внешних факторов, влияющих на предприятие и выбранной финансовой политики.

Например, «при консервативном подходе (т.е. высоком риске потери ликвидности) – на банковских счетах предприятию рекомендуется оставлять сумму, равную операционным расходам компании за три месяца. Остальные же деньги возможно размещать на срочных депозитах с различными сроками (зависит от финансового плана компании)» [3].

При меньшем риске потери ликвидности предприятию можно рассчитать необходимый «минимальный остаток (без учета выручки) по текущим счетам или по коротким депозитам (1-3 дня) как произведение среднесуточных расходов (платежей) компании на ее денежный оборот, выраженный в днях» [3].

При определении политики компании в части денежных остатков следует учитывать государственные регуляторы банковской сферы.



Модель оптимизации структуры капитала предприятия

На крупных предприятиях с вертикально интегрированной структурой достаточно много структурных подразделений и у каждого из них открыты свои банковские счета, при этом не всегда один. Как правило, финансирование структурных подразделений осуществляется с основного банковского счета компании, при этом практически вся выручка предприятия аккумулируется тоже на основном расчетном счете. Структурные подразделения могут находиться в разных часовых поясах и для своевременного исполнения своих обязательств перед сотрудниками и контрагентами, на счетах структурных подразделений всегда должны находиться или своевременно поступать денежные средства.

Вопрос управления остатками и ликвидностью крупных предприятий является ключевым для казначейства компании независимо от того, выделена ли казначейская функция в компании в отдельное структурное подразделение, или реализована в структуре финансового блока. Управление остатками средств на банковских счетах является одной из финансовых задач любой организации в связи с чем идет тесное сотрудничество предприятий с банками партнерами по использованию всех возможных инструментов, которые может предложить банк [4]. Это могут быть схемы кэш-пуллинга как физического, так и автоматического, различные варианты овердрафтов, возможные варианты размещения свободных остатков на депозитах различной продолжительностью, применение прогрессивных банковских систем, например, использование технологий host-to-host.

Если предусмотреть возможность проведения платежей структурными подразделениями при отсутствии остатка на расчетном счете предприятия (внутридневной овердрафт) с гарантированным резервом данной суммы на мастер – счете центрального подразделения предприятия и пополнением расчетного счета после окончания операционного дня, то можно регулировать притоки и оттоки денежных средств и минимизировать их остатки. В этом и заключается определение механизма, названного «красное сальдо».

Целью использования данного механизма является: сокращение расходов на внешние заимствования путем актуализации фактически понесенных расходов в операционном дне структурными подразделениями; минимизация остатков на расчетных счетах структурных подразделений, сокращение документооборота; соблюдение сроков расчета с персоналом компании; своевременный расчет по обязательствам

компании согласно предельных сроков и соблюдение всех процедур казначейского контроля, если он организован на предприятии.

В период экономических кризисов у предприятий остро стоит вопрос при расчете с поставщиками и подрядчиками, зачастую предприятия сталкиваются с кассовыми разрывами, одним из способов отсрочки платежа является применение факторинга. Он позволяет ликвидировать кассовый разрыв и обеспечивает стабильность финансового оборота. Так, например, если в политике предприятия предусмотрена отсрочка платежа в 45 дней, применение факторинга позволяет производить расчет с фактором в течении 90 дней с оплатой минимальной комиссии фактору, при этом поставщик своевременно получает денежные средства.

Тщательным образом проверяются компании, которые относятся к тем экономическим отраслям, в которых существуют какие-либо сложности, проблемы ликвидности или платежеспособности [5].

Крупные предприятия могут изменять договорные отношения с поставщиками, сдвигая оплату поставок на следующий год. Контрагентам предлагается воспользоваться факторингом, что приводит к массовому притоку новых клиентов в сегмент.

Факторинг традиционно «выстреливает» в кризисные периоды, подтверждает исполнительный директор Ассоциации факторинговых компаний (АФК) Дмитрий Шевченко. По итогам третьего квартала 2020 г. члены ассоциации ожидают роста рынка вплоть до 50 % к предыдущему кварталом [6].

В следующем году может произойти резкое падение рынка, когда оплаты поставщикам все же пройдут, а новые программы модернизации и крупные инвестпрограммы будут приостановлены.

Договор цессии широко применяется в коммерческой деятельности. Часто таким договором не совсем верно называют договор уступки права требования.

В обычном соглашении по уступке вместе с правами возможна переуступка связанных с ними обязанностей. Именно факт передачи обязанностей отличает простой договор уступки от договора цессии, который тоже является договором переуступки прав, но без обязанностей.

Например, когда банк переуступает право получения денег по кредиту: он передает контрагенту лишь право.

В вышеперечисленных инструментах можно отметить как положительные, так и отрицательные моменты. При принятии решения об их использовании необходимо просчитать все возможные риски.

Таблица 2

Анализ отчетности ОАО «РЖД» с 2011 г. по 2019 г.

Период	2011	2012	2013	2014	2015	2016	2017	2018	2019
Лeverидж	0,23	0,24	0,3	0,38	0,42	0,35	0,39	0,42	0,48
Изменение к предыдущему году в %		4%	25%	27%	11%	-17%	11%	8%	14%
Проценты к уплате (размер налогового щита) млрд.руб.	17,65	17,16	25,19	34,69	64,51	64,23	55,22	55,89	72,15
Изменение к предыдущему году в %		-3%	47%	38%	86%	0%	-14%	1%	29%
Чистый оборотный капитал млрд. руб.	-86,8	-144	-125,9	-135,4	-107	-207	-259	-392	-486
Изменение к предыдущему году в %		66%	-12%	7%	-21%	94%	25%	51%	24%
Прибыль на акцию, руб.	9,91	7,9	0,4	-22,68	0,16	3,17	8,27	8,44	23,76

Анализируя отчетность ОАО «РЖД» с 2011 по 2019 годы на предмет соотношения заемного и собственного капитала, изменения его структуры, объема «налогового щита» – суммы процентов к уплате, полученные результаты, приведенные в табл. 2.

Таблица составлена по данным финансовой отчетности ОАО «РЖД», размещенной на сайте <https://www.rzd.ru/>.

Из приведенных данных видно, что за рассматриваемый период ОАО «РЖД» наращивает коэффициент финансового левериджа, за период с 2011 по 2019 года изменение данного показателя составило 0,25, что свидетельствует об увеличении доли заемного капитала.

На протяжении рассматриваемого периода чистый оборотный капитал отрицательный, что свидетельствует об агрессивной модели поведения предприятия в управлении оборотным капиталом. В связи с ростом привлечения заемных средств, проценты к уплате за период с 2011 по 2019 года возросли в 4 раза, тенденция к росту продолжается и в первом полугодии 2020 года. Стоит отметить, что ОАО «РЖД» активно использует описанные в статье финансовые инструменты, так с середины 2019 года запущен пилотный проект «Красное сальдо» в одном из крупнейших филиалов ОАО «РЖД», к концу 2020 года этот проект планируется внедрить еще в нескольких филиалах. В 2020 году чаще стали использоваться договора цессии и факторинга.

Заключение

В данной статье рассмотрены возможные инструменты для формирования струк-

туры капитала компании и эффективным использовании денежных средств и кредитных продуктов, однако стоит отметить, что источники финансирования деятельности в различных сферах деятельности имеют свои особенности. Это зависит от вида деятельности компании, структуры и использования активов, способность организовать формирования чистого притока денежных средств, инвестиционной и дивидендной политики предприятия, ценой привлечения заемных средств и других факторов. Из этого следует, что ключевым вопросом при формировании структуры капитала в условиях экономического кризиса является рациональность соотношения отдельных групп источников средств в составе собственного и заемного капитала.

Список литературы

1. Чалдаева Л.А. и др. Финансы: учебник и практикум для среднего профессионального образования / Под ред. Л.А. Чалдаевой. 2-е изд., перераб. и доп. М.: Издательство Юрайт, 2020. 439 с. (Профессиональное образование) // ЭБС Юрайт. [Электронный ресурс]. URL: <https://urait.ru/bcode/457474> с.209 (дата обращения: 25.01.2021).
2. Ушаева С.Н. Грани оптимизации структуры капитала в условиях кризиса // Вестник Челябинского государственного университета. 2010. № 5.
3. Как управлять денежными средствами на счетах компании? // Ваш казначей. [Электронный ресурс]. URL: <https://vashkaznachei.ru/kak-upravljat-ostatkami-na-schetah-kompanii/> (дата обращения: 25.01.2021).
4. Лукасевич И.Я. Развитие подходов к управлению запасами денежных средств на предприятии // Финансы. 2015. № 12.
5. Факторинг: что это такое, сколько стоит, зачем и кому он нужен. [Электронный ресурс]. URL: <https://www.klerk.ru/bank/articles/430093/> (дата обращения: 25.01.2021).
6. Факторинг стал популярнее из-за кризиса. [Электронный ресурс]. URL: <https://www.klerk.ru/buh/news/503014/> (дата обращения: 25.01.2021).

КАЗНАЧЕЙСКИЙ КОНТРОЛЬ И ИТ – СИСТЕМЫ В УПРАВЛЕНИИ ФИНАНСАМИ ТРАНСПОРТНОГО ХОЛДИНГА

Галтер В.В., Фомина Н.К.

*Сибирский государственный институт путей сообщения, Новосибирск,
e-mail: n41504202@gmail.com, vvgalter@mail.ru*

Финансы – это совокупность денежных отношений, в процессе которых осуществляется сбор и использование денежных средств для выполнения производственных задач. И как экономический инструмент они являются неотъемлемой частью денежных отношений. Можно выделить как наиболее важную из четырех основных функций (распределение, контроль, регулирование, стабилизацию) – функцию финансового контроля. Финансовый контроль обеспечивает динамичное развитие производства, ускоряет научно-технический прогресс, повышает качество работы во всех отраслях народного хозяйства. С момента создания и по сей день Казначейство как инструмент финансового контроля позволило добиться значительных успехов в финансовом регулировании предприятий, повысить эффективность использования средств компаний, усилить контроль над денежными потоками. Появление казначейства в системе управления транспортным холдингом возникло как необходимость, которая помогает улучшить качество распределения финансовых ресурсов. В статье рассматривается казначейский контроль как инструмент системы финансового управления холдинга. Исследуется и анализируется структура казначейства и его роль в холдинге. Определена важность переноса функций казначейства в сторону стратегического управления холдингом и его развитие. Выделены возможные сценарии развития данной структуры и приоритетные направления дальнейшей работы.

Ключевые слова: холдинг, финансовый контроль, казначейство, капитал, управление, ИТ – система

TREASURY CONTROL AND IT SYSTEMS IN FINANCIAL MANAGEMENT OF A TRANSPORT HOLDING

Galter V.V., Fomina N.K.

Siberian State Transport University, Novosibirsk, e-mail: n41504202@gmail.com, vvgalter@mail.ru

Finance is a set of monetary relations, in the process of which the collection and use of funds for the implementation of production tasks is carried out. And as an economic instrument, they are an integral part of monetary relations. It can be distinguished as the most important of the four main functions (distribution, control, regulatory, stabilization) – the function of financial control. Financial control ensures the dynamic development of production, accelerates scientific and technological progress, and improves the quality of work in all sectors of the national economy. Since its inception and to this day, the Treasury, as a financial control instrument, has made it possible to achieve significant success in the financial regulation of enterprises, to increase the efficiency of the use of companies' funds, to strengthen control over cash flows and to accelerate the process of cash flow to the end consumer. The emergence of the treasury in the management system of the transport holding arose as a necessity that could improve the quality of the distribution of financial resources. This paper examines treasury control as an instrument of the holding's financial management system. The structure of the treasury and its role in the holding is investigated and analyzed. The importance of shifting the functions of the treasury towards the strategic management of the holding and the rapid development of technologies in their implementation is determined. Potential for the development of this structure and priority vectors of further work are highlighted.

Keywords: holding, financial control, Treasury Department, fund, administration, IT – system

Со дня образования холдинга ОАО «РЖД» одной из важнейших задач для его руководства является повышение эффективности финансового менеджмента компании. Сегодня в холдинге функционирует структура казначейства, учитывающая особенности деятельности компании, с целью регламентирования управления денежными потоками. Начиная с 2014 года, внедряются элементы службы единого казначейства, обозначенные в директиве Правительства РФ от 8 августа 2014 года № 5110п-П13 [1]. Тем не менее на сегодняшний день вопрос целесообразности существования подобной структуры, выполняемых ею функций, а также степени наделяния казначейства соответствующими полномочиями по-прежнему актуален. Дальнейшее совершенствование системы управления финансами транспортного холдинга требует тщатель-

ного анализа текущего функционала казначейства, в том числе в области казначейского контроля, и эффективности выполняемых им функций, а так же совершенствование ИТ – систем используемых для осуществления функциональных обязанностей. В связи с вышеизложенным, целью данного исследования является анализ системы управления финансами транспортного холдинга в рамках функционала казначейства и определение возможных путей ее развития.

Материалы и методы исследования

Исследование проводилось с использованием методов анализа и синтеза (в том числе методов сравнительного анализа), методов моделирования. В основе исследования лежат труды отечественных ученых – специалистов по вопросам финансового управления, нормативная документация,

регулирующая деятельность казначейства. По результатам проведенного исследования сформировано авторское мнение о проблеме и предложены возможные способы ее решения.

Актуальность данной статьи обусловливается тем, что в работе рассмотрен функционал структуры казначейства и осуществляемый им контроль как относительно новая ступень в процессе непрерывного совершенствования системы управления финансами транспортного холдинга. Появление казначейства в системе управления транспортного холдинга – необходимость, способная повысить качество распределения финансовых ресурсов. В данной публикации исследуется и анализируется структура казначейства и его роль в холдинге. Определена важность смещения функций казначейства в сторону стратегического управления холдинга, рассмотрено развитие технологий при их выполнении. Освещается потенциал для развития данной структуры и приоритетные векторы дальнейшей работы.

Т.А. Фролова, автор учебника «Финансы и кредит» указывает, что исторически термин финансы понимался, как понятие, связанное с системой денежных отношений между населением и государством по поводу образования государственных фондов денежных средств [2].

Такая позиция определяла деньги как материальную основу существования и функционирования финансов, государство в финансовых отношениях обладает особыми полномочиями, в процессе финансовых отношений формируется бюджет, который в свою очередь обеспечивался нормативно – принудительным характером обязательных платежей (налоги, сборы), что в свою очередь спровоцировало появление фискального аппарата.

В.И. Даль в «Толковом словаре» [3] определял термин «финансы» как: «все, что касается прихода и расхода государства». В этом понимании В.И. Даль максимально близко подошел к современной трактовке понятия «финансы».

В широком смысле слова, финансы – это отношения по:

- созданию и использованию денежных фондов государства, предприятия;
- дифференциации и распределению ресурсов (общественных благ) путем использования бюджета;
- объединению и распределению фондов предприятий.

Данный термин включает в себя как государственные финансы, так и финансы организаций и корпораций.

Таким образом, финансы – это отношения по созданию и перераспределению общественных благ и средств предприятия.

Финансы как система, объединяющая экономические отношения, возникшие при распределении, формировании и использовании денежных ресурсов, развиваются по специфическим принципам.

Таковыми принципами финансов являются [4]:

– единство в части форм финансовой отчетности и документации, законодательной и нормативно-правовой базы, унифицированность расчетов и платежей, единообразие порядка отражения финансовых операций в бухгалтерском учете, общий порядок формирования затрат и финансовых результатов, а также применения санкций за нарушение финансовой, платежно-расчетной и налоговой дисциплины;

– направленность, которая подразумевает ориентацию на: повышение рентабельности производства и производительности труда, извлечение прибыли, достаточность материальных, трудовых и финансовых ресурсов, обеспечение устойчивого положения компании на рынке;

– диверсификация источников и направлений финансирования, а так же вложений средств. Компании следует заимствовать денежные средства у нескольких кредиторов, в той же равной мере осуществлять вложения денежных средств в разные направления.

Итак, финансы – это совокупность экономических отношений, возникающих при формировании, распределении и использовании фондов денежных ресурсов, выполняющих распределительную, контрольную, регулируемую и стабилизирующую функции. Финансы строятся на принципах унификации, целевой направленности, диверсификации источников финансирования и направлений вложения средств.

Финансы – это совокупность денежных отношений, в процессе которых осуществляется сбор и использование денежных средств для осуществления производственных задач. И как экономический инструмент являются неотъемлемой частью денежных отношений.

Как любой инструмент, финансы имеют свою специфику и выполняют определенное назначение, соответственно выполняют определенные функции.

Представителями Санкт-Петербургской школы финансов М.В. Романовский и Г.Н. Белоглазова выделяются три функции финансов [5]. Функции финансов представлены на рис. 1.

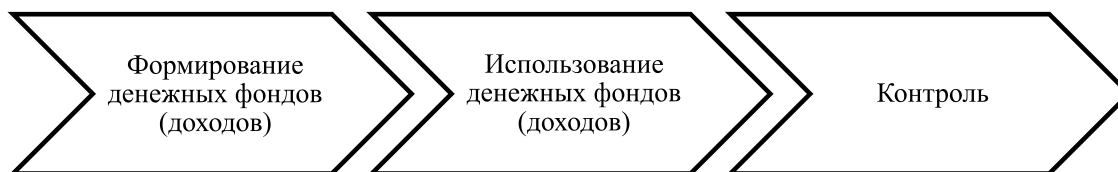


Рис. 1. Функции финансов



Рис. 2. Основные функции системы управления финансами

Эриашвили Н.Д. [6] в работе «Финансовое право» выделяет как важнейшую из 4 основных функции (распределительная, контрольная, регулирующая, стабилизационная) – функцию финансового контроля. Финансовый контроль обеспечивает динамичное развитие производства, ускоряет научно-технический прогресс, улучшение качество работы во всех отраслях народного хозяйства. Ключевые функции управления финансами в транспортном холдинге представлены их на рис. 2.

Финансовый контроль — это регламентированная нормами права деятельность государственных, муниципальных, общественных и иных хозяйствующих субъектов по проверке своевременности и точности финансового планирования, обоснованности и полноты поступления доходов в соответствующие фонды денежных средств, правильности и эффективности их использования [6].

Нас же интересует финансовый контроль в системе управления финансами транспортного холдинга, который осуществляется казначейством.

Можно выделить две основные формы организации казначейства в рамках компаний:

- Централизованное казначейство;
- Децентрализованное казначейство.

Централизованное казначейство характерно для небольших компаний, где служба казначейства способна контролировать все финансовые потоки. Относительно холдингов, крупных корпораций, то здесь вопрос о децентрализации или централизации казначейства стоит остро, так как крайне важен эффективный контроль над денежными потоками.

Холдинги с демократической структурой управления, отлаженными бизнес – процессами, жесткой системой контроллинга, выбирают децентрализованные структуры казначейства.

Децентрализованные модели казначейства обладают большей гибкостью, их динамичность, позволяет снизить сроки согласования платежей, повышает скорость решения оперативных задач, позволяет повысить компетентность сотрудников в структурных подразделениях и дочерних компаниях. Слабость данной модели заключается в том, что холдинг утрачивает свое преимущество в использовании внутренних резервов для оптимизации и в значительной степени начинает зависеть от квалификации управленческого персонала в структурных подразделениях и дочерних компаниях. Следовательно, указанный вариант подходит для холдингов, состоящих из независимых компа-

ний с надежной и грамотно выстроенной управленческой структурой.

Централизованное казначейство отличается жесткой централизацией финансового управления организации. В большинстве случаев, структурные подразделения и дочерние компании лишены права проведения платежей. Все платежи производит головная организация. При данных условиях полностью исключаются проведение платежей структурными подразделениями или дочерними компаниями, а головная компания использует все финансовые ресурсы холдинга. Это приводит к увеличению нагрузки на специалистов головной компании, а манёвренность и самостоятельность структурных подразделений и дочерних компаний уменьшается. Данная модель подходит лишь небольшим холдингам. Жёсткость централизованной модели казначейства оправдывается снижением возможных финансовых рисков. Это связано с тем, что планирование потребностей в денежных средствах обычно осуществляется Холдингом централизованно, путем формирования платёжного календаря. При этом собираются и принимаются во внимание заявки всех структурных подразделений и ДЗО (дочерних и зависимых обществ). Кроме того, аккумулируются все поступления, что дает возможность перераспределения финансовых ресурсов между участниками Холдинга согласно их потребностям, не прибегая к привлечению внешних средств. Дополнительным бонусом централизованной модели является возможность размещения свободных денежных средств с целью получения более высоких доходов. Кроме того, централизация казначейства при территориальной разобщенности разнопрофильных структурных подразделений рассматривается как один из инструментов координации и интеграции деятельности Холдинга.

Допустимы смешанные формы организации казначейства. Подобные структуры объединяют в себе признаки как централизованной, так и децентрализованной модели [7].

Казначейский контроль – это деятельность по формированию и организации финансового контроля на всех уровнях финансовой системы транспортного холдинга в соответствии с бюджетом, регламентирующей документацией, так же законодательством РФ и нормативно – правовыми актами самого предприятия.

В таком холдинге как ОАО «РЖД» задачи по реализации казначейского контроля в процессе исполнения расходных обязательств, а так же корректности отражения доходных поступлений находятся в веде-

нии Департамента корпоративных финансов в состав, которого входит Управление «Казначейство». Департамент имеет в своем непосредственном ведении региональные центры «Казначейство» – структурные подразделения ОАО «РЖД» [8].

Основными стратегическими задачами казначейства в холдинге являются: обеспечение ликвидности холдинга, выполнение внутривхолдинговых расчетов, повышение доходности от управления денежными средствами, снижение операционных затрат на осуществление финансовых операций, внутренний контроль осуществления платежей и обеспечение эффективной контрольной среды, контроль использования средств по источникам финансирования и проектам, а так же строительного комплекса.

Важнейшими функциями казначейства транспортного холдинга, исполнение которых необходимо для решения основных задач, являются:

- формирование такой системы взаимоотношений с банками, которая позволит минимизировать затраты на операционные расходы и проценты по кредитам с максимальной выгодой для холдинга;

- оперативное управление и оптимизация денежных потоков, остатков на банковских счетах структурных подразделений транспортного холдинга;

- контроллинг – проверка исполнения платёжного календаря и бюджета движения денежных средств на соответствие установленных лимитов, контроль корректности отражения проведённых платежей, полноту и своевременность отражения поступлений, непрерывный мониторинг и анализ дебиторской и кредиторской задолженностей;

- управление рисками – выявление возможных проблемных мест в финансовой системе транспортного холдинга и разработка мероприятий по минимизации финансовых рисков.

В части контроля Управление «Казначейство» и региональные центры «Казначейство» координируют: целостность и своевременность зачисления доходов на счета структурных подразделений холдинга, обоснованность и рациональность использования поступивших средств (и средств финансирования), эффективность проведения операций со средствами в соответствии с распорядительными документами.

Контроль над движением денежных средств, в части исполнения расходных обязательств холдинга осуществляется путем проведения:

- 1) проверки оснований для исполнения платежей условиям действующих договоров и проведения расчетов;

2) анализа исполнения плановых показателей;

3) контроля перечислений денежных средств на центральный расчетный счет холдинга с банковских счетов структурных подразделений в размере поступившей выручки.

Для решения вышеперечисленных задач и реализации функций используются различные информационные системы, в том числе: ERP-системы, а именно ЕК АСУФР (Единая корпоративная автоматизированная система управления финансами и ресурсами), ЕК АСУД (Единая корпоративная автоматизированная система управления документами), ERD (Единый реестр договоров) и систему 1С. ОАО «РЖД» ведет активную деятельность по внедрению цифровых технологий в рамках реализации проекта «Цифровое казначейство» и достигло значительных успехов в финансовом регулировании, повысило эффективность использования средств компании, усилило контроль над денежными потоками, ускорился процесс их движения до конечных потребителей. Нововведения и автоматизация в структуре казначейства уже сделало более эффективным управление временно свободными денежными средствами холдинга, ускорило вовлечение в использование выручки, сократило расходы на обслуживание внешнего финансирования, повысило финансовую дисциплину. За счёт автоматизации бизнес-процессов ускорились внутригрупповые платежи.

Все мероприятия, реализуемые в рамках проекта «Цифровое казначейство» позволяют холдингу ОАО «РЖД» выйти на новый, более качественный уровень управления, а также осуществлять строгий контроль целевого использования выделяемых холдингом средств целевого финансирования в рамках реализации крупных инфраструктурных проектов.

Отдельно остановимся на предприятиях холдинга использующих систему 1С в своей деятельности. Опыт работы и анализ сложившейся ситуации позволяет говорить о том, что в предприятиях холдинга использующих 1С, возникают сложности. В таких предприятиях казначейский контроль осуществляется на бумажных носителях, а отчетность сводится вручную в таблицах, что ведет за собой вероятность потери информации, ошибочные начисления и несанкционированные платежи, низкую оперативность получения данных и их использования для принятия управленческих решений, возрастает вероятность двойного ввода информации и снижена информационная безопасность.

Помимо проблем возникающих при использовании ИТ – системы 1С, существуют

риски и угрозы, которые влечет за собой внедрение службы Единого казначейства, согласно директивы Правительства РФ:

- территориальная разрозненность структурных подразделений холдинга, что затрудняет оперативное проведение платежей и связанные с ними финансовые риски (предприятия холдинга находятся в 11 часовых поясах);

- ограничение ИТ – систем в части системных возможностей, что влечет за собой неисполнение обязательств компании (каждая дирекция имеет свой мандат, переход всех предприятий на одну платформу уменьшит быстродействие системы в десятки раз и возникнут неполадки в системе);

- ограничение в законодательной базе;

- ослабление экономической безопасности (увеличилось число киберпреступлений в стране и мире).

Указанные выше проблемы требуют серьезного и комплексного решения. К сожалению, сделать это быстро не удастся, однако постепенные преобразования действующей системы казначейского контроля, создание единого информационного пространства в рамках проекта «Цифровое казначейство» позволят решить возникшие проблемы.

Успешное внедрение технологических новшеств в развитие казначейских функций и построение новых бизнес-процессов позволит дать руководству холдинга исчерпывающую информацию о финансовых потоках в каждом сегменте и позволит осуществлять как краткосрочное, так и стратегическое планирование.

Результаты исследования и их обсуждение

Векторы развития казначейства:

1. Разработка казначейской политики.
2. Оптимизация управления денежными потоками с помощью механизма «красное сальдо», кэш-пулинга, единого платежного календаря.
2. Внедрение и доработка ИТ-систем.
3. Минимизация остатков денежных средств на счетах компаний холдинга.
4. Максимально оперативное согласование и исполнение платежей.
5. Проведение казначейского контроля во всех дочерних общества холдинга.

Актуальность наличия казначейства как инструмента системы управления финансами незыблема, а его развитие в холдинге ОАО «РЖД», в том числе и автоматизация, внедрение искусственного интеллекта является одним из приоритетных векторов дальнейшей работы. Ведь именно информация, полученная от казначейства, дает возможность оценить оптимальность приня-

тых решений, эффективность размещения денежных средств, сформировать данные о текущих и планируемых платежах. А движение в сторону децентрализации управления финансами и казначейского контроля позволит сделать данную систему гибкой и мобильной, устойчивой к внешним изменениям и кризисам.

Список литературы

1. Директива Правительства РФ от 8 августа 2014 года № 5110п-П13.
2. Фролова Т.А. Финансы и кредит: конспект лекций: конспект лекций. Таганрог: Изд-во ТТИ ЮФУ, 2011. [Электронный ресурс]. URL: <http://www.aup.ru/books/m216/>.
3. Даль В.И. Толковый словарь русского языка. Издательство: Эксмо, 2015. 896 с.
4. Миляков Н.В. Принципы и роль финансов: электронный журнал «PSYERA» [Электронный ресурс]. URL: <https://psyera.ru/6235/principy-i-rol-finansov/>
5. Белоглазова Г.Н., Романовский М.В. Финансы и кредит [Текст]: учебник / Под ред. М.В. Романовского, Г.Н. Белоглазовой. М.: Высшее образование, 2006 575 с.
6. Эриашвили Н.Д. Финансовое право: учебник для ВУЗов. М.: ЮНИТИ-ДАНА, Закон и право, 2000. [Электронный ресурс]. URL: <http://be5.biz/pravo/f002/1.html>.
7. Роль и задачи казначейства на предприятии / Институт проблем предпринимательства 2009. [Электронный ресурс]. URL: <https://www.ipnou.ru/article.php?idarticle=006092>.
8. Распоряжение ОАО «РЖД» от 29.12.2018 № 2873р «О казначейском контроле за движением денежных средств по банковским и прочим счетам ОАО «РЖД».

ПУТИ ПОВЫШЕНИЯ ЭФФЕКТИВНОСТИ УПРАВЛЕНИЯ ИНВЕСТИЦИОННО-СТРОИТЕЛЬНЫМИ ПРОЕКТАМИ НА ПРИМЕРЕ СТРУКТУРНОГО ПОДРАЗДЕЛЕНИЯ ДИРЕКЦИИ ПО СТРОИТЕЛЬСТВУ СЕТЕЙ СВЯЗИ – ФИЛИАЛА ОАО «РЖД»

Яковлева Е.В., Никонова Я.И.

Сибирский государственный университет путей сообщения, Новосибирск,

e-mail: dks_YakovlevaEV@wsr.ru

В статье рассматриваются основные проблемы, возникающие при реализации инвестиционно-строительных проектов в ОАО «РЖД» на примере Западно-Сибирской дирекции по капитальному строительству – структурному подразделению Дирекции по строительству сетей связи – филиала ОАО «РЖД», а также анализируются возможные пути разрешения этих проблем. Рассмотрены теоретические аспекты в определении инвестиционно-строительных проектов, предложенные различными авторами в целом в экономической системе. На основании данных бухгалтерской отчетности проведен краткий анализ физического состояния основных фондов и степени их износа в целом по ОАО «РЖД» и обоснована необходимость их более интенсивного обновления на сегодняшний день. Представлена краткая характеристика задач и функций Западно-Сибирской дирекции по капитальному строительству, а также проанализирована динамика инвестиционной программы за последние пять лет. На примере Западно-Сибирской дирекции по капитальному строительству – структурного подразделения Дирекции по строительству сетей связи – филиала ОАО «РЖД» выявлен ряд факторов снижающих эффективность реализуемых инвестиционно-строительных проектов, а также предложен ряд мероприятий организационного, экономического и технического характера способствующих более эффективному управлению инвестиционно-строительными проектами и улучшающих качество выполняемых работ по строительству и реконструкции объектов, заказчиком по которым выступает ОАО «РЖД».

Ключевые слова: инвестиционно-строительный проект, капитальное строительство, капитальные вложения, управление проектами, инвестиционная программа, договор подряда, типовые условия расчетов по договорам подряда, авансовые платежи

THE WAYS TO IMPROVE THE EFFICIENCY OF MANAGEMENT OF INVESTMENT AND CONSTRUCTION PROJECTS FOR EXAMPLE OF THE STRUCTURAL DIVISION OF THE DIRECTORATE OF THE CONSTRUCTION OF COMMUNICATION NETWORKS-A BRANCH OF JSC «RUSSIAN RAILWAYS»

Yakovleva E.V., Nikinova Ya.I.

Siberian Transport University, Novosibirsk, e-mail: dks_YakovlevaEV@wsr.ru

In article discusses the main problems of investment and construction projects of JSC «Russian Railways» for example, the West Siberian capital construction Directorate-structural unit of the Directorate for the construction of communication networks, a branch of JSC «RZD», as well as analyzes possible solutions to these problems. The theoretical aspects in the definition of investment and construction projects proposed by various authors in the economic system as a whole are considered. Based on the accounting data, a brief analysis of the physical condition of fixed assets and the degree of their depreciation in general for JSC «Russian Railways» and the need for their more intensive updating is justified today. The article presents a brief description of the tasks and functions of the West Siberian Directorate for Capital Construction, as well as analyzes the dynamics of the investment program over the past five years. The example of the West-Siberian capital construction Directorate –structural unit of the Directorate for the construction of communication networks, a branch of JSC «Russian Railways» identified a number of factors which reduce the effectiveness of investment projects, as well as a number of organizational, economic and technical nature, contributing to more effective management of construction investment projects and improve the quality of work performed on the construction and reconstruction of facilities, the customer of which is JSC «Russian Railways».

Keywords: investment and construction project, capital construction, capital investments, project management, investment program, contract agreement, standard terms of settlement under contract agreements, advance payments

Сложно недооценить значимость инвестиционно-строительных проектов в функционировании и процветании ОАО «РЖД», в результате реализации которых решаются такие важные вопросы как, строительство и реконструкция объектов инфраструктуры железнодорожного транспорта – мосты, тоннели, административные здания, диспетчерские центры по управлению перевозками, дома отдыха локомотивных бригад, в результате чего значительно растет опера-

тивность работы и производительность труда. Кроме того, осуществляются программы строительства объектов социальной сферы, баз отдыха, санаториев, больниц, и даже частично решаются жилищные проблемы работников ОАО «РЖД», повышается качество их жизни, улучшается архитектурный облик городов.

Цель исследования: выявление проблем, связанных с реализацией инвестиционно-строительных проектов на примере

Западно-Сибирской дирекции по капитальному строительству – структурного подразделения Дирекции по строительству сетей связи – филиала ОАО «РЖД», а также разработка комплекса мероприятий по повышению их эффективности.

Материалы и методы исследования

Цель данного исследования достигается с использованием методов системного анализа, аналитического метода, анализа экономической динамики, метода прогнозирования.

Результаты исследования и их обсуждение

Капитальное строительство – сложный многофакторный процесс, требующий больших затрат экономических ресурсов в течение определенного периода. Капитальные вложения являются более широким понятием, чем капитальное строительство. В процессе капитального строительства осуществляется лишь часть капитальных вложений, равная стоимости строительно-монтажных работ по данному объекту. Значительная часть капитальных вложений осуществляется минуя стадию строительства (например, затраты на приобретение оборудования не требующего монтажа, транспортных средств и другой техники). К капитальным вложениям относятся также затраты на проектно-изыскательские работы, научные исследования, на мероприятия по вводу сооружаемых объектов в эксплуатацию (пусконаладочные работы, отвод земельных участков).

Согласно законодательству Российской Федерации (Федеральный закон от 25.02.1999 г. № 39-ФЗ (ред. от 08.12.2020) «Об инвестиционной деятельности в Российской Федерации, осуществляемой в форме капитальных вложений»), под инвестициями следует понимать денежные средства и имущество, имеющее денежную оценку, вкладываемые в объекты предпринимательской или иной деятельности в целях:

- получения прибыли;
- достижения иного полезного эффекта [1].

В частности, под инвестиционным проектом с юридической точки зрения понимают обоснование экономической целесообразности, объёма и сроков осуществления капитальных вложений, в том числе необходимую проектно-сметную документацию, разработанную в соответствии с законодательством Российской Федерации и утверждёнными в установленном порядке стандартами (нормами и правилами), а также описание практических действий по осуществлению инвестиций [2, с. 17].

Один из ключевых филиалов, реализующих инвестиционные проекты и осуществляющих функции Заказчика по капитальному ремонту, строительству и реконструкции объектов ОАО «РЖД», является Дирекция по строительству сетей связи (далее – ДКСС), имеющая 16 региональных структурных подразделений, в том числе на Западно-Сибирском полигоне – Западно-Сибирскую дирекцию по капитальному строительству (далее – З-Сиб ДКС).

Основными задачами З-Сиб ДКС являются:

1) Своевременное и качественное обеспечение потребностей ОАО «РЖД» и других юридических и физических лиц в строительстве, реконструкции, проектировании и отдельных видах капитального ремонта объектов недвижимости, расположенных в границах Западно-Сибирской железной дороги, в том числе по вводу в действие производственных мощностей и объектов;

2) Соблюдение норм градостроительства, архитектурных требований, обеспечение выполнения утвержденных проектных решений при выполнении капитального строительства и капитального ремонта;

3) Эффективное использование финансовых и материально-технических ресурсов, осуществление сбалансированной и оптимальной ценовой политики в капитальном строительстве и капитальном ремонте;

4) Обеспечение экологической, транспортной безопасности при капитальном строительстве и капитальном ремонте.

Осуществление функций Дирекции производится на трех стадиях:

1) предпроектная подготовка и проектирование объектов;

2) выполнение строительно-монтажных работ на объекте;

3) сдача в эксплуатацию объектов.

Под физическим износом зданий и сооружений понимают потерю ими с течением времени несущей способности (прочности, устойчивости), снижение теплоизоляции и звукоизоляционных свойств, водо- и воздухопроницаемости.

Основными причинами физического износа являются воздействия природных факторов, а также технологических процессов, связанных с использованием здания. Степень износа зданий может иметь две стадии – устранимую и неустраиваемую. В первом случае износ здания происходит постепенно, его можно замедлить, приняв меры по реконструкции объекта. Во втором случае здания подлежат немедленному сносу.

Нормативы, требования и правила оценки физического износа зданий, сооружений

регламентируются требованиями ВСН 53-86(р), ВСН 53-88(р), СП 13-102-2003, ГОСТ 31937-2011, ФЗ-384 (ст. 15), градостроительным кодексом РФ и муниципальными требованиями отдельного региона Российской Федерации.

По данным бухгалтерского баланса ОАО «РЖД» (Приложения (пояснения) к бухгалтерскому балансу и отчету о финансовых результатах) за 2019 год первоначальная стоимость зданий и сооружений составляла 5 399 883 млн. руб., а накопленная по ним сумма амортизации – 1 950 293 млн. руб., исходя из этих данных определяем, что износ зданий и сооружений числящихся на балансе ОАО «РЖД» составляет 36 % [3].

Износ основных фондов ОАО «РЖД»:

2015 год (первоначальная стоимость зданий и сооружений 3887 823 млн. руб., амортизация – 1227 231 млн.руб.) износ составил – 32 %;

2009 год (первоначальная стоимость зданий и сооружений 2 549 329 млн. руб., амортизация – 587 577 млн. руб.) износ составил 23 %.

Можно сделать вывод, что на сегодняшний день фонд объектов капитального строительства ОАО «РЖД» устаревает и обновляется медленными темпами. Данная ситуация произошла в результате резкого сокращения объемов инвестиций в период экономического спада с начала 2000-х годов.

В настоящее время, в связи с постоянным ростом грузопотоков и пассажиропотоков, повышению требований населения, хозяйствующих субъектов, а также правительства РФ к уровню обслуживания, ОАО «РЖД» целенаправленно проводит рост инвестиционных программ.

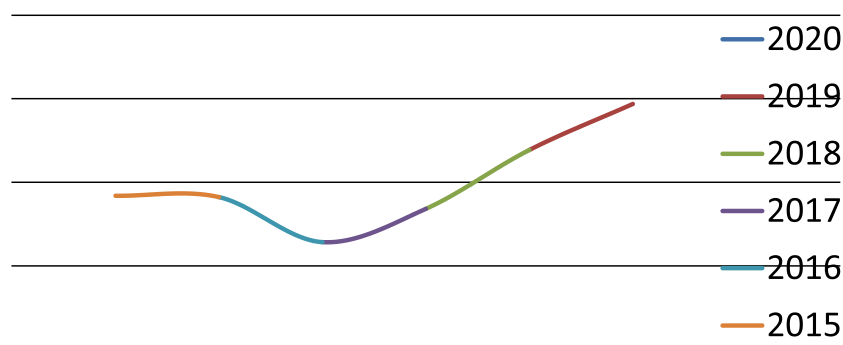
По 3-Сиб ДКС прирост объема инвестиционной программы за последние 5 лет составил 38 %, с 3,6 млрд. руб. до 5,9 млрд. руб. Данные представлены на рисунке.

Однако, с увеличением объема капиталовложений, текущие проблемы с качеством строительства и с нарушениями сроков реализации строительных проектов не исчезли.

Одним из существенных препятствий на пути к стабильной реализации инвестиционно-строительных проектов в ОАО «РЖД», на сегодняшний день, является длительная отсрочка платежа по договорам подряда на выполнение строительно-монтажных и проектно-изыскательских работ. Согласно распоряжению ОАО «РЖД» от 1 августа 2006 г. N 1594р «Об утверждении типовых условий расчетов по договорам, заключаемым от имени ОАО «РЖД» с контрагентами, плательщиком по которым является ОАО «РЖД» (в редакции от 09.07.2019 N 1399/р), по типовым договорам подряда на осуществления строительно-монтажных работ вообще не предусмотрено авансовых платежей, а отсрочка платежей за выполненные работы по данным договорам составляет от 30 до 60 календарных дней [4].

Исключением являются только компании – подрядчики, относящиеся к объектам малого и среднего бизнеса, для них отсрочка платежа с декабря 2019 года установлена в течение 15 рабочих дней. В таблице представлены условия расчетов по договорам подряда на выполнение строительно-монтажных работ, проектно-изыскательских работ и выполнения капитального ремонта.

В исключительном порядке может быть согласован с Департаментом корпоративных финансов ОАО «РЖД» авансовый платеж по таким договорам – не более 30 % от стоимости выполняемых работ, что на практике происходит крайне редко. Большинство контрагентов вынуждены работать на условиях полной отсрочки платежей от 1 до 2-х месяцев, что зачастую приводит к ухудшению их финансовой стабильности.



Динамика инвестиционной программы 3-Сиб ДКС

Типовые условия расчетов по договорам подряда в ОАО «РЖД»

Вид договора	Предоплата (%)	Срок авансирования	Поэтапное выполнение договора	Срок окончательного расчета
Договор подряда на выполнение строительно-монтажных работ	до 30 процентов стоимости годового объема работ по договору	-	может быть предусмотрено	40 дней
Договор подряда на выполнение капитального ремонта (кроме капитального ремонта подвижного состава)	авансовые платежи не предусмотрены	-	может быть предусмотрено	60 дней
Договор подряда на выполнение проектных и изыскательских работ	авансовые платежи не предусмотрены	-	может быть предусмотрено	60 дней

Попадая в полную зависимость от заемных источников финансирования, подрядчик вынужден экономить на всевозможных статьях расходов, во-первых на материалах, приобретаемых более дешевые ресурсы для строительства, во-вторых на рабочей силе, привлекая для выполнения работ менее квалифицированных рабочих и специалистов, и в третьих на невыполнении скрытых работ (скрытые работы составляют от 40% до 60% от общего объема работ), что в конечном итоге негативно отражается на качестве и сроках работ на объектах ОАО «РЖД».

В российских крупных монопольных компаниях, таких как ПАО «Газпром», ПАО «НК Роснефть», которые также как и ОАО «РЖД» помимо основной деятельности, реализуют широкий спектр инвестиционно-строительных проектов, в своей практике широко применяют авансовые платежи от 30 до 50% от стоимости выполняемых работ во всех договорах строительного подряда. В западной практике также применяется авансирование по договорам подряда, в типовых договорах разработанных национальными и международными промышленными организациями и объединениями предпринимателей.

Для получения более эффективного экономического результата от инвестиционных проектов 3-Сиб ДКС, также необходим комплекс организационных и технических мероприятий в работе для получения качественных и своевременно сданных в эксплуатацию объектов строительства.

К организационным мероприятиям в данном случае следует отнести расширение штата инспекторов по качеству и приемке строительно-монтажных работ, для более регулярного ими посещения объектов. В данный момент в работе у каждого инспектора находится более 20 объектов капитального строительства, учитывая раз-

бросанность объектов по всей Западной Сибири, контроль за качеством строительства значительно снижается.

Важнейшую роль в успехе реализации инвестиционных проектов ОАО «РЖД» играет выбор подрядчика путем проведения закупок конкурентным способом.

Конкурентный способ закупки – это способ, при котором заказчик осуществляет выбор исполнителя на конкурсной основе среди подходящих поданных заявок.

Конкурентные процедуры закупок – это наиболее приемлемый способ осуществления выбора исполнителей для крупных и длительных контрактов, таких как договоры подряда. Конкуренция позволяет выбрать наиболее подходящего исполнителя среди большого количества претендентов [5, с. 147]. Проведение данных процедур регламентируется Федеральными Законами № 223-ФЗ и № 44-ФЗ.

В 3-Сиб ДКС, на сегодняшний день, существенным фактором, снижающим эффективность реализации строительных проектов, является возможность подрядчика заключать договоры субподряда, передавая функции по осуществлению строительно-монтажных работ сторонним компаниям, если договором не предусмотрено личное выполнение подрядчиком своих обязательств. Количество субподрядных организаций для генерального подрядчика не ограничено законом, следовательно, с каждой последующей передачей функций исполнителя на субподряд конечная стоимость договора снижается, и, как правило, снижается качество материалов и квалифицированных кадров, а также заказчику сложнее контролировать процесс выполнения работ.

На рынке услуг строительных компаний существует значительное количество небольших развивающихся фирм, которые имеют возможность осущест-

влять строительные работы на высоком уровне по приемлемым ценам, но по причине того, что у более крупных компаний победить в конкурентных закупках гораздо больше шансов, небольшие перспективные фирмы остаются в стороне. Поэтому необходимо при проведении конкурентных отборов учитывать эти факторы и ограничивать условиями отбора возможность передачи функций исполнителя на субподряд более чем на одно звено.

К техническим мероприятиям относится внедрение комплекса видеофиксации на все основные скрытые работы подрядчика и субподрядчиков. Этим мероприятием можно решить целый ряд вопросов по качеству работ и невыполнению или неполному выполнению отдельных видов скрытых работ. Данное условие необходимо включить в типовые договоры подряда, заключаемые от имени ОАО «РЖД».

Также необходимо повышать качество и точность проектно-сметной документации, от которой в огромной степени зависит конечный результат строительства и соответствие запланированным инвестиционным планам.

Заключение

В заключение можно сделать вывод, что для увеличения эффективности работы подрядных организаций и, как следствие, повышения эффективности реализации

инвестиционно-строительных проектов в ОАО «РЖД» необходимо усилить контроль за проведением строительно-монтажных работ со стороны Заказчика, пересмотреть типовые условия расчетов ОАО «РЖД» по договорам подряда и установить авансовые платежи от 30% до 50% от стоимости выполненных работ, а окончательных расчетов за выполненные работы сократить до 15 рабочих дней, а также внести ограничения в типовые договоры подряда на количество привлекаемых субподрядчиков.

Список литературы

1. Федеральный закон от 25.02.1999 № 39-ФЗ (ред. от 08.12.2020) «Об инвестиционной деятельности в Российской Федерации, осуществляемой в форме капитальных вложений» [Электронный ресурс]. URL: http://www.consultant.ru/document/cons_doc_LAW_22142/ (дата обращения: 26.01.2021).
2. Бовтеев С.В. Основы управления инвестиционно-строительными проектами: учеб. пособие / С.В. Бовтеев. СПб.: Изд-во Политехн. ун-та, 2013. 197 с.
3. Финансовая отчетность ОАО «РЖД» [Электронный ресурс]. URL: <https://www.e-disclosure.ru/portal/files.aspx?id=4543&type=3> (дата обращения: 26.01.2021).
4. Распоряжение ОАО «РЖД» от 1 августа 2006 г. N 1594р «Об утверждении типовых условий расчетов по договорам, заключаемым от имени ОАО «РЖД» с контрагентами, плательщиком по которым является ОАО «РЖД» (в редакции от 09.07.2019 N 1399/р). [Электронный ресурс]. URL: http://www.consultant.ru/document/cons_doc_LAW_64888/ (дата обращения: 26.01.2021).
5. Мазур И.И., Шапиро В.Д., Ольдерогге Н.Г. Управление проектами: Учебное пособие / Под общ. ред. И.И. Мазура. 2-е изд. М.: Омега-Л, 2004. С. 664.