European science review

№ 3–4   2019
March–April

European Journal of Arts is an international, German/English/Russian language, peer-reviewed journal. It is published bimonthly with circulation of 1000 copies.

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The journal has the GIF impact factor 1.26 for 2017.

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"GREEN"ALGAE ON THE GROUNDS OF URBAN AREAS (AS EXAMPLE OF ANDIJAN CITY)

Abstract. Information about the causes of becoming "green" of grounds in different ecologic areas, algae that spread on them and their development.

Keywords: ecologic area, soil, cyano-bacteria, algae, phototroph.

In our arid region, we have few rainy days, the weather in some years gets warm at the end of February or at the beginning of March and causes drying the surface of the ground. It rains when the temperature of the air and soil goes up and the rain causes rapid increase and growth of phototrophs on the surface of the ground. In such cases, the surface ground in shades, in small areas with high humidity becomes green, a bit yellowish-brown color [1; 2; 4]. Russian specialists, who learned the cause of this colorfulness on the surface ground, call it "blossoming" [1; 3; 4]. In our opinion, it may be correct to call it "becoming green". We have come across no information about systematic and taxonomic composition of phototrophs on the ground surface that have "become green" in works of algology specialists of our republic. Russian algology specialists, Shtina E. A. (1972), Androsova Ye. Ya (1964), Ye. A. Busigina (1976); Domracheva L. I. (1985, 2005, 2010); Ibragimova S. T. (2009); Kabirova R. R. (1994, 1997); Kondakova L. V. (2012); Sugachkova Ye.V. (2010); Suhanova N. V. (1996, 2000) gave detail information on the principles of becoming "green" of the soils where the systematic and taxonomic composition of phototrophs was studied about this in their research [5; 6].

The types and quantity of organic and unorganic units, macro and microelements have an influence on phototroph organisms developing and becoming "green" on the surface of the ground after the rain in early spring or in warm autumn. They are ususally observed in the form of mineral salts that get solved easily and difficult to get solved [6; 7].

One can see two kinds of scene in the samples taken from the "green" surface of the ground and concrete covers in Andijan city. Gray green, somewhat dark green spots appeared on the surface of industrial waste, due to the development of algae on soil surfaces with sufficient moisture. The surface of the soils where light is insufficient and where there is no immediate contamination is yellowish – green, light green, slightly brown – green, and become "green" [7]. 36 sorts of algae were detected in the samples collected when the temperature rose to $15–18^0C$ after the rainy days of spring. The systematic content mainly consisted of 22 species (61.11%) cyanobacteria, 10 species (27.7%) green algae and 5 (13.8%) diatomous weeds. *Microcoleus vaginatus, Phormidium acruginosa, Ph. autumnale, Ph. brevis, Plektonema notation, Palmella mimit, Asteriococcus rupestris, Chlorella tericola, Navicula minuscula, Pinnularia intermedia* were dominat in this content.

The total number of taxons in the yard of the Andijan city heating hubs has risen to 23, 63.9 per cent compared with the total species (36), 19 species in the Biochemistry Plant (52.77 per cent), and 19 in the yard of the Machine Plant (52.77%). Among them, there are 17 types of cynobacteria in the northern part of the city, including 3 types (15.8%) of the ones with heterocysts. There are 18 types

of (50.0%) heterocyst cyno-bacteria in the central areas, 2 types (5.5%) of which were observed in the southern areas as in the central areas. The biological diversity of the algae in the algae layer of the soils exposed to the soil surface in the studied regions is characterized by climatic conditions, similarity of soil type, its properties and anthropogenic impact. In algae flora, we observed a large number of P and B bioforms of algae.

No large differences were detected in species varieties; their development was less frequent in the samples than in spring. During this period, cyno-bacteria without heterocysts – *Phormidium breve, Microcoleus vaginatus,* species of green algae – *Chlamydomonas,* diatoms of *Navicula* species were frequently observed in *Hantzschia amphioxys* samples.

In the samples taken from 1 cm^2 areas of the surface that became much "green", the number of cells detected from each of the three regions was 14.2–8.3 million in spring, and 6.1 to 4.3 million in autumn. The number of cells depends on the weather condition, the time when these samples are taken, it depends on the factors like humidity of the soil. One should take into account the changes that occur by the time the samples are brought to the laboratory. When we compared the obtained numbers with the data of Kirov (Kondakova, 2012; Yefremova, 2014); Izhevik (Aksenova, 2010); Novosibirsk (Androsova, 1987); Novosibirsk (Suchakova, 2000); Ufa (Kabirov, 2010) Russia, there was a difference in edaphophyle

forms although there was not a systematic difference and significant difference in the quantity of cells. There is a significant difference in the quantity of cells taken from the surface of 1 cm^2. This is explained that the above-mentioned cities of Russia are in the damp/humid region and Andijan city is in the arid area. There are few rainy days, the rainfall is few. This certainly had an influence on the development of edaphophyle phototrophs.

There are many species belonging to Cyanophyta division according to quantity of cells. The quantity of cells in diatoms is a bit more in development of the types belonging to Bacillariophyta and Chlorophyta divisions. When we too kthe average indicators of this data, it consisted of 11.25 mln cells in the southern area of the city; 9.65 mln – in the central area; 12.9 mln – in the northern area. The difference between the figures is not larga. This depends on physical, chemical, biological features of the soil.

Cyanobacteria, green algae and diatoms that have developed in the soils form a dense layer on the surface of the soil together, and thus it makes the particles harder in the soil. Gray, gray-green appearance on the soil surface indicates high pollution [5; 6; 7]. This is evident in the area of waste disposal.

– The high number of types in high level develoment of phototrofloras, dominance of taxons of cynobacteria with heterocysts and withous heterocysts was much observed in western areas.

A   B

Figure 1. Settlements on the soil: (A) and "green" places in the industrial area (B)

Indicators of algae types in the soil are often dependent on the properties, technology, and raw materials used in the production process of the enterprise and institution in the area. Contamination of soil with heavy metal salts and various organic and non-organic acids causes more green algae to develop in it. Where there is a high concentration of polluted soils and organic matter, algo-groups consisting of blue-green algae are often observed.

An analysis of soil algae and species diversity in areas with anthropogenic impacts allows them to assess the ecological state of the site. The decline in the generation of harmful emissions from industrial plants, and particularly the industrial enterprises, and the change in the risk of injury depends on many factors. The major ones are the mass of harmful emissions and air flow in the area.

Because of the fact that the air flow in Andijan is mainly oriented from west to east, more pollutants in the eastern part of the facilities producing harmful gases are higher.

One of the major factors contributing to the pollution of the city is the process of air condensation in the polluted atmosphere (Figure 1).

Hazardous waste gas emitted from industrial plants, transport and other facilities will be condensed into the soil and will adversely affect existing biocenosis. Due to the concentration of emissions of the harmful gasses, the concentration of the mass decreases and the amount of damage to the soil environment and organisms decreases with the concentration associated with atmospheric dissipation.
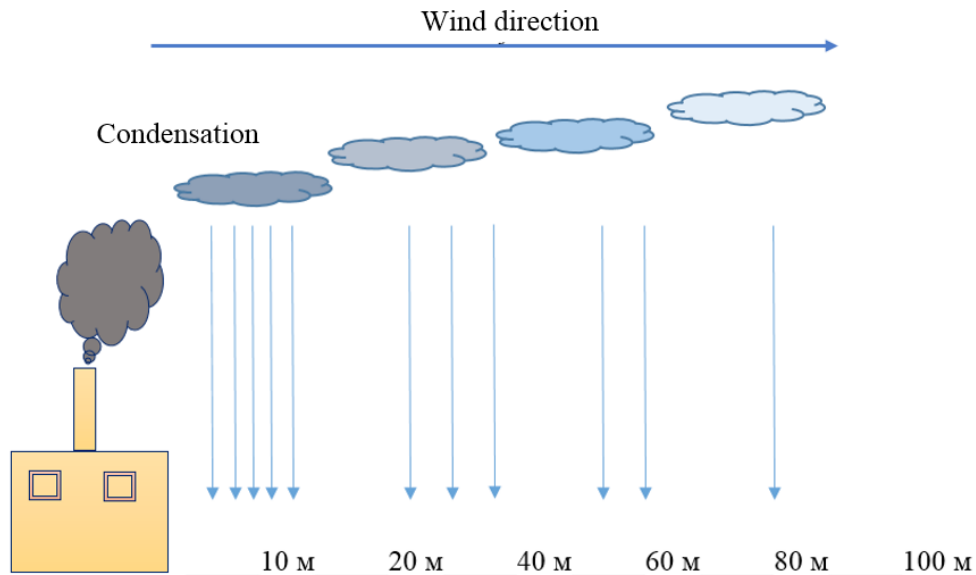
Figure 2. Condensation of water vapor with exhaust gases

Thus, in the areas where the research was carried out, the "green" surface of the globe became apparent in the shadowy areas where the sunlight was not always diminished. Their systematic structure consists of cyanobacteria, green algae and partial diatoms. There were few species of Xanthophyta, representatives of the Euglenophyta division were not come across. In our opinion, the pollution of the environment as a result of the operation of the industrial zone affects the biodiversity and their development. The development of populations of cyanobacteria and green algae in the urban environment is quite high.

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GROWTH AND DEVELOPMENT OF *SALVIA OFFICINALIS* L. UNDER THE OASIS OF KARSHI

Abstract. The article summarizes the results of the study of the growth and development of *Salvia officinalis* L. which was initially introduced into the condition of the oasis of Karshi. It is defined that 2-year-old plants are in the generative phase and 3-year-old ones produce much umbel and biomass.

Keywords: sage, cotyledon, true leaf, double leaf, shoot, growth, development, vegetation, generative phase.

Medicinal sage (*Salvia officinalis* L.) has been used in medicine sinu very ancient times. The leaves, flowers, and young branches of the plant contain many alkaloids, flavonoids, additives, erythrolytes and oleanic acids, vitamins P and PP, as well as phytoncides, coumarins, saponins and other substances. Its leaves are available in the collected ten used for throat, chest, upper respiratory tract infections, gastrointestinal and diarrhea, and are used in medicine as a dysentery, splinter, anti-inflammatory agent.

In vegetation leaf, up to 1–2.5%, on top of green and on flowery branches, are collected from 0.32% to 0.40% of essential oils [1]. Taking into account the predominance of the medicinal properties, the essential oil is introduced in the Botanical Garden of the Academy of Sciences of the Republic of Uzbekistan and it is a promising plant in these conditions [2; 3; 4].

The germination of seeds has been studied in laboratory and field conditions. There are generally accepted methods for studying productivity. Morphology of vegetative organs are studied I. G. Serebryakov [5] method, the results of measures were statistically analyzed by G. N. Zaytsev [6].

The seeds of *Salvia officinalis* L. are round, dark-brown, diameter is 1;5–2 mm and 4 walnut seeds. The weight of 1000 seeds is 7–8 g.

In experiments conducted, it was found that the optimal temperature for the seeds growth was 20–22° C, and their productivity was equal to 92%. In other variants, the productivity of seeds was lower (Table 1).

Table 1.– *S.officinalis* L. seeds at different temperatures spark indicators

The time of the planting	Air temperature,°C	The length of the seeds, days	Productivity,%
10.04.2012	16–17	22–26	65
	20–22	18–21	92
	24–25	16–20	75

The productivity of the seeds in field conditions was 80–85%.

Thus, *Salvia officinalis* L. produces high-quality seeds in Karshi oasis, and seeds are grown in optimal conditions.

After 3–4 days after sowing, the microscopic hole appears in the root, and in 5 days a yellow-green spleen occurs.

On the tenth day of March 2012 seedlings exposed to the open field began to grow on the earth after 8 days. The grasses hypocotyl is pink, with a length of 8.6 ± 0.4 mm. The hornbeam sews along with the seeds. The length of the seeds per day is 3.5 ± 0.2 mm. width 2.8 ± 0.2 mm. The main root length is 2.5–3 cm and the initial stem originates.

The length of a week's plant reaches 2 ± 0.1 cm. The main root length is 4–4.5 cm and forms up to 3 to 4 side roots. The growth stems from growth when the width of the larvae is 7 mm in width, 5.5 mm in height and 5 mm in diameter.

The size of the 20-day plant will be 9.9 ± 0.2 cm in length and it will form 5 pairs of leaves. First and foremost, the first system branches begin to form. By this time, the length of the main root reaches about 11 cm and the second order roots begin to develop.

The growth of the main stem of a month's plant is slowed, and the height of the plant stems mainly from the increase in the size of the leaves. The leaves of *S.officinalis* L. are long-lasting ovulation and are contraindicated. The main plant of a month has 5 pairs of leaflets ranging from 1.5 × 1.2 cm to 5 × ×1.5 cm and the length of the plant is 11.4 ± 0.3 cm. Branches from the first part drop off well. In the first part branch formed

from the second one, two pairs of leaves are formed. By this time, the root of the plant is spun along the side roots and sprinkled up to the second order, with its root diameter up to 0.4 mm.

The life span cotyledons is 35–40 days, with a maximum size a height of 7.1 ± 0.25 mm and a width of 6.2 ± 0.2 mm.

The height of the 3-month plant is 17.8 ± 0.4 cm, and the growth of the main branch is slowed down. The first number of branches is 6 pairs. The second systemic branch begins to form from the first systemic branches formed from the second branch of the main horn. At that time (in mid-June) the temperature in Karshi is sharp, and the seedlings of *S.officinalis* L. dramatically decrease the growth. The majority of the plant is not growing at all. Apparently, the plant consumes all the energy needed to survive the extreme period.

In the second half of August, when the partial decrease in air temperature is observed, seedlings of *S.officinalis* L. begin to grow again, but the growth rate is very slow. In mid-September (seedlings are currently 6 months old), the growth of the plant's main and first branches is accelerated. Their height is 18.6 ± 0.4 cm in this period. It ensures the rapid growth of the marmalade seedlings in warm and pleasant temperatures of the autumn. The cooling temperature, which began with the introduction of December, stopped *S.officinalis* L. seedlings from growth. At the same time, the height of the main stem of the plant seedlings was 33.1 ± 1.03 cm, the first number of

branches ranged from 11 to 12 pairs and the second to the 6th to 8th. At this age, the development of generic organs in the plant did not occur.

Thus, in the conditions of southern Uzbekistan, the majority of trees and shrubs in the extreme summer period ceased to grow and began to grow again after the end of this period [7]. The same law was also recorded in our observations by *S.officinalis* L., a grass herbivorous species.

S.officinalis L. sprouted in the open space. There were no colds in them. Early spring (in mid-February) plants begin their own vegetation. At the end of March, they develop their generic organs. Thus, it has been established that medicinal sage enters the generative phase in the Karshi Oasis in the 2nd year.

During the growing season, foliage forms at the tip of the main stem and at the end of the first spruce branch. In the next year, that is, in the third year of plant life, the foliage forms at the end of the second order and the third tertiary branches. In the 2-year-old plants, up to 8–10 species, and 150–300 for 3 years (Table 2).

In 2-year-old plants, the height of the main stem was 20 ± 0.6 cm, the first system branches were 64.9 ± 1.9 cm long. The number of first seedlings in plants is 11–12 pairs, each with a number of second-order branches ranging from 18 to 29 pairs. At the same time, the third ordered branches are also formed, and the number is about 1–2 pairs per branch.

Table 2.– Growth and development of *S.officinalis* L

The age of the plant	The height of the plant	The order of branches of plants, pair			
		first order	second order	third order	fourth order
1 month	11.4 ± 0.3	2–3	–	–	–
2 month	15.1 ± 0.3	2–3	–	–	–
3 month	17.8 ± 0.4	6–7	2–4	–	–
6 month	18.6 ± 0.4	7–8	4–6	–	–
1 year old	33.1 ± 1.03	11–12	6–8	–	–
2 years old	20 ± 0.6	11–12	200–250	70–100	–
3 years old	18.2 ± 0.2	11–12	360–380	210–220	60–80
4 years old	15.7 ± 0.4	11–12	320–370	240–250	80–120

During this period, the main stem of the plant is tightly packed, and the joints are shortened. The height of the main stem of the plant is 18.2 ± 0.2 cm in the 3-year-old plants and 15.7 ± 0.4 cm in the 4th year. In the third year of the vegetative period, the plant also forms the fourth ordered buds.

In recent years, there has been no epidemic in plant life. Our researches have shown that, in the Karshi Oasis, medicinal sage is the most common biomass in the age of three.

In conclusion, *S.officinalis* L. developed well in new conditions, and the 1 year old plant height was higher than the plants grown under other conditions of the same age. At this age, it ranges to the second order and enters the generative phase from the second year. In the third year of his life, he grows the most foliage up to the fourth order (1–3 Fugire).
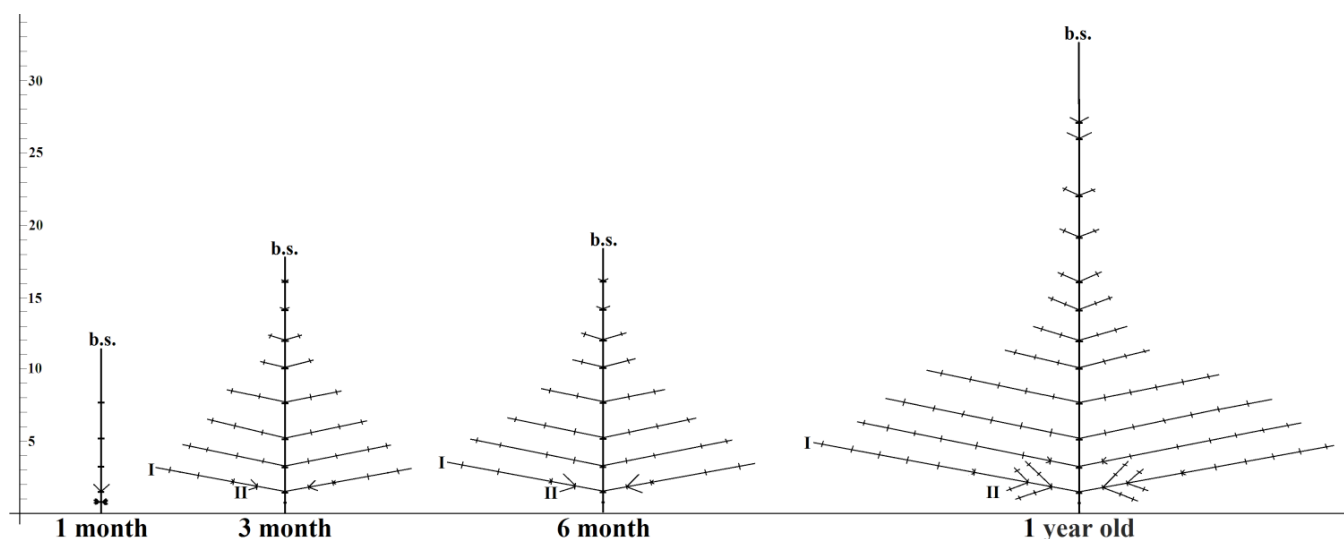
Fugire 1. 1-year-old plant growth and development scheme
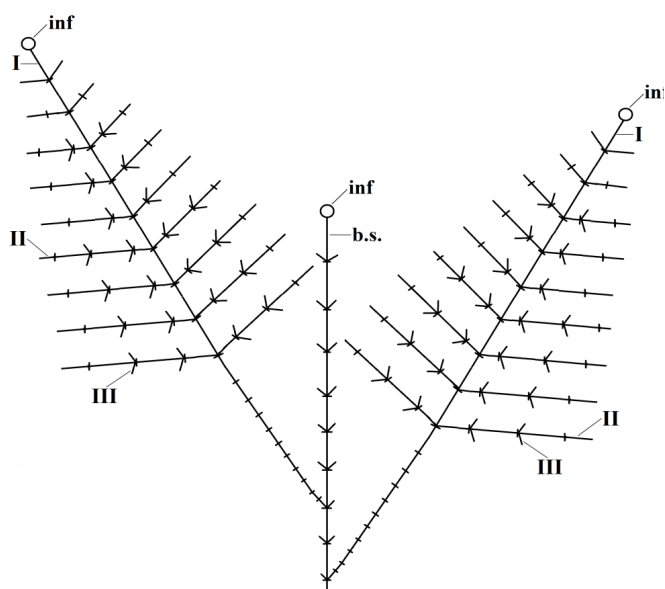
Fugire 2. 2-year-old plant sprouts scheme
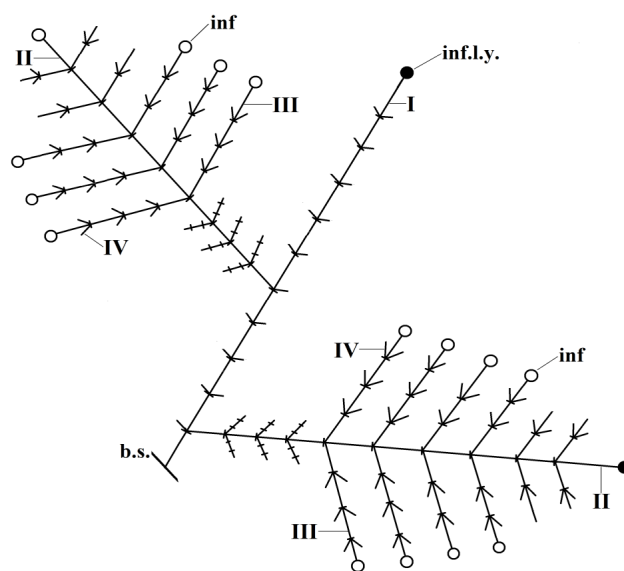
Fugir 3. 3-year-old plant sprouts scheme

Commentary: a – basic stem; t – inflorescence; o.t.– the inflorescence bloomed last year; I – first order branching, II – second order branching, III – third order branching, IV – fourth order branching.

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ECOLOGICAL — TAXONOMICAL ANALYSIS OF COLLEMBOLANS OF THE NORTHEAST OF UZBEKISTAN

Abstract. Paper is devoted to the ecological and faunistic analysis of the collembolans unit of the Northeast region of Uzbekistan. In the agrocenoses of apple orchard, wheat and surrounding ecosystems, 40 species of collembolans have been identified. Of these, 29 species were found in agrocenoses (apple orchard and wheat), and 40 (in natural communities). We observed the same pattern in a huge population density in the cenoses studied. It is significantly more in natural communities (12386 copies per 1 m² of soil) as compared with agrocenoses (6980 copies per 1 m² of soil). The horizons of the surface layer (10–20 cm) of soil are most densely populated by collembolans.

Keywords: collembola, agrocenosis, soil, seasonal dynamics, sample, wheat, Uzbekistan.

Introduction. The springtails order (*Collembola*) is a relatively small, well-defined group of predominantly soil animals – one of the most ancient taxa of land arthropods, which retained a plesiomorphic level of organization. Collembolans are one of the leading groups of arthropods in the saprotrophic complex in soil biota. The significant role of collembolans in soil biodynamic is due to their abundance, taxonomic richness, and the rapid change of generations. They are very sensitive to ecological conditions and quickly respond to environmental alterations that allows the use of collembolans for bio monitoring of contaminated and disturbed ecosystems [1; 3; 5].

Research of collembolans fauna in specific regions gives a complete picture of the taxonomic composition of certain groups, their interrelations in biogeocenoses, and their role in the circulation of substances in nature. Therefore, the research of taxonomic composition, distribution, quantity, biology, ecology of especially significant soil-forming species of collembolans in various agrocenoses and surrounding ecosystems is of great scientific practical importance.

The aim of our research is to determine the taxonomic composition of collembolans, the study of the seasonal dynamics of the number of individual groups of soil organisms in the biogeocenoses of the Northeast of Uzbekistan.

Materials and methods. To study the structure and number of populations of soil collembolans, soil samples were collected in agrocenoses, and stationary studies of their surrounding ecosystems were conducted in the "Karakalpak" farm in Parkent district of Tashkent region. The material for the study was collected in all seasons of the year in three points. To study the qualitative and quantitative composition of soil small arthropods, soil samples were taken from three points of each investigated agrocenosis and surrounding ecosystem in layers of three horizons (0–10, 10–20, 20–30 cm). In total, we received 405 samples in a fivefold repetition.

The extraction of collembolans from soil samples was carried out in the laboratory using an eclectic method. The extrusion of collembolans from substrate was carried out using a modified Berlese-Tulgren apparatus. Permanent preparations in liquid phora are prescribed [2; 4]. The counting and determination of the taxonomic affiliation of collembolans was performed under MBS-9 binocular microscope. The digital material was statically processed. A quantitative account of the number of collembolos was carried out on the basis of counting them in 1 dm³ of the soil sample. Based on the data obtained, recalculation was carried out for 1m² for each soil layer. Digital material is statistically processed (N. M. Chernova B. R. [4], Striganova [3]).

Results and discussion. Analysis of the collected material showed that in wheat agrocenoses, an apple orchard and the surrounding ecosystem of the Parkent district of Tashkent region live 40 species of collembolans from 6 families belonging to *Collembola* order.

The number of species constituting these complexes in the studied cenoses is not the same. Since the apple orchard identified 29 species, wheat field 17, the surrounding ecosystem, 40 species. Representatives of the families Isotomidae (14 species), Onychiuridae (17), Entomobryidae (7) and Neanuridae (5 species) dominated.

From found 40 species of collembol, 17 species: (*Lipura sibirica, Lipura groenlandica, Brachystomella maritima,*

Odonitella ewingi, Xenyllodes armatus, Onychiurus ramosus, Lipura armata, Pentacanthella decemoculata, Folsomina onychiurina, Istoma producta, Cruptopygus antarcticus, Istoma minor, Istoma sensibilis, Istoma notabilis, Desoria saltans, Digeeria muscorum, Parasira ornate), found in the soil layers of agrocenoses and natural ecosystems; 9 species (*Achorutes inermis, Xenylla maritima, Tullbergiya tricuspis, Triaeana mirabilis, Pseudachorutes subcrassus, Micranurida pygmaea, Podura palustris, Istomodella pusilla, Istoma communa*) were characteristic only for the soils of natural ecosystems.

The results of studies on the seasonal dynamics of the number of collembolans in agrocenoses of apple orchard, wheat and the surrounding ecosystem are shown in the (table 1).

From table 1 it can be seen that the total number of collective balls is 8782 copies per 1 m^2 of soil. The main population of collembolans is concentrated in the soil layer of 10–20 cm, the number of which reaches 4604 individuals on 1 m^2.

The soil layer at a depth of 0–10 cm, the maximum populated in springtime is 10580 copies on 1 m^2. With increasing soil depth, their number drops sharply.

Table 1.– Seasonal dynamics of the number of collembolans in agrocenoses of apple orchard, wheat and the surrounding ecosystem of Parkent district of Tashkent region

Depth	Agrocenosis apple orchard			Wheat agrocenosis			Environmental ecosystem		
	IV*	VIII	X	IV	VIII	X	IV	VIII	X
0–10 cm	1600**	440	720	1600	580	840	5600	680	1840
10–20 cm	1680	2200	1680	7400	3200	5100	7100	6980	6100
20–30 cm	1200	2000	1560	3100	4300	2680	2460	3800	2600
Total	4480	4640	3960	12100	8080	8620	15160	11460	10540

* – months of the year;

** – on average per 1 m^2.

In the soil tier of the apple orchard, the number of collembolans was not lower than 4360 copies per 1 m^2 in the soil layer 0–30 cm. In all soil layers, they are distributed more evenly, where the number ranged from 440 to 1600 copies on 1m^2 in a 10 centimeter layer of soil.

Under the conditions of wheat agrocenosis, the number of collembolans was 9.600 copies on 1 m^2 of soil.

Collembolans inhabited all soil layers at a depth of up to 30 cm, their numbers in different layers ranged from 580 to 7400 copies on 1 m^2 of soil. In springtime, a more dense settlement was observed (on average, 4033 copies per 1 m^2). In the soil layer in the surrounding ecosystem collembolans make up an average of 12386 copies on 1 m^2 of soil. The bulk of the population of collembolans was concentrated in soil layers of 10–20 cm, where their numbers reached 6.100 and 7.100 copies on 1 m^2 of soil. In the spring season, a more dense settlement was also observed (on average, 5053 copies per 1 m^2).

Thus, all soil tiers of the surrounding ecosystem of the studied agrocenoses were the most populated by collembolans.

Conclusions: Results of the research allowed finding out the ecological and faunistic analysis of the collembolans of the surveyed region. In the agrocenoses of apple orchard, wheat and surrounding ecosystems, 40 species of collembolans have been identified**.**

From found 40 species of collembol, 17 species -*Lipura sibirica, Lipura groenlandica, Brachystomella maritima, Odonitella ewingi, Xenyllodes armatus, Onychiurus ramosus, Lipura armata, Pentacanthella decemoculata, Folsomina onychiurina, Istoma producta, Cruptopygus antarcticus, Istoma minor, Istoma sensibilis, Istoma notabilis, Desoria saltans, Digeeria muscorum, Parasira ornate*, met in the soil layers of agrocenoses and natural ecosystems; 9 species-*Achorutes inermis, Xenylla maritima, Tullbergiya tricuspis, Triaeana mirabilis, Pseudachorutes subcrassus, Micranurida pygmaea, Podura palustris, Istomodella pusilla, Istoma commun*were characteristic only for the soils of natural ecosystems.

It has been established that the agrocenoses of apple orchard and wheat are much poorer by the species of collembolans than those in natural communities. Thus, in the agrocenoses, 29 species of collembolans were noted (6980 copies per 1 m^2). In natural communities, however, there are 40 species respectively (12386 copies per 1 m^2 of soil). The horizons of the surface layer (0–20 cm) of soil are most densely populated by collembolans.

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Section 2. Geography

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THE MAIN PROBLEMS OF YOUTH EMPLOYMENT IN UZBEKISTAN AND THEIR SOLUTION

Abstract. This article describes the main problems of youth employment in Uzbekistan and their solutions. In addition, the problems of unemployment among young people as a whole are analyzed.

Keywords: the urban population, employment, the rural population, working age, Youth Policy, the reform, development, priority areas, unemployment, promotion.

Recognizing the problems of employment, the Government of Uzbekistan attaches high priority to the creation of decent jobs and the promotion of employment. Thus, increasing the level of employment by creating new sustainable jobs is one of the most important areas of social development in the framework of the Action Strategy for the five priority areas of development of the Republic of Uzbekistan for 2017–2021. At the same time, the creation of sustainable and decent jobs for such categories of the population as women and youth is of particular importance.

As to April 1, 2018, the number of the resident population of the Republic of Uzbekistan, according to preliminary data, amounted to 32,763.7 thousand people and increased from the beginning of the current year by 107.0 thousand people, or 0.3%. At the same time, the urban population amounted to 16,583.0 thousand people (50.6% of the total population), and the rural population – 16,180.7 thousand people (49.4%).

In 1991–2017 Also observed significant changes in the age structure of the population of the republic.

For example, in 1991 the population under working age (0–15 years old) made up 43.1 percent of the total population of the republic; people of working age (men aged 16–59 years, women 16–54 years old) – 49.1 percent older than working age. (men aged 60 years and older, women 55 years and older) – 7.8 percent.

On January 1, 2017 this indicator was equal to 30.1 percent, 60.5 percent and 9.4 percent respectively (Table 1).

Table 1. – Information on the age structure of the permanent population
of the Republic of Uzbekistan (thousand people)

	1991y.		2011 y.		2017 y.	
	Number	Specific gravity,%	Number	Specific gravity,%	Number	Specific gravity,%
Total population	**20607.7**	**100.0**	**29123.4**	**100.0**	**32120.5**	**100.0**
including:						
younger than working age	8883.7	43.1	9099.3	31.3	9665.7	30.1
at working age	10122.5	49.1	17804.7	61.1	19440.8	60.5
older than working age	1601.5	7.8	2219.4	7.6	3014.0	9.4

Source: The state committee of the Republic of Uzbekistan on statistics

In Uzbekistan, young people have a special place in the process of forming a legal democratic state and civil society. It is well known that the majority of the population of Uzbekistan are young people under the age of 30 years. Recognizing that the youth is a decisive force in the modernization of society, the state pays special attention to the education and support of the young generation.

This is reflected in the Law of the Republic of Uzbekistan "On State Youth Policy", in fulfillment of which about half of the state budget of the country is spent on social protection of young people, on the education and upbringing of the young generation, creating conditions for a healthy lifestyle. In Uzbekistan, special attention is paid to the development of sports, culture, art and other spheres of spiritual life, with the goal of educating physically strong and morally rich young people.

In addition, such an organization, the Union of Youth of Uzbekistan, has been created in Uzbekistan. This is a youth organization that is engaged in consistent and effective implementation of the state youth policy, full support for young people, fundamental reform of the system of protection of their rights and legitimate interests, taking into account the opinions and suggestions of the general public, especially young people. The Union of Youth of Uzbekistan is entrusted with a number of important new tasks to increase the activity of young people in the reform process, carried out within the framework of the Actions Strategy of the Republic of Uzbekistan in 2017–2021.

In Uzbekistan, young people are the most dynamic part of the labor force. This age category has increased mobility, potential abilities for fast learning, non-standard thinking. However, in accordance with the data of the International Labor Organization, the unemployment rate in the republic in 2016 exceeded 7%, and the unemployment rate among young people aged 15–24 years was more than 16%. Thus, on average, the youth unemployment rate exceeded the unemployment rate among adults (25 years and above) by almost 2.5 times.

The causes of youth unemployment are: high demographic pressure on the labor market; insufficient supply of new jobs in the labor market of Uzbekistan; insufficient level of cognitive and non-cognitive skills of young people, received in colleges and lyceums and which are important for the formation of skills to make rational decisions in problem situations; low youth productivity due to lack of work experience; insufficient level of competence among young persons who have graduated from vocational schools.

Further employment of the population, especially young people, can be achieved in the following main areas:

– the study of the state, problems, their causes and consequences in the field of youth employment;

– development of practical recommendations for solving problems of reducing youth unemployment;

– reduction of informal employment through the accelerated creation of sustainable and high-performance jobs;

– increasing the level of employment in existing workplaces due to advanced training and reprofiling in accordance with the requirements of enterprises-employers;

– improving the competitiveness of the population in the global labor market by increasing knowledge and skills. It is necessary to introduce the practice of distributing university students studying on a budgetary basis, improving the activities of marketing departments;

– In vocational colleges, to ensure a closer link between their specialization and placement with the directions and parameters of transformations that provide for the accelerated development of new sectors of the economy;

– to create in all areas specialized vocational colleges for the preparation of production managers in the sphere of small and medium business, etc.;

– to introduce into the practice of personnel activities of enterprises the timely formation of orders for the training of specialists of relevant professions in vocational colleges.

The implementation of the recommendations will allow to successfully solve the problems of the development of the labor market of Uzbekistan.

Providing youth employment remains a priority for the government. According to statistics, in 2017, 438.5 thousand

out of 477.7 thousand college graduates or 91.8% were employed. But how correct are these numbers? "If we have employed all college graduates, where do unemployed young people come from?"

The Ministry of Employment and Labor Relations, the Ministry of Finance, the Ministry of Economy and the Association of Craftsmen were instructed to create the necessary conditions for young entrepreneurs, especially girls, in the field of handicraft.

From January 1, 2018, income tax for graduates of academic lyceums, vocational colleges and universities, graduated from educational institutions no later than three years ago and first applying for jobs, will be reduced by 50% in the first year, and by 25% in the second and third years.

The Youth Union will partially (35–40%) cover the cost of contracts in universities to its most active members, whose performance is 85% or more.

Annually, 140 active employees who have worked in the Youth Union system for at least three years and expressed a desire to purchase housing in a mortgage will be paid 25–30% down payment.

Proposals for the construction of affordable housing for young families will now be prepared by the heads of the district departments of the Youth Union.

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RISK ASSESSMENT OF DISEASES IN THE CONDITIONS OF CLIMATE CHANGE

Abstract. In this article proposed methods which are included in the early warning system, that allows the timely development of adaptation measures to climate change in the health care system.

Keywords: climate change, risk assessment, Tashkent region, the spread of diseases, adaptation.

Many studies on climate change focus on the sharp and anomalous rise in air temperature and changes in precipitation. Global climate change has led not only to an increase in air temperature, but also to the "imbalance" of climate systems. This means that, against the background of mild changes in the averaged characteristic (air temperature, precipitation), there is an increase in the number of extreme events. Precipitation begins to fall in the form of heavy rain, but then a long drought occurs. Thus, changes in climatic or averaged values are poorly expressed, but at the same time, an increase in the number of extreme (maximum and minimum) weather phenomena during the same period of instrumental observations is pronounced. These processes are most vividly observed in Central Asia, where the continental climate is preserved and, at the same time, an increase in the number of extreme weather events is observed.

Medical research confirms that in the state of public health there is also a great dependence on sudden changes in weather characteristics, especially for meteosensitive or weakened by chronic human diseases.

To adapt the health system to climate change, it is necessary to develop an early warning system for the risk of disease, depending on the dynamics of weather and climate factors in a particular region. The system of observation of various types of diseases currently does not correspond to the system of instrumental observations of hydrometeorological parameters.

If hydrometeorological observations are carried out regularly and continuously, according to certain methods and standards, the medical statistics are based on the cases of the diseased. In some cases, the diseases are not fixed, since patients often prefer to self-medicate and acquire the appropriate medications in pharmacies without a prescription and without going to a doctor.

In this regard, the following approach is proposed as a definition of the dependence of incidence on weather factors.

Due to the fact that it is almost impossible to detect an increase in the number or spread of morbidity in the daily incision, since one part of the population see a doctor immediately, some only on the second or third day, and some only when a critical condition occurs.

To determine the statistical dependencies between the number of diseases and weather changes, we propose to use the expression:

$$Y_i = \sum_{j=1}^{N} \left| X_{j+1} - X_j \right|, \qquad (1)$$

where Y_i is the weather characteristic (air temperature, atmospheric pressure, pressure difference per day, etc.), X_i – is some "weather" factor from the set $i \in N$ – some set of meteorological observations, N – is the number of observations.

Thus, the dependence of the number of diseases is some function or:

$$\psi_j = f\{Y_i\}, \qquad (2)$$

where ψ_j – type of disease from the set $j \in \Omega$.

In addition, it is a priori known that several weather factors can have a significant effect on the increase in the number of diseases at the same time, for example, a sharp change in air temperature and atmospheric pressure. In this case, it is possible to use multifactor regression analysis to identify meaningful links:

$$\varphi = \sum_{i=1}^{F} a_i Y_i, \qquad (3)$$

where φ – is the type of disease, a_i – is the coefficient, F – is the number of parameters taken into account.

The average, maximum and minimum air temperatures per day, the values of atmospheric pressure and its change per day and others were taken as weather factors.

A set of detectable diseases – a disease characterized by elevated blood pressure, diseases of the circulatory system, and diseases of the respiratory organs – was taken as the types of morbidity.

Thus, it turns out some summary analytical table of the risk of growth in the number and distribution of the type of morbidity of the population depending on weather and climatic factors in the form of a certain dependence of morbidity

on the weather, with a corresponding multiple regression coefficient and approximation reliability value.

Table 1 shows the matrix of the magnitude of the accuracy of the approximation for certain types of diseases and weather characteristics of the Tashkent region of Uzbekistan for the period 2005–2015. Of course, the accuracy of the approximation is not great for all cases, but it can still be used to assess the risk of increasing incidence, especially depending on the dynamics of weather factors. In case of extreme changes in weather and climatic factors, to warn different categories of users in a timely manner – from the level of the Ministry of Health to attending physicians and risk groups themselves.

The magnitude of the accuracy of the approximation serves as a probabilistic characteristic of the dependence of the type of morbidity on the weather factor and can serve as a measure of the risk, in terms of its probabilistic excess over the norm, since it varies from 0 to 1.

It should be noted that in this case only the weather factor is taken into account, which is secondary, if unhealthy lifestyles, unbalanced nutrition, stressful situations, constant psycho-emotional stress, hypodynamia, elevated blood cholesterol, arterial hypertension and tons are taken as primary factors.

According to the weather forecast, it is possible to make a prediction of the risk of an increase in the number or spread of morbidity with a predetermined degree of probability corresponding to the magnitude of the approximation reliability for a particular area.

The World Health Organization (WHO) project, jointly carried out by experts from Uzhydromet and the Ministry of Health, developed an early warning system for disease risk, which uses the proposed approach to develop recommendations for various groups of users.

The system is designed to prevent risks for various categories of users and to apply various response measures developed in advance by specialists.

At the state level – for timely prevention and warning of the population by appropriate means of warning.

Table 1.– The matrix of the magnitude of the accuracy of the approximation for certain types of diseases and weather characteristics

Type of disease	Atmospheric pressure	Differential Atmospheric Pressure per day	Temperature air, average per day	Delta temperatures of air per day
acute rheumatic fever	0.0001	0.0668	0.0238	0.0016
chronic rheumatic heart disease	0.0055	0.0282	0.0088	0.0635
rheumatic heart disease	0.0570	0.0019	0.0312	0.0790
disease characterized by high blood pressure	0.0141	0.2163	0.0027	0.0040
coronary heart disease	0.0146	0.0230	0.0094	0.0221
angina pectoris	0.1720	0.2463	0.3288	0.4280
acute myocardial infarction	0.0661	0.4262	0.2520	0.3488
acute myocardial infarction	0.0395	0.2290	0.2024	0.2108
chronic ischemic heart disease chronic diseases of tonsils and adenoids, peritonsular abscess	0.0979	0.1972	0.1469	0.2212
pneumonia	0.0300	0.0957	0.1149	0.0864

For early warning, recommendations will be made on the categories of patients, including not only chronic, but also group – children, the elderly, women, and chronic patients.

For pharmacology – the degree of use of drugs and drugs for the prevention of diseases.

The system is placed on a special website www.meteomed. uz, which provides access to all blocks of users who are at a distance, does not require the development and use of special communication lines between different users, ensures efficiency, which is important in extreme cases.

The system contains its own database, which allows you to enter data on morbidity, to carry out their graphical and tabular control, if necessary, correct and correct the input data. Risk calculation programs use the entered data and put it on a special page. The analytical group of health workers monitors the calculation results and issues the appropriate recommendations in accordance with previously developed action plans and risk criteria.

The system consists of separate blocks. Block receipt and entry information. Baseline information for statistical pro-

cessing comes from the SES of the Ministry of Health – the number of diseases per decade. Directly on the page, you can enter, analyze the entered data in tabular and graphical form, thus avoiding technical errors (Figure 1).
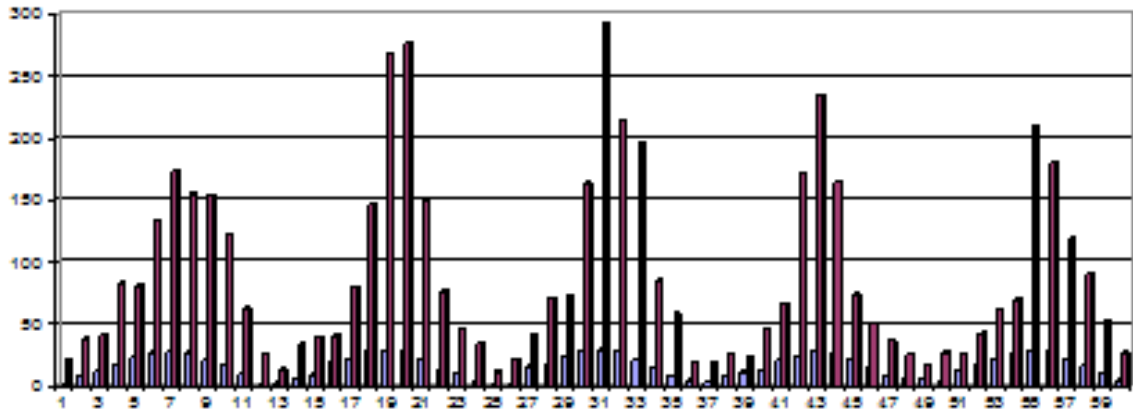
Figure 1. Graph of the decade progress comparing the number of recorded acute intestinal diseases and average air temperature

The system of equations calculates the parameters of the statistical dependence of the number of diseases on weather and climatic factors.

In (Figure 2) the calculated equation with the coefficient of approximation and the dependence graph are given. The coefficients of the calculated equations of multiple regression are entered in the appropriate calculation unit. According to hydrometeorological data, which are substituted into the appropriate equations, the estimated number of diseases is calculated. The calculation results are placed in a special table with the appropriate values of the accuracy of the approximation, which are analyzed by the relevant group of experts of the Ministry of Health.

For widespread use, an approach can be used in which three criteria of excess over the norm are applied – 75%, 90%, above 100% –when extreme values of the used weather factors are used. For treating physicians appropriate action plans.

For the convenience of the analytical group, the system provides GIS processing of database materials. In (Fig. 3) shows an example of displaying the results in cartographic form for the districts of the Tashkent region in a predetermined time interval.

Using the nosogeographic maps built in the GIS system, it becomes possible to analyze the territorial distribution of the disease. For example, in (Fig. 3) clearly visible territorial intensity of the spread of acute intestinal infections, depending on the location in the direction of the flow of watercourses.

This is explained by the increase in the concentration of pollution as a result of not only polluted water entering the watercourses, but also pollution from the slopes of the foothills. What subsequently leads to an increase in the concentration of water pollution along river flows downstream.

In this case, the analytical group may focus on individual territories most affected by not only weather and climate factors, but also distribution throughout the region.
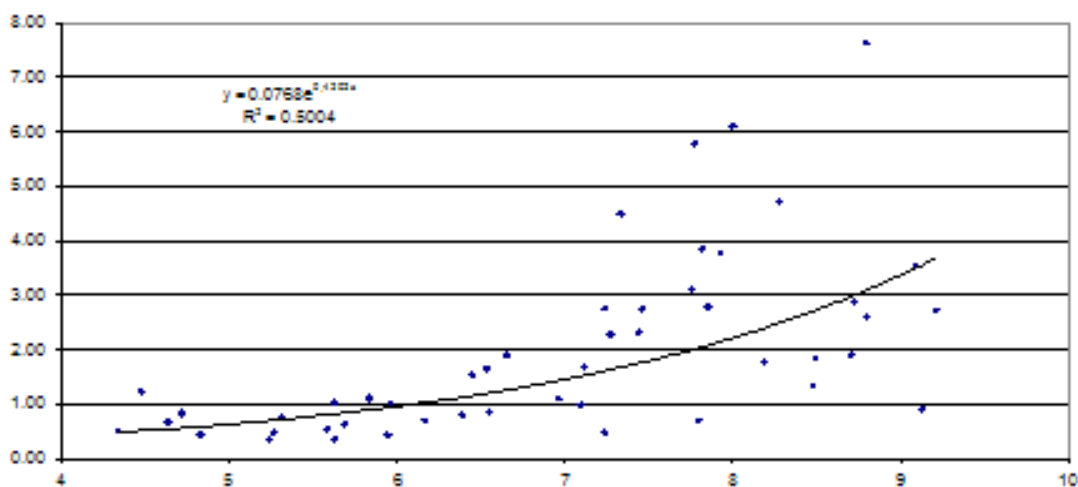
Figure 2. Dependence of the number of acute intestinal diseases for a month on the average air temperature in the previous month
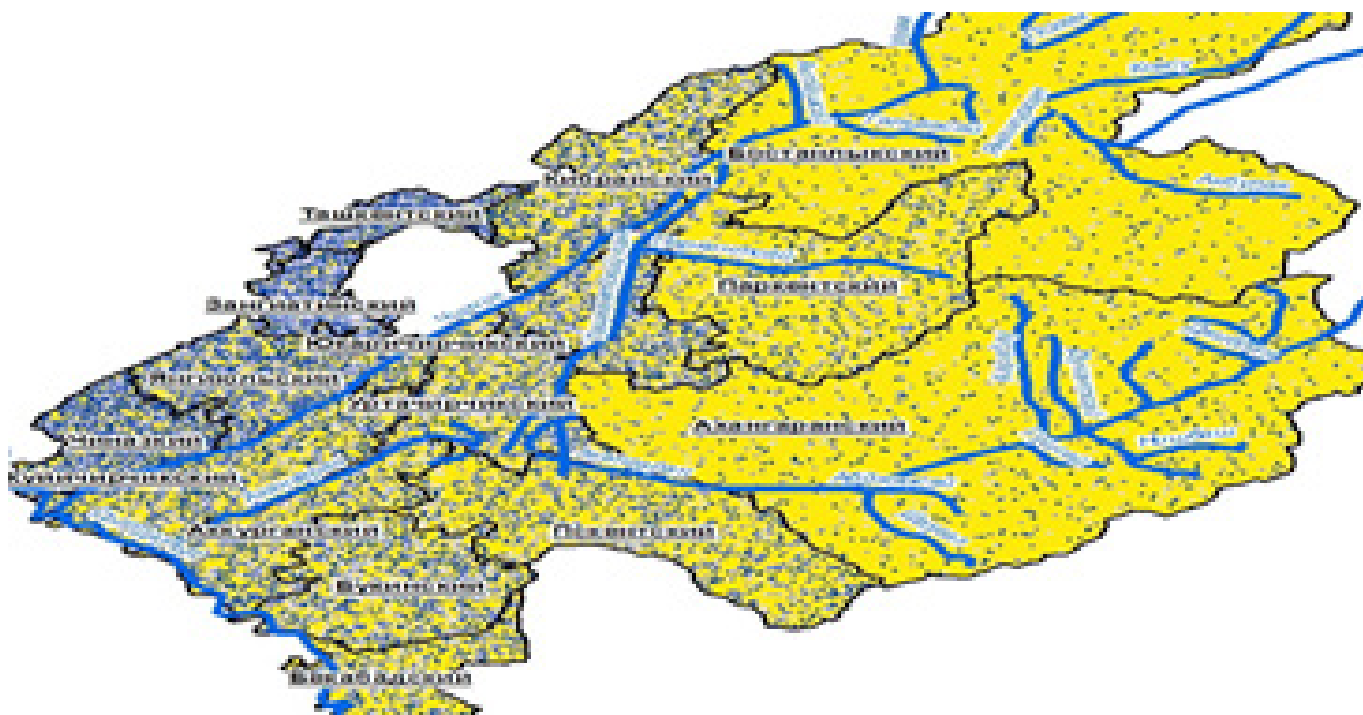
Figure 3. A zoological map of the spread of acute intestinal infections Tashkent
region for the period 2005–2015

An analytical approach has been developed for comparing average decadal (monthly averages) data on morbidity and average daily meteorological data to obtain quantitative values of prognostic equations.

The location of the system on a special site allows prompt entry of source information, without the use of special communication tools, calculation, output of calculation results into a special (password-protected) page for medical analysis.

The analytical group will make the appropriate decision and promptly disseminate the results of the analysis in the form of appropriate, previously developed action plans for various categories of users.

This approach can be used for various territories at the global level, taking into account national specificity in the choice of morbidity risk criteria and climatic factors. To develop response measures for critical values of weather variability and climate change.

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ENVIRONMENTAL SUSTAINABILITY OF GEOSYSTEMS IN UZBEKISTAN: EVALUATION, FORECAST, MANAGEMENT AND ISSUES OF RECREATIONAL NATURAL RESOURCE MANAGEMENT

Abstract. Natural conditions and resources of Uzbekistan are extremely diverse, unique and specific in some places. Their combination seriously aggravates economic use of the resources. This is primarily due to mosaic pattern of environmental sustainability of Geosystems. In this regard, evaluation, forecast and management of sustainability of dominant Geosystems in the country has certain practical importance. An analysis of exploitation of resources of the Geosystems with a variegated environmental sustainability is given on the basis of an example of recreation natural resource management.

Keywords: Geosystem, Ecological Balance, Natural Resource Management, Geographical Forecast, Recreation.

Introduction

In conditions of intensive use of natural resources in Uzbekistan, ecological balance is more and more violated, which is considered as an indicator of a normal state of environment, and social and economic consequences of the process is well known. It suffice to say in this regard about ecological catastrophe of the Aral Sea and the Aral Sea Region, which resulted from mismanagement of water resources in the region, as a result of which economic condition of the Aral Sea Region has been steadily deteriorating for more than 50 years [1, p. 4]. All this is directly related, on the one hand, to fragility of a desert Geosystem, and, on the other hand, to the nature of the natural resources management. Therefore, study of the environmental sustainability of Geosystems in the Republic under conditions of intensification of impact of the technogenic factor is of great importance.

1. Evaluation of Environmental Sustainability of Geosystems

Geosystems (landscapes) of Uzbekistan in regional and typological respect are located in mountain areas, at foothills and flat areas.

The following can be said about mountain Geosystems occupying the areas of erosion and substances run off with respect to their stability: the main natural properties that determine mechanism of stability are self-cleaning and self-healing ability of waters, soil, subsoil, vegetation and ecosystems. The greater steepness (12–15^0 and more) of slopes contributes to degree of purity, loss of microbes, viruses and bacteria. Light mechanical composition of soils, presence of a large amount of humus (2–5%), thickness of soils and subsoil is based on the ability to be self-cleaned from oil products, pesticides, heavy metals, etc. during the year.

On mountain slopes, especially at the northern exposure, density of vegetation cover is the largest (10–15 pieces of trees per 10 square meters, 6–10 units of shrubs and dense grassy cover), therefore stability of Geosystems is high, as erosion, landslide, gravity processes are manageable in these areas. Dense vegetation cover protects the slopes from development of various natural processes. Environmental sustainability of Geosystems on these slopes is ensured, but the issue is rational use of local resources, i.e. maintenance of constant preservation of ecological balance.

The foothill areas (zones of proluvial trains, cone deltas) are characterized by accumulation of parts of substances run off from slopes, and the rest is carried away by delta zones of rivers. In the foothill zone, the environmental sustainability of Geosystems is sharply differentiated by parts of the cone deltas and proluvial trains. In particular, it is the most stable in their head part due to ensured underground outflow of groundwater, it is less stable in the middle part due to poor presence of horizontal outflow of groundwater, and it is sharply unstable in the lower peripheral part due to practically drainless territory [1, p. 28].

The plain (desert) areas of the Republic are distinguished by formation of deltaic, sandy Geosystems, as well as Geosystems of plateau and residual mountain heights. Delta Geosystems as well as cone deltas are differentiated at the head, middle and peripheral parts; and due to the same known reason, the delta Geosystems of Amu Darya (Khorezm Oasis in Pri-Sarykamysh Delta, Karakalpak Oasis in the Aral and Akchadarya deltas), Zarafshan (Bukhara and Karakul Oases in Bukhara and Karakul Delta, respectively), Kashkadarya (Karshi Oasis in the Delta of Kashkadarya), Sherabaddarya (Sherabad Oasis in the Sherabaddarya Delta) and others are

characterized by a variegated environmental sustainability with a clear dominance in unstable degree. This is related to prevalence of the peripheral part of deltas in the area ratio and general flooding of the oases due to their practically drainless territories. Therefore, at the present time almost all oases of Uzbekistan are strongly flooded, which has a significant impact on crop yields, land reclamation conditions and sanitary and hygienic conditions of settlements, quality of groundwater, etc. [3, P. 44–45].

The Kyzylkum Geosystems are structurally and dynamically unstable in general; here, elimination of a rarefied cover at rapid rates leads to formation and establishment of deflation sites, formation of barkhans, securing of which is very difficult and requires a large amount of labor and experience. Therefore, in order to restore previous productivity of pastures requires a long time, lasting at least 5–7 years, sometimes even longer. Ustyurt is also not stable With regard to stability of Geosystems, restoration of ecosystems of degraded areas does not occur usually, deflation (so-called "bald" lands), karst formation, suffusion, in the absence of conditions for vegetation (wormwood, biyurgun, tasbiurgun) are developed [3, p. 61–63].

A brief analysis of the environmental sustainability of Geosystems in Uzbekistan indicates that almost all Geosystems are unstable in the region, except for the mountain zones, i.e. natural complexes are not capable for self-regulation and self-recovery, requiring a special approach for use of their resources and, in general, for nature management.

2. Forecast of Environmental Sustainability of Geosystems

In order to foresee the future state of environmental situation in the Geosystems it is required to be prepared for prevention of expected negative processes in advance, and it is also advisable to develop a forecast of changes in the environmental sustainability of Geosystems of the Republic for the next 5–10 years. It has a significant practical importance under conditions of intensive use of natural resources, since we shall be aware of the consequences of the current nature management in advance.

Some changes may be expected in environmentally sustainable mountain Geosystems in the nearest 5–10 years with a trend to erosion of slopes, especially at the southern exposition as a result of development of linear erosion, soil landslides, where sparsity of vegetation cover is high (1–3 trees and 5 pieces of shrubs on the area of 100 m² and projective covering of grasses is 30–50%). At this time, development of negative processes is not expected at the northern exposure due to presence of a dense vegetation cover.

In the oases with conditions of current salt balance, especially in the delta and terrain Geosystems, it is expected that

saline lands will increase by 10–30%, and it is also necessary to take into account transition of highly saline soils to the category of medium saline, and the latter to highly saline soils, and it appears that the range of salt marshes will be expanded. Expansion of areas of saline soils is a result of sharp dominance of hydromorphic irrigation regime in oases [4, p. 17].

In the lower reaches of the Amu Darya River, especially in Karakalpakstan, where the positive salt balance clearly prevails, deterioration of land-reclamation state of irrigated lands will become even worse, since horizontal outflow of groundwater is almost absent, and a vertical runoff of moisture conducive to salt accumulation in the aeration zone is sharply prevailing. Therefore, under the current conditions of neglected drainage and other effective measures in the region, an increase in soil areas with salinity of medium- and heavily saline soils with salt pans is expected.

In the northern part of the Amudarya Delta, where anthropogenic desertification is intensified due to decrease in the level of the Aral Sea, further aggravation in development of this process is to be expected. Especially in this respect, degradation of riparian woodland will be accelerated, and it is possibly that the riparian woodland ecosystems along the channels of the delta will dry up under conditions of a deficit of the Amudarya water. The ranges of Black Saxaurs, "Yulgunnik", "Karabarachnik" and annual "Solyanka" will expand due to the reduction of the areas of grassy riparian woodland and wild grasses. This will result in decrease in pasture productivity by 20–60% or more. As a result of intensification of deflation, it will be obvious that activation of formation of mobile sands in the places of the riverine embankments, which are mainly composed of river sand, will occur.

Developing Geosystems of the dried up part of the Aral Sea bottom (at the beginning of 2016 this area was more than 5.7 million hectares) are extremely unstable, i.e. highly dynamic. The designed forecast versions show that they acquire eluvial features that are specific for the surrounding deserts, formation of a zonal soil-vegetation cover will occur, and the emerging mobile sands will be fixed by psammophytes and xerophytes. It is established that, in this case, pasture exploitation can lead to development of undesirable processes in a large scale, therefore, in future, it is necessary to refrain from even local use of them. In the Karshi Steppe, where oil and natural gas drilling is performed on a large scale under conditions of insufficient environmental sustainability of Geosystems, further degradation of soils and vegetation in the first place shall be expected.

Elimination of vegetation and soils. Elimination of vegetation will cause formation and establishment of mobile sands in the drilling areas, and in the oil and gas production area, where eolian relief forms have already appeared in lo-

cal sites. Technogenic load on the ecosystem is several (3–5) times higher than permissible load [4, p. 53–55].

As a result of forecast studies it was found that due to insufficient environmental sustainability of Uzbekistan's Geosystems, especially in its flat areas, it is possible that development of negative anthropogenic phenomena related to extraction of minerals, lack of radical measures to control large areas with salt accumulation in oases and degradation of desert pastures shall be expected in the nearest 5–10 years.

3. Problems of Recreational Nature Management

Natural conditions and wealth represent one of blocks of a recreational resource. A person rests and heals being in nature, spends a lot of time outdoors. Recreational activities require favorable natural locations (Geosystems), where a person may get good relaxation (it can be mountain valleys with unique landscape and a water pool, mild climate, lakes or rivers with constant water level in summer, forests or gardens with a water pool etc.). Tourists are more interested in mountain valleys, steep slopes, passes, snowfields and highland glaciers, rugged rivers and small rivers (sais), nature monuments (caves, waterfalls), etc.

Currently, the recreants almost do not go beyond the country, and are planning to have a rest or to be treated at good resorts in sanatoria, boarding houses, at beautiful places of nature (although there is no appropriate infrastructure in such places at all) of the Republic [2, p. 13]. Number of uncontrolled tourist groups and townspeople having a short-term rest in mountainous areas is increasing. In this situation, the natural environment of the country's recreational areas begins to degrade; ecological balance is broken, water basins are polluted, new paths appear, and vegetation on the paths is destroyed, number of local fires increases, nature is polluted by garbage left by the tourists.

It is feasible to develop the following for rational use of natural environment and its wealth, and the recreational zone of the country: first, general provisions on use of nature resources by recreators, second, to legitimize use of environment, to pay a certain "green" tax for staying in the recreational zone, to impose penal fines in quite large amounts for violations of rules for resources use, especially for pollution, fires, gathering medicinal herbs and plants listed in the Red Book, animal hunting and damaging or destruction of other geo-ecological items; third, to intensify activities for promotion of ecological culture in the recreation zone for natural resources use; fourth, to issue special recreational cards with appropriate circulation showing places for rest, bathing, interesting objects (monuments) of nature, forests, hiking routes for tourists, slopes appropriate for ascending to high peaks, springs, unique mountain scenery locations, rental points for boats, catamarans, tents, sports grounds, public catering facilities, recreation facilities, libraries, shops, hotels, campsites, etc.

Uzbekistan is a rich country with regard to favorable natural conditions and resources for recreation, there are complexes of sanatoriums and recreation areas (Chartak, Chimyon, Botanica, etc.) of world significance. Nevertheless, the existing recreational potential of the Republic is not able to accommodate a large number of holidaymakers. There are great opportunities for creation of new recreation centers and treatment of population, not only from our country, but also for foreign tourists, all year round on the territory of Kashkadarya, Surkhandarya, Tashkent, Samarkand, Namangan, Fergana and in other regions.

Conclusion

In Uzbekistan, studies of environmental sustainability of Geosystems identified: 1) in general, mountain and foothill Geosystems are relatively stable to technogenic impacts in comparison with the flat (desert) zone; 2) it is established that evaluation, forecast and management of Geosystems of unstable regions are logically interrelated and interdependent; 3) recreational nature management, in conditions of mostly weak environmental sustainability of the territory, has its own specific features.

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Section 3. Study of art

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STRUCTURAL FEATURES AND CHOREOGRAPHY OF THE BALLET "SEVEN BEAUTIES" IN CO-PRODUCTION BY RAFIGA AKHUNDOVA AND MAKSUD MAMEDOV

Abstract. The article gives a detailed analysis of the ballet "Seven beauties" of K. Karayev in choreography R. Akhundova and M. Mamedov. The choreographers of the "Seven Beauties" performed a complex "interweaving" of all the imaginative spheres into a single, continuously evolving dramatic effect. With good reason this allows to list the performance of the "Seven Beauties" of Azerbaijani choreographers to a symphonic ballet performance.

Keywords: Azerbaijani ballet, Kara Karayev, choreography, Rafiga Akhundova, Maksud Mamedov.

The ballet "Seven Beauties" by Kara Karayev is one of the most significant works in domestic musical and scenic art of the second half of the twentieth century. For the first time, the literary primary source became the storyline for the Azerbaijani ballet show "Seven Beauties". And in his first ballet, the composer turned to the classical heritage – the works of the great Azerbaijani poet and philosopher of the XII century Nizami Ganjavi. The composer's appeal to the works of Nizami was due to K. Karayev's passion for the philosophical lyrics and artistic perfection of the poetic language of the great Azerbaijani thinker. Therefore, it is quite predictable that after the celebration of the anniversary (the 800th anniversary of the birth of the great poet), K. Karayev turned to the work of Nizami creating the symphonic suite "Seven Beauties" (1949) and, based on the musical material of the suite, the ballet of the same title (1951).

In his first ballet K. Karayev continued the genre of national ballet, which, unlike the opera genre, was less developed and formed in the musical and scenic art of Azerbaijan. Certainly, two previous ballets – A. Badalbeyli's "Maiden Tower" (1940) and S. Hajibeyov's "Gyulshen" (1951) played an important role in the formation of the ballet art of Azerbaijan (The ballet "Maiden's Tower" became the first Azerbaijani ballet, combining the principles of classical ballet with the techniques of folk music and stage art. The second ballet, "Gulshen" became the first national ballet on contemporary themes), but starting with the ballet "Seven Beauties" and "The Path of Thunder" K. Karayev "completely overcame the elements of an entertaining dance performance; he has reached a mature mastery on the way of creating a realistic dancing drama that captivates

the audience with the exciting fate of the characters, embodies great ideas, and achieves high aesthetic pleasure [1, p. 5]. Thus, K. Karaev for the first time (for the Azerbaijani ballet performance) created an integral symphonized musical choreographic canvas, in which he organically synthesized individual ballet plays, scenes into a single developing stage act.

This factor attracted R. Akhundov and M. Mamedov for creating their choreographic version of the ballet "Seven Beauties": "With a vengeance this work for us was a huge, joyful shock". Having already faced up with the music of new Soviet ballets, among which there were some interesting shows for us, we felt that there was something unusual and some particularly deep "third dimension" in the music of Karayev's ballet; that attracts and excites us, attracts not only flawless dancing plasticity, not only the beauty of melody and not even the broadest opportunity for interesting choreographic decision of our parties, not only the opportunity to express your acting personality in all its nuances of characters and feelings. All this you can find in the outstanding music score "Seven Beauties". But behind all this, we, as the greatest revelation that inspires the artist, have opened the philosophical depth of thought and the great heart of the artist" [2, p. 162].

The fact that K. Karayev offered R. Akhundova and M. Mamedov to revise the ballet "Seven Beauties" proofs that the composer was clearly not satisfied with the previous libretto with the direction emphasizing "socialist realism" (artistic method of literature and art, leading in the art in the countries with the communist system, including former Soviet Union). Certainly, as a composer who lived in the Soviet period, K. Karayev could not ignore the decree to introduce and remake

the subject of the ballet, concentrating all the stage action not around the main characters of the poem – Bahram-Gur and seven beauties, but around seven craftsmen and people. At the same time, the image of the people introduced an additional "burden" in the multi-line dramatic art of the ballet (opposing seven craftsmen to seven beauties). However, K. Karayev, as an intellectual artist, could understand the absurdity of these innovations in the libretto of the ballet. Therefore, it is not by chance that the main condition of the composer for a new production was a new rethinking and reworking of the old libretto to be done by R. Akhundova and M. Mamedov.

The Azerbaijani choreographers, starting from the literary source, created their own libretto and scenario, where they offered their own interpretation of the plot, focusing on two storylines: the love relationship of Bahram and Aishi, and the struggle of Vezir and Bahram for power. At the same time, in addition to external conflict (interpersonal conflict), Vizir-Bahram, the authors of the new libretto, approaching the poetic plan of the poem by Nizami, "play up" and internal conflict (intrapersonal conflict) – the struggle of Shakh Bahram with himself: between earth love and illusory love for seven beauties.

Such a significant change in the scenario plan, of course, could not affect the rethinking of the images of the main characters involved in the production of Azerbaijani composers. In the production of R. Akhundova and M. Mamedov, the composition of the characters involved in the performance was minimalized (compared to the original libretto of Y. Slonimsky in the production of P. Gusev). All the action is centered on the quartet of performers: Aisha, Bahram, Vizier and the Seven Beauties (as the fourth generalized participant of the stage action).

The choreographers of the "Seven Beauties" performed a complex "interweaving" of all the imaginative spheres into a single, continuously evolving dramatic effect. With good reason this allows to list the performance of the "Seven Beauties" of Azerbaijani choreographers to a symphonic ballet performance.

In terms of composition, the dramatic line of the seven beauties is very expressively revealed throughout the ballet production of R. Akhundova and M. Mamedov. If we look at the images of the Seven Beauties from the perspective of the shaping function, then the first appearance of the beauties is the exposition, the Big Scene of the Seven Beauties is a detailed development, and the final appearance is a reprise of this scenic figurative sphere.

It should be noted that the deliberately mechanical orientation of the beauties circling around the Shah, their "clockwork" movements are designed to emphasize the puppet, soulless essence of Vizier's dolls. The same "robotization" (dominance of exaggerated-mechanical exercises), heartless-

ness is characteristic of the entire chorolex of the male corps de ballet – the servants of Vizier. All "automated", "angular" movements of the male corps de ballet create a generalized image of an insensitive, ruthless military system that grinds everything in their path. A similar choreolexic is inherent to Vizier (the first exit is the Procession), which is not surprising in its figurative sense, since it stands at the head of this militarized mechanism.

Choreographic image of Aisha is presented in the interaction of classical traditions with national ones. The national ballet synthesis of choreolexics is most vividly manifested in "Aisha's dance with girls", which, according to its style, resembles "Gulyanag Dance" (to the music "Ay, beri bax") from the "Maiden Tower" ballet: the traditional croise derriere posture is "colored" by national colors position of the hands, the rotation of the hands, the graceful bend of the body and the flirtatious twitching of the shoulders (In their choreographic style, both dances have something in common with the Azerbaijani folk dance "Terekeme").

At the end Azerbaijani choreographers leave a spectacular way (the disappearance of Bahram in a dark color-light opening from the center to the back of the stage), found by his predecessors: Not being pursued by anyone, he (Bahram – *AE's remark*) retreats and disappears in the darkness of the night – in the darkness of eternal oblivion (a proven theatrical effect is used – the black figure, hitting the background of black velvet, disappears). Every time the curtain slowly fell or converged, an unusual silence was set up in the auditorium, and only a few seconds later burst into applause. There was something in this silence that gave us the right to consider the final performance to be poetically successful" [3, p. 118].

Choreographers successfully use bas-relief method in their performance that has a hidden meaning. For example, the final bas-relief in scenes symbolizing the "living" throne (on the outstretched arms of corps de ballet) acquires symbolic significance: if the throne of Bahram is stable and he is carried out from the stage, then the throne of Vizier (in his dreams of power) "crumbles" like a card house.

In conclusion, it should me mentioned that the ballets "Seven Beauties" and "The Path of Thunder" by the outstanding Azerbaijani composer K. Karayev became not only historically significant for the Azerbaijani ballet of the second half of the 20th century. These ballets became an important milestone in the creative biography of the choreographers – R. Akhundova and M. Mamedov, and brought them deserved success.

The choreographers themselves repeatedly expressed the multilateral influence of K. Karayev's ballets on their creative biography: "Karayev's music belongs to such cultural phenomena that not only delight with compositional skill, elegance of form, dramatic development, but teach to see the

world, understand its diversity, contrasts and conflicts; teach to overcome difficulties, struggle, excellence; teach the beauty We, the representatives of another, although in somewhere close to the art of music – choreography; of a different generation, who joined to the art later, believe that does not owe anyone their artistic and spiritual formation, like Kara Abulfaz Karayev" [2, p. 161].

These performances by R. Akhundova and M. Mamedov outlined the real ways of deviating from the principles of choreodrama in Azerbaijani ballet art, approved the artistic principles of the symphonized choreographic form in the performance. The lexical basis of their author's choreographic style is the synthesis of national choreography, classics and elements of modern choreography.

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Section 4. Mathematics

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THE CAUCHY PROBLEM FOR A ONE-DIMENSIONAL SYSTEM OF BURGERS-TYPE EQUATIONS ARISING IN TWO-SPEED HYDRODYNAMICS

Abstract. The Cauchy problem for a one-dimensional system of Burgers-type equations arising in two-speed hydrodynamics is considered. The formula for solving the Cauchy problem in the class of functions of finite smoothness is obtained. It is shown that with the disappearance of the kinetic coefficient of friction, which is responsible for energy dissipation, the formulas proceed to the well-known solution of the Cauchy problem for the one-dimensional Burgers equation.

Keywords. Two-speed hydrodynamics, Burgers-type system, Florin-Hopf-Cole transformation.

Introduction

In recent decades, mathematicians have become increasingly interested in problems related to the behavior of solutions of systems of partial differential equations, with a small parameter with higher derivatives, and taking into account kinetic parameters. These problems arose from physical applications, mainly from modern hydrodynamics (compressible multiphase fluids with low viscosities). An analogy of the Burgers equation arises, for example, in the study of a weakly nonlinear one-dimensional acoustic wave moving at a linear speed of sound. In this case, the nonlinear in terms of the terms in the system of equations of Burgers type are obtained from the dependence of the speeds of sound on the amplitude of the sound wave, and the terms with the second derivative and the velocity difference represent the attenuation of sound waves associated with energy dissipation. In other words, these terms ensure the continuity of solutions and represent dissipative processes associated with the production of entropy. These members, in turn, provide non-reversal of waves [1]. The considered system is a special case of the system of equations of two-speed hydrodynamics in the one-dimensional case [2–6].

A one-dimensional analogue of the Navier-Stokes equations for compressible fluids can be considered a system of Burgers-type equations, which is a system of nonlinear convection-diffusion equations

$$u_t + uu_x = \nu u_{xx} - \tilde{b}\,(u - \tilde{u})) \qquad (1)$$

$$\tilde{u}_t + \tilde{u}\tilde{u}xx = \nu u_{xx} + \tilde{b}(u - \tilde{u}), \qquad (2)$$

where u and $\tilde{u}$ can be considered as the speeds of subsystems with dimensions $[x]/[t]$, that make up a two-speed continuum with corresponding partial densities ρ and $\tilde{\rho}$, $\bar{\rho} = \tilde{\rho} + \rho$ is the total density of the continuum, $\tilde{b} = \dfrac{\tilde{\rho}}{\rho}\,b$, b – is the friction coefficient with the dimension $1/[t]$, which is an analogue of the Darcy coefficient for porous media. Positive constants ν and $\tilde{\nu}$ play the role of the kinematic viscosities of subsystems with the dimension $[x]^2/[t]$.

The system of equations of two-speed hydrodynamics and the system of equations of Bügers type have much in common. For example, the adjective term corresponding to the dependence of sound on the amplitude of sound waves and linear viscosities ν, $\tilde{\nu}$, friction coefficient b [1] in the right-hand side, responsible for the attenuation of sound waves. As for the properties of the solutions, they are completely different. With the Burgers equation system with vanishing coefficients ν, $\tilde{\nu}$, b both strong (shock waves) and weak discontinuities are formed, while solutions of the two-speed hydrodynamics system do not possess such features. However, the scope of applicability of this system is by no means limited to the examples given; such systems arise in many problems, which is what determines its meaning.

The Cauchy problem for a system of equations of Burgers type

Consider for system (1), (2) in the band $\Gamma[0,T] = = \{(t,x): 0 \le t \le T,\ x \in R\}$ a Cauchy problem with the following initial data

$$u\mid_{t=0} = u_0(x),\ \tilde{u}\mid_{t=0} = \tilde{u}_0(x)\ x \in R. \qquad (3)$$

We will be interested in solutions of the Cauchy problem for a system of equations of the Burgers type (1), (2), in contrast to [7; 8] in the class of finite smoothness, namely $u(t,x),\ \tilde{u}(t,x) \in C^{1,2}(\Gamma[0\ T])$ is the class of functions once continuously differentiable in t and twice continuously differentiable in x.

The formula for solving the Cauchy problem for a Burgers-type equation system

Convenient to make the replacement variables Florin-Hopf-Cole

$$\phi = Exp\left[-\frac{1}{2v}\int u\,dx\right],$$

$$\psi = Exp\left[-\frac{1}{2\tilde{v}}\int \tilde{u}\,dx\right].$$

In this case, the functions u and v are expressed in terms of the functions ϕ and ψ by the formulas

$$u = -2v\frac{\phi_x}{\phi},\ \tilde{u} = -2\tilde{v}\frac{\psi_x}{\psi}.$$

In terms of the function ϕ and ψ the system of dynamic equations (1) and (2) takes the form

$$\left(\frac{\phi_t}{\phi}\right)_x = \left(v\frac{\phi_{xx}}{\phi}\right)_x - \frac{\tilde{b}}{v}(\ln\frac{\phi^v}{\psi^{\tilde{v}}}).$$

$$\left(\frac{\psi_t}{\text{ш}}\right)_x = \left(\tilde{v}\frac{\psi_{xx}}{\psi}\right)_x + \frac{b}{\tilde{v}}(\ln\frac{\psi^v}{\psi^{\tilde{v}}}).$$

From here, after integrating over x, we get

$$\phi_t = v\phi_{xx} - \frac{\tilde{b}}{v}\phi(v\ln\phi - \tilde{v}\ln\psi) + C_1(t)\phi, \qquad (4)$$

$$\psi_t = \tilde{v}\psi_{xx} - \frac{b}{v}\psi(v\ln\varphi - \tilde{v}\ln\psi) + C_2(t)\psi, \qquad (5)$$

Where $C_1(t)$ and $C_2(t)$ are arbitrary functions of time.

Solutions of the Cauchy problem for system (4), (5) with data

$$\phi\mid_{t=0} = \phi_0(x),$$

$$\phi_x(t,x) = -\frac{1}{2v}\int_{-\infty}^{\infty} u_0(\xi)G^v(x,\xi,t)Exp[-\frac{1}{2v}\int_0^\xi u_0(\eta)d\eta]\,d\xi + \frac{\tilde{b}}{2v}\int_0^t\int_{-\infty}^{\infty}\frac{x-\xi}{t-\tau}G^v(x,\xi,t-\tau)Exp\left[-\frac{1}{2v}\int_0^\xi \tilde{v}(\tau,\eta)d\eta\right]\int_0^\xi [u(\tau,\eta)-\tilde{u}(\tau,\eta)]\,d\eta\,d\xi\,d\tau,$$

$$\psi_x(t,x) = -\frac{1}{2\tilde{v}}\int_{-\infty}^{\infty} \tilde{u}_0(\xi)G^{\tilde{v}}(x,\xi,t)Exp[-\frac{1}{2\tilde{v}}\int_0^\xi \tilde{u}_0(\eta)d\eta]\,d\xi - \frac{b}{2\tilde{v}}\int_0^t\int_{-\infty}^{\infty}\frac{x-\xi}{t-\tau}G^{\tilde{v}}(x,\xi,t-\tau)Exp\left[-\frac{1}{2\tilde{v}}\int_0^\xi \tilde{v}(\tau,\eta)d\eta\right]\int_0^\xi [(\tau,\eta)-\tilde{u}(\tau,\eta)]\,d\eta\,d\xi\,d\tau,$$

From here, taking into account (9), (10) and from the definition of the fundamental solution of the thermal conductivity operator, we obtain

$$\phi_x(t,x) = -\frac{1}{2v\sqrt{4\pi\tilde{v}t}}\int_{-\infty}^{\infty}\frac{x-\xi}{t}Exp[-\frac{1}{2v}F(u_0,x,\xi,t,)]d\xi - \frac{1}{2v}\int_0^t\int_{-\infty}^{\infty}\frac{1}{\sqrt{4\pi\tilde{v}(t-\tau)}}\frac{x-\xi}{t-\tau}F_2(u,\tilde{u},x,\xi,t,\tau)d\xi\,d\tau, \qquad (11)$$

$$\psi_x(t,x) = -\frac{1}{2\tilde{v}\sqrt{4\pi\tilde{v}t}}\int_{-\infty}^{\infty}\frac{x-\xi}{t}Exp[-\frac{1}{2\tilde{v}}F(\tilde{u}_0,x,\xi,t,)]d\xi - \frac{1}{2\tilde{v}}\int_0^t\int_{-\infty}^{\infty}\frac{1}{\sqrt{4\pi\tilde{v}(t-\tau)}}\frac{x-\xi}{t-\tau}G_2(u,\tilde{u},x,\xi,t,\tau)d\xi\,d\tau. \qquad (12)$$

The following notation is used in formulas (11) and (12):

$$F_2(u,v,\xi,\tau,t,x) = \{C_1(\tau) + \frac{\tilde{b}}{2v}\left[F_1(u,x,\tau,t,\xi) - F_1(v,x,\tau,t,\xi)\right]Exp\left[-\frac{1}{2v}F_1(u,x,\tau,t,\xi)\right],$$

$$\psi\mid_{t=0} = \psi_0(x),$$

have a look

$$\phi(t,x) = \int_{-\infty}^{\infty} G^v(x,\xi,t)\phi_0(\xi)d\xi + \int_0^t\int_{-\infty}^{\infty} G^v(x,0,t-\tau)C_1(\tau)\phi(\xi,\tau)d\xi\,d\tau -$$

$$-\frac{\tilde{b}}{v}\int_0^t\int_{-\infty}^{\infty} G^v(x,\xi,t-\tau)\phi(\xi,\tau)(v\ln\phi(\xi,\tau)-\tilde{v}\ln\psi(\xi,\tau))d\xi\,d\tau \quad (6)$$

$$\psi(t,x) = \int_{-\infty}^{\infty} G^v(x,\xi,t)\psi_0(\xi)d\xi + \int_0^t\int_{-\infty}^{\infty} G^{\tilde{v}}(x,\xi,t-\tau)C_2(\tau)\psi(\xi,\tau)d\xi\,d\tau +$$

$$+\frac{2}{v}\int_0^t\int_{-\infty}^{\infty} G^{\tilde{v}}(x,\xi,t-\tau)\psi(\xi,\tau)(v\ln\phi(\xi,\tau)-\tilde{v}\ln\psi(\xi,\tau))d\xi\,d\tau \quad (7)$$

Where

$$G^a(x,\xi,t) = \frac{1}{\sqrt{4\pi at}}e^{-\frac{(x-\xi)^2}{4at}}$$

there is a fundamental solution to the one-dimensional heat equation.

Further suppose, as in [9], that the Cauchy data $u_0(x)$, $u_0(x)$ satisfy the following conditions

$$\int_0^x u_x(\xi)d\xi = o(x^2)\ \int_0^x \tilde{u}_0(\xi)d\xi = o(x^2), \qquad (8)$$

For large $|x|$.

Introduced the following functions

$$F(u,x,y,t) = \frac{(x-y)^2}{2t} + \int_{-\infty}^y u(t,\eta)d\eta. \qquad (9)$$

$$F(u,x,y,t,\tau) = \frac{(x-y)^2}{2(t-Å)} + \int_{-\infty}^y u(\tau,\eta)d\eta. \qquad (10)$$

Note that the following equalities are true.

$$F(u_0,x,y,t) - F(\tilde{u}_0,x,y,t) = \int_{-\infty}^y [u_0(\eta)-\tilde{u}_0(\eta)]d\eta.$$

$$F(u,x,y,t,\tau) - F(\tilde{u},x,y,t,\tau) = \int_{-\infty}^y u(\tau,\eta)-\tilde{u}(\tau,\eta)]d\eta.$$

For any x,y,t,τ.

Differentiating both sides of equality (6) and (7) with respect to the variable x. after simple transformations we get

$$G_2\left(u,v,\xi,\tau,t,x\right)=\{C_2\left(\tau\right)-\frac{b}{2\tilde{v}}\Big[F_1\left(u,x,\tau,t,\xi\right)-F_1\left(v,x,\tau,t,\xi\right)\Big]Exp\Big[-\frac{1}{2\tilde{v}}F_1\left(u,x,\tau,t,\xi\right)\Big].$$

Theorem. Let $u_0\left(x\right)$, $\tilde{u}_0\left(x\right)$, $\in C2(R)\cap W_2^1\left(R\right)$ and satisfy relation (10), where $W_2^1\left(R\right)$ is the Sobolev space.

Then to solve the Cauchy problem (1) – (3) Spread Formulas

$$u\left(x,t\right)=\dfrac{\int_{-\infty}^{\infty}\dfrac{x-\xi}{t}Exp[-\dfrac{1}{2v}F\left(u_{0},x,\xi,t,\right)]d\xi+\int_{0}^{t}\int_{-\infty}^{\infty}\dfrac{\sqrt{t}}{\sqrt{(t-\tau)}}\dfrac{x-\xi}{t-\tau}F_2\left(u,\tilde{u},x,\xi,t,\tau\right)d\xi d\tau}{\int_{-\infty}^{\infty}Exp[-\dfrac{1}{2v}F\left(u_{0},x,\xi,t,\right)]d\xi+\int_{0}^{t}\int_{-\infty}^{\infty}\dfrac{\sqrt{t}}{\sqrt{(t-\tau)}}F_2\left(u,\tilde{u},x,\xi,t,\tau\right)d\xi d\tau},$$

$$\tilde{u}\left(x,t\right)=\dfrac{\int_{-\infty}^{\infty}\dfrac{x-\mathrm{o}}{t}Exp[-\dfrac{1}{2\tilde{v}}F\left(\tilde{v}_{0},x,\xi,t,\right)]d\xi+\int_{0}^{t}\int_{-\infty}^{\infty}\dfrac{\sqrt{t}}{\sqrt{(t-\tau)}}\dfrac{x-\xi}{t-\tau}G_2\left(u,\tilde{u},x,\xi,t,\tau\right)d\xi d\tau}{\int_{-\infty}^{\infty}Exp[-\dfrac{1}{2\tilde{v}}F\left(\tilde{v}_{0},x,\xi,t,\right)]d\xi+\int_{0}^{t}\int_{-\infty}^{\infty}\dfrac{\sqrt{t}}{\sqrt{(t-\tau)}}G_2\left(u,\tilde{u},x,\xi,t,\tau\right)d\xi d\tau}.$$

The investigation. Let $u_0\left(x\right)$, $\tilde{u}_0\left(x\right)$ satisfy the conditions of the theorem.

Then for solving the Cauchy problem (1) – (3) the following formulas are valid

$$u\left(x,t\right)=\dfrac{\int_{-\infty}^{\infty}\dfrac{x-\xi}{t}Exp[-\dfrac{1}{2v}F\left(u_{0},x,\xi,t,\right)]d\xi}{\int_{-\infty}^{\infty}Exp[-\dfrac{1}{2v}F\left(u_{0},x,\xi,t,\right)]d\xi}-\dfrac{\int_{0}^{t}\int_{-\infty}^{\infty}\sqrt{1+\dfrac{\tau}{t-\varphi}}\left(u\left(x,t\right)-\dfrac{x-\xi}{t-\tau}\right)F_2\left(u,\tilde{u},x,\xi,t,\tau\right)d\xi d\tau}{\int_{-\infty}^{\infty}Exp[-\dfrac{1}{2v}F\left(u_{0},x,\xi,t,\right)]d\xi},\qquad(13)$$

$$\tilde{u}\left(x,t\right)=\dfrac{\int_{-\infty}^{\infty}\dfrac{x-\xi}{t}Exp[-\dfrac{1}{2\tilde{v}}F\left(\tilde{u}_{0},x,\xi,t,\right)]d\xi}{\int_{-\infty}^{\infty}Exp[-\dfrac{1}{2v}F\left(u_{0},x,\xi,t,\right)]d\xi}-\dfrac{\int_{0}^{t}\int_{-\infty}^{\infty}\sqrt{1+\dfrac{\tau}{t-\tau}}\left(u\left(x,t\right)-\dfrac{x-\xi}{t-\tau}\right)G_2\left(u,\tilde{u},x,\xi,t,\tau\right)d\xi d\tau}{\int_{-\infty}^{\infty}Exp[-\dfrac{1}{2\tilde{v}}F\left(\tilde{u}_{0},x,\xi,t,\right)]d\xi}.\qquad(14)$$

Comment. When the friction coefficient b disappears (in the absence of energy dissipation due to the friction coefficient and $C_k\left(t\right)=0\left(k=1,2\right)$ solution (13), (14) goes to the well-known solution of the Cauchy problem for the Burgers equation [9].

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Section 5. Medical sciences

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PERCUTANEOUS LIVER BIOPSY GUIDED WITH ULTRASONOGRAPHY FOR DIFFERENTIAL DIAGNOSIS OF LIVER TUMOR LESIONS

Abstract. Widespread diffusion of ultrasound in medical practice has improved percutaneous biopsy technique for liver tumor lesions diagnosis. The aim of our study was to estimate the efficiency of percutaneous liver biopsy guided with ultrasonography in differential diagnosis of focal liver lesions suspected for tumor ones. The study has been performed between 2015–2017. This study includes data on 156 patients with focal liver lesions suspected for tumor lesion. The patient's age varied from 51 to 69 years. The procedure has been performed with 18G needles with automatic gun PRO-MAG® in out-patients and in-patient conditions. In 147 cases (94.1%) histopathological reports were obtained after percutaneous liver biopsy guided with ultrasonography. In 10 cases (7.0%) the routine pathological examination was supplemented with immunohistochemistry for accurate diagnosis. As a conclusion, the authors consider that the percutaneous liver biopsy guided with ultrasonography is safe and a highly effective diagnostic method for histopathologic confirmation of the diagnosis in patients with liver tumor lesions.

Keywords: tumor liver lesions, percutaneous liver biopsy, histopathology diagnosis confirmation.

Widespread diffusion of ultrasound in medical practice has improved percutaneous biopsy technique for liver tumor lesions diagnosis. The aim of our study was to estimate the efficiency of percutaneous liver biopsy guided with ultrasonography in differential diagnosis of focal liver lesions suspected for tumor ones. The study has been performed between 2015–2017. This study includes data on 156 patients with focal liver lesions suspected for tumor lesion. The patient's age varied from 51 to 69 years. The procedure has been performed with 18G needles with automatic gun PRO-MAG® in out-patients and in-patient conditions. In 147 cases (94.1%) histopathological reports were obtained after percutaneous liver biopsy guided with ultrasonography. In 10 cases (7.0%) the routine pathological examination was supplemented with immuno-histochemistry for accurate diagnosis. As a conclusion, the authors consider that the percutaneous liver biopsy guided with ultrasonography is safe and a highly effective diagnostic method for histopathologic confirmation of the diagnosis in patients with liver tumor lesions.

Background. Liver biopsy remains the standart procedure in the evaluation of the origin and extend of liver's diseases. In the late 1950s Menghini developed a one second aspiration liver biopsy technique and since that time the procedure has been widely used [7].

The introduction and widespread diffusion of ultrasound in medical practice has improved percutaneous biopsy technique [11].

Liver biopsy is generally safe and it is a powerful clinical tool for liver diseases diagnosis, especially in case of suspected hepatic neoplasm.

The procedure is undertaken on an outpatient basis [1]. The ultrasound guided liver biopsies yielded higher-quality specimens that other methods and allow to obtain the tissues not only for classic histopathological examination, but also for

immunohistochemistry method. The immunohistochemistry method could differentiate liver tumor lesions and give possibilities to establish an accurate diagnosis and elaborate an adequate treatment [8; 13].

The most common reason for liver biopsy is focal liver lesions. Hepatocellular carcinoma is a primary malignancy of the liver that needs histopathological confirmation [3; 6; 8]. About 90% of liver biopsies are perfomed for liver metastases [12; 13]. Tomographic characteristics of metastatic liver lesions are nonspecific and biopsy specimens are required for diagnostic establishing [9; 10].

Focal nodular hyperplasia is the second most common lesion of the liver, surpassed in prevalence only by hepatic hemangioma [9; 10].

In medical literature a variety of approaches for obtaining liver tissue specimens have been discussed. Authors [2; 4; 8] conclude that real-time ultrasound guidance is convincing and clinically beneficial, but the procedure have to be performed by specialists, experienced in percutaneous liver biopsies guided with ultrasonography.

The method's sensitivity according to the literature data is about 80% with specificity about 90% [12].

Contraindications for percutaneous liver biopsy are few. Suspection of hemangioma or echinococcal cyst, ascities, thrombocytopenia and hypoprothrombinemia are considered contraindications for this procedure.

Study's aim. The aim of our study was to estimate the efficiency of the percutaneous liver biopsy guided with ultrasonography in differential diagnosis of suspected focal liver lesions.

Materials and methods. The study has been performed between 2015–2017. This study includes data on 156 patients with focal liver lesions suspected for tumors. There were 116 male and 40 women included in the study (F: M=1:2.9). The age of the patients varied from 51 to 69 years.

The focal lesions have been revealed beforehand by ultrasonography, computed tomography or MRI. The patients have been examined endoscopicaly (esophagogastroduodenoscopy, colonoscopy) for excluding primary affectations of other organs. In 54 cases (35%) beforehand investigations presented solitary focal liver lesion and in the rest of the cases multiple liver lesions have been determined.

The percutaneous liver biopsy guided with ultrasonography has been performed with 18G needle with automatic gun PRO-MAG®. In out-patients condition the procedure was performed on 115 patients (73.7%) and in 41 cases the procedure has been done on hospitalized patients (26.3%). In the majority of cases the S6 segment of the liver was involved (75%).

According to undertaking examinations the primary liver lesions have been suspected in 97 cases (62.2%) and metastatic lesions – in 59 (37.8%).

Results and discussion. The percutaneous liver biopsy guided with ultrasonography was successful in 147 cases (94.1%), allowing histopathologic confirmation of tumor lesions. In 9 cases (5.9%) the percutaneous liver biopsy guided with ultrasonography did not confirm the tumor lesion.

From 147 patients with histopathological confirmation of liver tumor lesions in 10 cases (7.0%) additional immunohistochemistry method was required to stablish a correct diagnosis. Immunohistochemistry allowed us to set the diagnostic of non-Hodjkin lymphoma with primary liver lesion in 5 cases, (the lesions being positive to CD-20), 4 cases were – metastasis of clear cell renal adenocarcinoma and one case – liver adenomas.

The rest of patients with histopathological confirmation of tumor liver lesions have demonstrated hepatocellular carcinoma in 65 cases (44.2%), adenocarcinoma in 48 cases (32.6%), cholangiocarcinoma – in 6 cases (4.1%) and metastatic lung microcellular carcinoma in 6 cases (4.1%).

Preoperative sedation was used in all patients who undergone percutaneous liver biopsy guided with ultrasonography. The procedure has been performed under local anesthesia.

The complications of percutaneous liver biopsy guided with ultrasonography in our study have been registered in 17.3% of patients. Transient pain was recorded in 26 patients (16.7%) and in one case subcapsular hematoma has been observed (0.6%). The patient was under observation and ultrasonographic monitoring during 5 post-procedural days and had no necessity of active intervention.

The obtained results of the study permitted us to conclude that:

1. The percutaneous liver biopsy guided with ultrasonography is safe and a highly effective diagnostic method for histopathologic confirmation of the diagnosis in patients with liver tumor lesions. According to our study's data it was possible to confirm diagnosis in 94.1% of cases.

2. The immunohistochemistry method is the main tool for differential diagnosis of metastatic tumors with unknown primary origin or in cases of rare tumor affection.

3. The correct diagnosis in patients with suspected tumoral liver lesions is of great importance for elaborating adequate further treatment.

4. The risk of complications in the percutaneous liver biopsy guided with ultrasonography is minimal: in our study only in one case has been registered a subcapsular liver hematoma without necessity of active intervention.

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LIVER CIRRHOSIS IN CHILDREN: ETIOLOGY, CLINICAL ASPECTS, AND PROGRESSION MARKERS

Abstract. Examination of 202 sick children in the age from 7 to 15 provided definition of etiological structure of LC, where viral infection (73.3%) prevailed with a greater part of hepatotropic viruses (90.6%), the accent among which was put on B+C+D(32.2%), B+D(21.4%) and B+C(16.1%)mixed infections. Mixed infection is considered to be a predictor of the pathology progression, especially in case of accretion with autoimmune hepatitis. In other cases LC is formed as an outcome of autoimmune (4.9%), hereditary "exchange" (6.9%), and combined (9.9%) hepatitis. Peculiarities of clinical progress and development of complications were determined dependently on the etiology. Self-descriptiveness of PINP and PICP terminal peptides was determined in the progression of liver cirrhosis in children.

Keywords: liver cirrhosis, etiology, clinical symptoms, complications, markers of fibrosis, children.

Liver cirrhosis (LC) is a chronic polyetiological damage of liver, characterized by disorder of hepatic architectonics, formation of fibrous septa, nodular regeneration, and growth of connective tissue, leading to hepatic failure. LC predetermines unfavorable vital prognosis and high lethality rate, especially among children [2; 5]. Real prevalence of LC is not studied well. It is obvious that in more than 50% of patients manifestation of the disease occurs at the decompensation stage, testifying unfavorable prognosis of the pathology and decreasing survival rate among the patients [1; 10; 11]. In 70% cases the only method of treatment is considered to be liver transplantation, the performance of which is quite limited [12; 13]. According to WHO among the reasons of death LC takes the eighth place, while in economically developed countries of the world it is included to the number of six basic dangerous diseases [7; 8]. At the same time, taking into account that LC can be a terminal stage of the development of both progressing and latent forms of chronic hepatic pathologies, and in 70–90% cases of liver cirrhosis there is risk of liver cancer development [14], it is not difficult to imagine the colossal economical and social damage caused by this pathology to society and states. Increase of the number of etiological factors in the progression of the disease predetermines the necessity to study nodular aspects of this pathology with a perspective of further development of differential approaches in the performance of diagnostic and therapeutic activities.

The objective: To determine the peculiarities of etiological structure, clinical progress of LC, and self-descriptiveness of serum tests for liver fibrosis in children.

Materials and methods. 202 children with LC diagnosis in the age from 7 to 15 years old were examined while they had "D" registration at the RSSPMC of Pediatrics of the MH of the RUz. 57.9% of them were boys, and 42.1% girls. The term of the disease was 5.3±0.2 years. According to Child-Pugh, dependently on the severity of LC the patients were classified to: class A – 35.6%, class B – 34.2%, class C – 30.2% [7]. LC diagnosis was based on the data of history, clinical, biochemical (ALT, AST, total bilirubin\fractions, alkali phosphotase, γ-glutamyl transferase (GGTP), thymol test, γ-globulin, prothrombin time and platelets, creatinine), and instrumental tests (US and elastometering on HD3Toshiba scanner with Doppler of portal system vessels; MRI, EGDS). PCR and EIA methods were used to verify HBV, HCV, HDV (with Bio-Red reactants, USA); Herpesviridae viruses such

as Herpes Simplex Virus (HSV), cytomegalovirus (CMV), Epstein-Barr Virus (EBV), Toxoplasma gondi, Chlamydia trachomatis, Ureaplazma urealiticum, Micoplazma; definition of auto antibodies ANA, SMA, anti-LKM-1 (Orgentec reactants, Germany), terminal N-propeptides (PINP) and C-teplopeptides (PICP) of the I type collagen in blood serum (Cloud-Clone Corporation reactants, USA), ceruloplasmin in urine (AssayPro reactants, USA). Statistical processing was performed by means of variation statistics using Student's t-criterion on special Excel-2012 software.
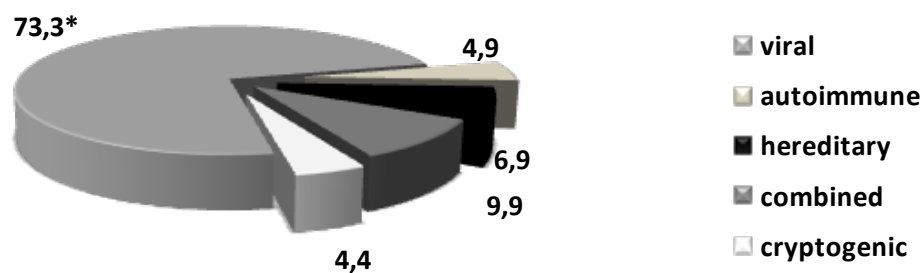
Results and discussion. The study of the etiological structure of LC (Fig.1) provided the definition of the prevailing of viral persistence (73.3%), 90.6% of which was due to hepatotropic viruses ($p < 0.001$) with the accent of mixed infection prevalence (HBV+HCV+HDV-35.5%, HBV+HDV-24.7% and HBV+HCV-17.7%). In the rest cases (9.4%) we detected TORCH-infections with dominant CMV-infection (78.5%), among which there were 42.9% cases of CMV combined with Herpes virus. Rarely ($p < 0.001$) we revealed EBV(14.3%) and Toxoplasma (7.1%).

Figure 1. Etiological structure of liver cirrhosis in the examined children (%)
* – reliability of the difference to the studied groups ($p < 0.001$)

The part of LC in the outcome of autoimmune hepatitis was 4.9% with prevailing of the I type (70%), where there was characteristic reveal of high titers (1:43–1:67) of ANA (85.7%) and SMA (57.2%) markers. One third of the children was diagnosed with the II type with anti-LKM-1 titers in 1:53–1:88 range. LC with hereditary character was revealed in 6.9% cases with diseases such as Wilson's (42.8%), glycogenosis (28.6%), sclerozing cholangitis (14.3%), and hemochromatosis (14.3%). From the total number of children 9.9% of LC cases had a combined etiology, where together with 20% cases of autoimmune hepatitis, 35% cases of Wilson's disease, and 45% of glycogenosis there was viral infection (HBV- 60%, HCV- 30% and HDV-10%). In 4.4% cases, due to some reasons, the etiology was not determined.

History analysis of the tempo of the disease progression dependent on the etiology (Fig.2), showed that the most early formation of LC at the moment of infection was noted among the patients with mixed infection (4.6 ± 0.3 years), especially in the cases of triple B+C+D infection (3.2 ± 0.2 years), autoimmune etiology (3.4 ± 0.5 year) and combined forms with HBV/HCV or HDV infections (3.0 ± 0.3 years). In cases of viral mono infections the speed of progression was average 7.9 ± 0.3 years for HBV infection and 9.9 ± 0.5 years for HCV. Development of LC as the outcome of hereditary syndromes took average 6.7 ± 0.3 years. When there was overlapping with viral infection the terms of LC development shortened up to 4.9 ± 0.3 years. Thus, a significant factor in the progression of the disease was the number of viruses and their long-lasting replication.

Assessment of LC severity according to Child-Pugh scale confirmed the importance of viral mixed infection in the progression of the pathology, where the majority of the children had clinical decompensation stage (class C), especially with HBV+HDV and triple infection (50% and 70.8%, respectively, $p < 0.05$). In contrast, most of the children with mono infection had compensation stage of LC (class A), corresponding to 66.6% in case of HBV and 80% in case of HCV infection ($p < 0.01$). The same pattern was observed with TORCH infections, where 71.4% had LC class A. LC analysis in the outcome of autoimmune process demonstrated, that the most severe forms were registered in cases of the II type (66.6%, $p < 0.05$). LC conditioned by hereditary pathologies of substance exchange, as well as combined etiology, was characterized by sub-compensation progressing (class B) in more than a half of the children 57.2% and 55% ($p < 0.05$), respectively. Compensated progression was noted only in children with LC as the outcome of Wilson's disease with HCV infection (60%) and glycogenosis with HCV(33.3%), and HBV infection (16.6%). The most severe progress of LC was characteristic for overlapping of HDV with autoimmune process (100%, $p < 0.001$). Independently of the etiology, LC was characterized by a wide range of clinical syndromes, but reliable differences were achieved only for individual parameters. So, LC as an outcome of autoimmune hepatitis was characterized by ($p < 0.05–0.01$) prevailing of cholestatic syndrome including icteric skin, sclera and itching (90%), and long-lasting fever (70%). At the same time, LC as an outcome of genetically determined disorders of exchange processes was char-

acterized by prevalence of enlargement (above 5 cm) of liver (85.7%) and dyspeptic syndrome including nausea, vomiting, stomachache, and flatulence (100%, p < 0.05–0.001). In case of viral etiology of LC it is possible to isolate hemorrhagic syndrome in the form of episodic nasal, gingival, esophageal bleedings and hemorrhages (83.8%), and less in case of autoimmune LC (70%, p < 0.01 to the III group of children).

Frequent complications of LC, deteriorating the progression and prognosis of the disease, were hepatic encephalopathy (HE), bleeding from varicose widened veins (BVWV) with development of hepatic coma, hepatorenal syndrome (HRS) (HRS), and joining of bacterial infection (BI) [9; 15; 16]. The frequency of the listed complications differed among the examined children dependently on the etiology (Tab.1). Hepatic-cellular failure with the development of HE the most often was formed in the patients with autoimmune (80%) and exchange LC (78.5%, p < 0.001). in cases of viral etiol-

ogy of LC only in 34.8% of the children, among which in 18.7% of the cases HE did not develop as a result of portal failure. BVWV of esophagus and stomach occurred in the majority of the patients with autoimmune (90%, p < 0.01) and viral (69.7%) LC; in 42.8% cases in children with hereditary LC. Mostly these were class B and class C patients. It occurred only in 8% cases of class A LC children with viral etiology. Endocopically determined stage of esophageal nodes correlated with sonographically determined one for portal hypertension, while the probability of bleeding was high in case of portal hypertension III stage and III–IV stages of esophageal VWV. Besides the size of VWV, the risk of bleeding (2–3 folds) depended on the presence of red color sings and severity of the disease. After bleeding the Child-Pugh score reliably increased (p < 0.05). Recurrent bleedings within a year were observed in 45.2% of class B and class C patients.

Table 1. – Development of LC complications dependently on the etiology

Value	LC etiology			P_{1-2}	P_{1-3}	P_{2-3}
	Viral (I)	Autoimmune (II)	Hereditary (III)			
HE	34.8± 3.9	80.0±12.6	78.5±10.9	< 0.001	< 0.001	> 0.05
BVWV	69.7±3.7	90.0±9.4	42.8±13.2	< 0.05	> 0.05	< 0.001
HRS	7.3±2.1	40.0±15.4	14.2±9.3	< 0.05	> 0.05	> 0.05
BI	67.7±3.8	70.0±14.4	57.1±13.2	> 0.05	> 0.05	> 0.05

P – reliability of the difference between the studied groups.

Among the other complications, HRS was revealed in 12.8% cases, with a greater frequency than in cases of autoimmune LC, especially when there was overlapping with hepatotropic viruses (70%, p < 0.05). Frequency of BI (pneumonia, pleuritis, myocarditis, etc.) did not depend on the etiology. The most perceptive for bacterial infections were the patients with LC class B (77.1%), especially class C (97%).

It is known that, various collagens (type I, III, IV, V, VI) are considered to be serum markers of tissue fibrosis, among which in case of liver pathology collagen type I and IV deserve a special attention as components of basal membrane of hepatocytes. While the level of collagen type IV reflects current hepatic-cellular damages at the initial stages and the processes of hepatic lobular structure regeneration [6], at the late stages of the pathological process in liver there is accumulation of ECM febrile type collagen, particularly type I, which participates in

the formation of bridge-like fibrosis and cirrhosis [3]. Then, the diagnostic criteria of fibrogenesis are PINP, and criteria of fibrolysis are PICP [1; 4]. The study of these markers revealed that (tab. 2) independently of the etiology of LC the amount of PINP reliably increased compared to the control values (p < 0.001), with greater expression in children with viral genesis of LC, indicating more intensive process of fibrogenesis in liver. At the same time, amount of other biomarker PICP did not exceed control values (p > 0.05). The exclusion were children with LC with viral genesis, where the level reliably decreased compared to the control one (p < 0.05), indicating prevailing of fibrogenesis over fibrolysis and, as a whole, progression of pathological process in liver. In the children of the other groups functional activity of these systems was in tension, confirming partial preserving of compensatory mechanisms of extra cellular matrix.

Table 2. – Values of terminal peptides of collage type I in children with LC with various etiologies

Collages type I values	LC etiology			Control
	Viral (I)	Autoimmune (II)	Hereditary (III)	
PINP, pg/ml	4.016 ± 0.28* [a]	2.961 ± 0.44*	2.103 ± 0.57* [b]	1.265 ± 0.26
PICP, pg/ml	0.291 ± 0.14*	0.477 ± 0.18	0.394 ± 0.10	0.767 ± 0.43

*Difference reliability * – to control; [a] – I and II; [b] – I and III groups (p < 0.001)*

It means that these fibrosis markers can be considered to be indicators of compensation and progression of pathological (cirrhotic) process in liver.

Conclusions

1. In the etiological structure of LC there is prevailing of viral infection (73.3%), where the greater part is taken by hepatotropic viruses (90.6%) with an accent of mixed infection by B+C+D (32.2%), B+D (214%) and B+C infections (16.1%). In the rest cases LC is formed as an outcome of autoimmune (4.9%), hereditary exchange (6.9%) and combined (9.9%) hepatitis.

2. The severity of the LC progression with viral genesis in children depends on the kind of infection – the more persisting viruses are there, the more severe the pathology proceeds – especially in cases of overlapping by HDV where the frequency of class C LC clinical stages was revealed in the most cases (60%).

Peculiarities of clinical progression of LC in children dependently on the etiology were stage prevailing of hemorrhagic syndrome and splenomegaly as an outcome of viral hepatitis, cholestatic syndrome and long-lasting fever as an outcome of autoimmune one, and dyspeptic syndrome and hepatomegaly as an outcome of hereditary exchange hepatitis.

3. Various amounts of N-terminal peptides and C-terminal teplopeptides of collage type I in children with LC with different etiology reflect not only the degree of hepatic cellular damage, but also can serve to be markers of the compensation and the pathology progression degree. The most expressed destructive alterations were characteristic for LC with viral genesis.

4. Frequency and expression of nosologic complications of LC in children were determined by etiological factors. The most frequent complications with the layout of all kinds of manifestations were characteristic for LC with autoimmune genesis. LC with viral genesis was characterized by the development of BVWV, and hereditary one by development of HE. Development of complications deteriorated progression and prognosis of LC in children requiring the search for new prevention measures and effective therapeutic methods.

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CURRENT APPROACHES AND RESULTS OF PALLIATIVE SURGICAL TREATMENT OF BONE MALIGNANCIES ON THE BASIS OF A GENERAL HOSPITAL

Abstract. A retrospective analysis of case histories of patients who applied for tumors of the bone system at the Chita Clinical Hospital № 1 and case-records of dispensary observation of patients of the Regional Oncological Dispensary (RCD) of the Zabaikalsky Krai was performed. The following data were evaluated: sex, age, structure of tumors, effectiveness of palliative treatment and long-term effects of this treatment.

Keywords: palliative treatment, osteogenic sarcoma, excochleation, autoplasty.

Bone tumors are referred to as malignant or benign degeneration of bone or cartilage tissue. Primary bone malignancies occur rather rare and account for about 0.2–1% of the total number of tumors. Secondary (metastatic) bone tumors turn to be a common complication of other malignancies.

Most tumors are localized in the tubular bones (in 40–70% of cases). Over the past 20 years thanks to recent advances in chemotherapy and emergency of new drugs, improvement and advances of radiotherapy techniques, significant progress has been made in the treatment of this complex group of patients. This contributed to the development of surgical approaches to the treatment of primary tumors and bone metastases. Bone cancer regardless of its type and location always requires surgical treatment. Current organ-preserving operations allow not only saving patient's limb but can also contribute to completely cancer curing even at the advanced stages of the disease. In the surgical treatment of malignant bone tumors, the following range of basic rules should be followed: radical character of treatment, ablasticity and possible preservation of the limb without violating its function.

Most surgical interventions applied in the treatment of bone tumors can be divided into two large groups: 1. Preservation or savings operations: a) excochleation – scraping or curettage of the tumor; b) regional removal of the tumor block; c) segmental resection – wide removal of the tumor block; d) resection of one of the articular sections; d) resection of the entire joint. 2. Destructive operations: a) amputation; b) exarticulation.

Current approaches to the treatment of primary and metastatic bone tumors are centered in the use of both combined and complex methods. The main objectives of surgical treatment turn to be the removal of tumors and metastases, reducing the severity or complete relief of pain, preventing the development of a pathological fracture, restoring the integrity of the bone in case of a pathological fracture, restoring the function of the affected limb, and, consequently, the resumption of patient self-care and improving the quality of his life in the shortest possible time.

Nowadays, the wide spread of cancer requires that each doctor of any specialty should possess a skill of cancer alertness. A high percentage of late detection of malignant neoplasms in the early stages testifies to the fact that the first symptoms, signs and conditions were not recognized at the stage of tumor formation. These factors necessitate the training of onco-orthopedists to provide specialized care on the basis of the oncological dispensary.

Objective: To evaluate the effectiveness of palliative surgical treatment of malignant tumors in patients of the trauma Department of a General Hospital.

Materials and methods: A retrospective analysis of case histories of patients applied for tumors of the bone system at the Chita Clinical Hospital № 1 and case-records of dispensary observation of patients of the Regional Oncological Dispensary (RCD) of the Zabaikalsky Krai was performed. The following data were evaluated: sex, age, structure of tumors, effectiveness of palliative treatment and long-term effects of this treatment. The results of the analysis were processed with Statistica 10 software using student and Mann-Whitney criteria.

Results: The review of the analysis performed showed that for the period of 2015 up to 2018 the total number of patients with bone tumors amounted 24 subjects, being 42% of them male and 58% female patients.

Figure 1. Age Group

	Основной	Основной	Основной	Основной
■ male	80%	Основной	063%	029%
■ female	20%	100%	038%	072%

Figure 2. Sex Prevalence

	Основной	Основной	Основной	Основной
■ Primary	80%	50%	063%	029%
■ Secondary	20%	50%	038%	072%
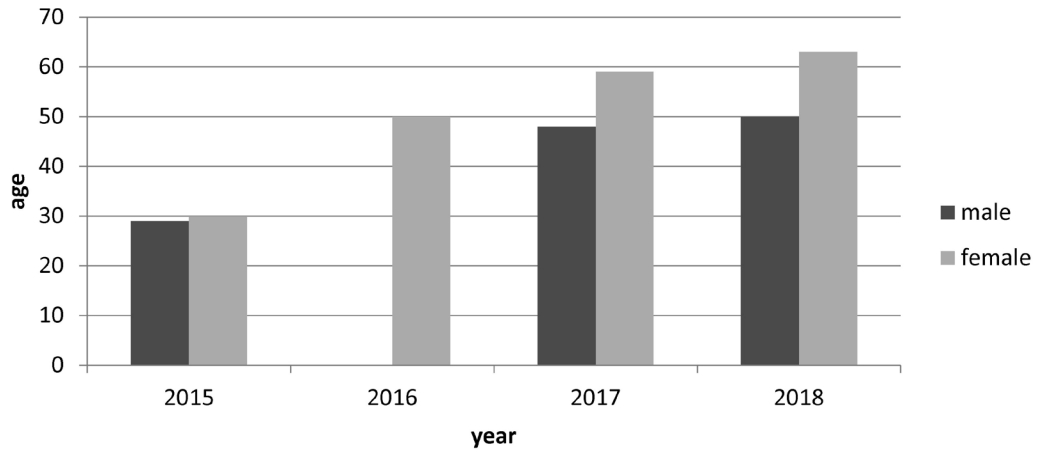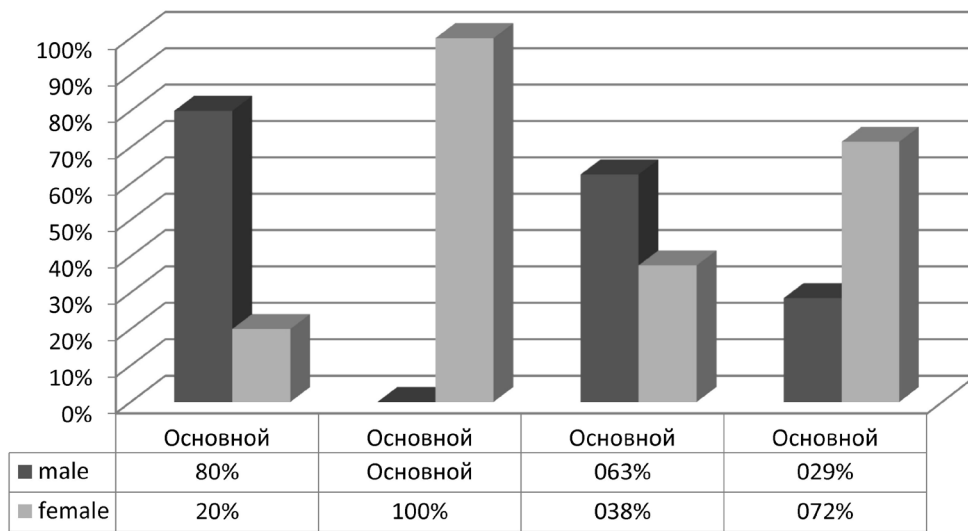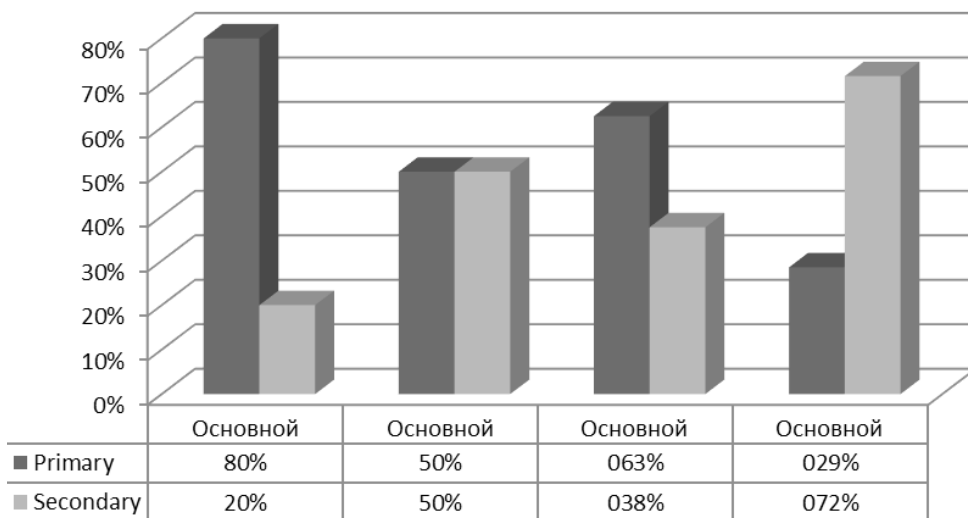
Figure 3. Structure of Tumors

The percentage of primary detected tumors in 2015 amounted 80%, male subjects aged 29±1.3 years being 100% of the identified cases. Primary detected tumors in 2016 amounted 50%, 100% of them being female subjects aged 50±1.1. For 2017 primary tumors accounted for 62.5%, 40%of them being male and 60% female subjects. In 2018, the percentage of detected primary tumors amounted 28, 5%, 100% of them being male subjects.

The analysis of metastasis confirmed that neoplasms of the bone system were most commonly detected in case of the tumors in the mammary gland – 62%, in the ovaries – 7.33%, and kidneys – 15%.
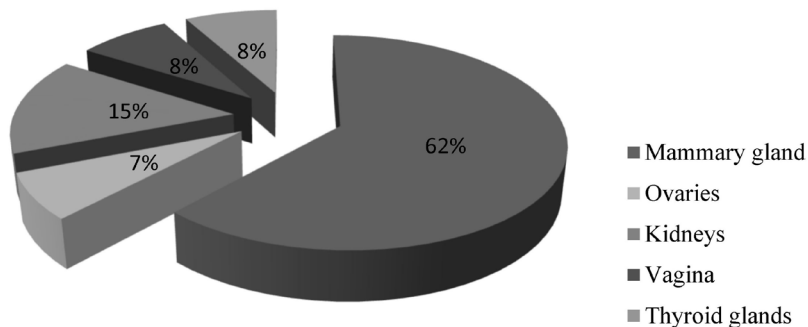
Figure 4. Metastasis Primary Focus

Patients of all groups under study were subjected to a standard set of examinations. Evaluating methods of palliative treatment of 24 studied patients showed that 11 excochleations were performed, 9 of which being applied in the primary tumors, and 2 being performed in secondary (metastatic) tumors; as well as 11 plastics, 9 of which with cement replacement, 2 – autoplasty.
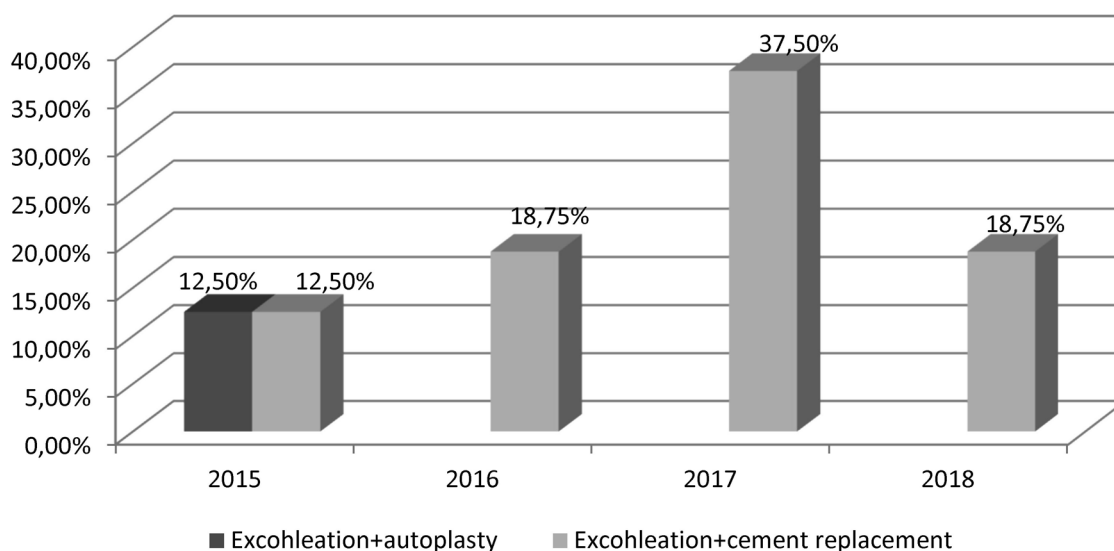
Figure 5. Palliative methoods of treatment

The survey revealed that the surgical treatment significantly improved the quality of life of all the patients studied: the reduction of pain syndrome was observed in 17, and the possibility of maintaining limb function – in 9 patients.

Value (Figure 6.)

100% – patients satisfied with the quality of life after treatment;

70% – patients with the reduced pain syndrome;

37% – patients with the maintained limb function.
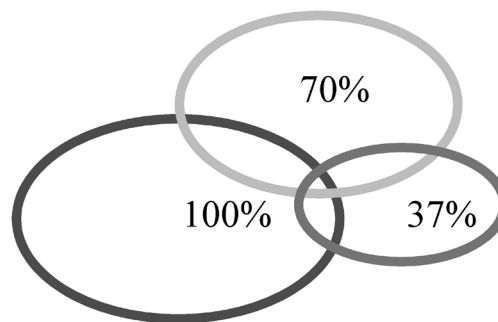
Figure 6. Satisfaction of the patients

Conclusion:

1. The number of patients with tumors of the musculo-skeletal system applying for medical care to a General Hospital is increasing every year.

2. Surgical palliative treatment of neoplasms of the bone system is an effective technique of preserving the function of the operated limb reducing pain or eliminating it altogether.

3. Palliative care can significantly increase the patient's life expectancy and improve its quality.

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VESTIBULAR VERTIGO IN EMERGENCY NEUROLOGY AND CERVICAL OSTEOCHONDROSIS

Abstract. The paper deals with the study of reasons for urgent neurological hospitalization for vestibular vertigo and a role of cervical osteochondrosis in the development of vestibular disorders. A subgroup of 109 patients (84 women and 25 men) who had isolated vestibular vertigo (without other symptoms of nervous system lesion) was identified among 230 patients with acute systemic dizziness, nausea, vomiting with the referral diagnosis of "cervical osteochondrosis, vertebral artery syndrome", or "acute vertebrobasilar circulatory attack". The patients underwent a standard neurological examination, brain magnetic resonance imaging, an otorhinolaryngologist's advice with otoscopy, cervical spine X-ray in two interperpendicular (frontal and lateral) projections, and functional spondylography (flexion, extension). The "cerebral" level of vestibular disorders could be excluded in most (82.3%) patients. The latter had acute peripheral vestibular pathology that required cerebral stroke or hemorrhage to be ruled out according to clinical data in most cases.

Keywords: vestibular vertigo, cervical osteochondrosis, acute peripheral vestibulopathy, vertebral artery syndrome.

Dizziness often occurs at different ages, depriving a person of the ability to maintain balance. Dizziness is the cause of falls and injuries, it reduces the adaptive capacity of a person, limits the ability to receive education in the whole number of professions, has a psychotraumatic effect, worsens the quality of life, and with the recurrent nature of acute rotational dizziness leads to disability [2; 3]. The multiplicity of causes causing dizziness makes it difficult to find a clear nosological form in this pathology. Thus, at the outpatient stage, the final diagnosis of the disease manifested by dizziness is established only in 20% of cases [4]. Mnogobrojne – headed nature of the possible lesions of the vestibular Ana – lysator creates difficulties in the differential diagnosis of this disease in terms of neurological Stazione – RA, where in our country are traditionally sent the pain – and with the attack of acute vestibular (rotational) vertigo.

In our opinion, in recent years there has been a tendency to increase the number of patients hospitalized in neurological hospitals with acute "vestigial" crisis, the only manifestation of which is rotational dizziness. Many patients – tov surveyed in neurological hospitals, erroneously diagnosed "acute violation of brain, the blood circulation in vertebrobasilar system" [3]. One of the most common causes of dizziness is still considered cervical osteochondrosis, which leads to a negative impact on the vertebral arteries and blood supply in the vertebrobasilar system. The present study was conducted to determine the causes of emergency hospitalization of patients in a neurological hospital in connection with vestibular headache and the role of cervical osteochondrosis in the development of acute vestibular disorders.

Material and methods of research

All patients were selected in the clinic № 1 of Samarkand medical Institute at the Department of neurology for the period from 2012 to 2018 "cervical degenerative disc disease, vertebral artery syndrome", acute circulatory disorders in the vertebrobasilar basin", which accounted for 13% in the structure of emergency hospitalization.

Out of 230 patients, 18(7.7%) were clinically diagnosed with heart attacks in the dorsolateral medulla oblongata (Wallenberg-Zakharchenko syndrome), infarcts in the anterior and inferior posterior arteries of the cerebellum.

In the remaining 212(82.3%) patients, no data were found for acute cerebrovascular accident, while in all elderly patients with stroke risk factors, the diagnosis of stroke was excluded both from clinical data and from the results of magnetic resonance imaging (MRI).

From this group 109 patients (84 women and 25 men) who had isolated vestibular vertigo (without other symptoms of damage to the nervous system) were isolated from this group. Of these, 67 patients experienced dizziness for the first time in life, the remaining 42 patients it was repeated.

Patients underwent standard neurological examination, brain MRI, consultation of consultation with otoscopy, radiography of the cervical section of the spine in two perpendicular projections (frontal and lateral), as well as functional spondylography (flexion, extension). For verification of reflex-muscular and myofascial pain syndromes as a cause of spinal artery irrigation in exacerbation of cervical osteochondrosis, a thorough manual examination was carried out. The search for hypertensive peninsular muscles of the head, tonic asymmetry, other myofascial pain syndromes, well-known to date [1; 2].

Taking into account the fact that a significant part of patients were long-term observed with the diagnosis of cervical osteochondrosis, 35 patients (18 women and 17 men) underwent x-ray examination; thus, to clarify the development of posterior and posterolateral osteophytes of vertebral bodies, deformation of hook-like processes, spondylograms were performed in oblique projections. In the complex assessment of the state of the cervical spine, the criteria for movement disorders in the vertebral – motor segments, impairment of disc depreciation function and fixation function of the vertebrae were used [3]. The degree of compression of intradural space was also evaluated. To determine the severity and prevalence of osteochondrosis, the classification proposed by Saker (1952) and modified by I. S. Abel'skaya in 2003 was used [4; 5].

Research result

The duration of pronounced vestibular dysfunction up to 1 day was observed in 74(68%) patients, in other cases vestibular disorders were stopped within 48–72 hours, followed by "fading" light dizziness induced by vestibular loads (rapid head tilt, extension. In 42(39%) patients dizzy spells wore stereotypical recurrent in nature. Characteristics of vestibular syndrome (in less the sensation of dizziness during the fixation of the gaze, increased dizziness when changing the position of the head and shaking the head, rapid vegetative reaction, relative short duration of vestibular attacks), as well as the absence of symptoms of brain stem and cerebellum lesion allowed all 109 patients to diagnose peripheral dizziness. All 109 patients was counseled ENT, OTO-examination with no pathology found. In manual examination of patients there were no muscle contractures, pain on the interosseous ligament, bending of the arch of the posterior articular surface. The majority of patients had moderate pain during palpation of standard biological active points of the neck and posterior surface of the occipital region, including the projection of the exit point of the vertebral artery, which is normal.

Palpation of the posterior Lateral muscle masses, the upper head of the trapezius muscle, the angular muscle of the spades did not reveal muscle bundles, trigger zones of the posterior straight and lower oblique muscles of the head, capable of responding to finger pressing with distant pains. In 15 women, there was pain characteristic of fibromyalgia syndrome (bilateral, unstable topography of deep muscle pain of variable intensity). There was no correlation between the severity of dizziness and changes found in the manual examination of patients.In MRI of the head, none of the patients showed signs of cerebral infarction or hemorrhage. Signs of leukoaraiosis, single lacunar infarctions were observed in 5(4.5%) patients, Chiari malformation – 2(1.8%), retrocerebellar arachnoid cyst – in 1 (0,9%). The results of the x-ray examination of 55 patients in whom according to the anamnesis and clinical picture it was possible to assume the role of cervical osteochondrosis in the development of the disease are presented in the table. In patients up to 29 years of age have not been established lay – Kie changes of the cervical spine (0–degree I – d), characterized by the straightening of the physiological lordosis, "the unstable bias" several callcov with no signs of decrease in height of intervertebral discs. In the groups of patients from 30 to 49 years and 50 years and older, the changes corresponding to the II stage of osteochondrosis (54 and 68% of cases, respectively) prevailed, more often there was a combination of functional and structural changes in the spine (decrease in the height of intervertebral dis – cov I degree, signs of instability). The diagnosis of osteochondrosis III and IV degree was made only 8 students (2 people aged 45 to 49 years, 6 people 50 years and older). Determined structural changes: subhand – General sclerosis, marginal bone growth, spondylo – arthritis, decrease of height of intervertebral disks II and III, deforming encountres.

To clarify the degree of narrowing of the intervertebral holes and the spinal canal were produced spon – demografia in the oblique projections. Only 5 patients had moderate narrowing of intervertebral openings, more often unilateral, mainly at the level of CV – CVI, CVI – CVII, and 2 patients had moderate narrowing of the spinal canal by osteophytes (tea – kovsky index 0.7 and less).

Of the total number of patients examined, 2 (one from the first and second groups) were diagnosed with anomalies the Atlanto-occipital region (partial fusion of the Atlan-TA with the occipital bone, signs of basilar IMPRESSIA), 2 people from the second group were determined by partial concressence of a pair of upper cervical vertebrae.

In no case was lateroflexia detected on radiographs in combination with rotation, which is opposite to physiological and leads to spinous processes of III – CIV, experiencing lateralized traction of the reduced postural muscles. X-ray

follow-up and functional spondylography did not reveal isolated axial rotation, cervical flexure, which was often found in other patients treated in the national neurological hospital for reflex – muscle syndromes associated with exacerbation of cervical osteochondrosis.

Traumatic history only in 1 woman allowed to assume the possibility of a history of whiplash herbs – we cervical spine. However, she also had no asymmetry in the stretching of the occipital muscles and ligaments of the posterior surface of the neck, and the data of functional spon-dilography did not differ from the group of patients with III degree of cervical osteochondrosis.

Patients had no correlation between the degree of degenerative changes in the cervical spine and the frequency and severity of recurrent vestibular collapses. The intensity of degenerative changes in the cervical spine was associated with an increase in the growth of patients.

OBS uz-message

Examination of patients hospitalized in connection with vestibular dizziness allowed to exclude "cerebral" level of vestibular disorders in the majority (82.3%) of patients. These patients had acute peripheral vestibular pathologies, which in most cases required clinical data to exclude cerebral infarction or hemorrhage, which was done according to the results of MRI.

Most doctors blame vestibular attacks on cervical osteochondrosis. This traditional point of view is widespread in the medical environment. "The cervical OS – teachedrs, vertebral artery syndrome" – a standard diagnosis of the neurologist in cases of acute vestibular occasionally – Yes. Indeed, the role of the cervical spine in the regulation of postural equilibrium is known. There are both the proprioceptive nature of nystagmus and the proprioceptive imbalance disorder [7]. Occipital tonic reflexes involved in the control of balance arise already in the first weeks of life, allowing the child to turn and hold the head, fix the gaze [14]. But the main role that allows you to rotate the head in all positions, tying in the space labyrinth and behold – tional coordinate system, belongs to the pre-emptive, but the first two vertebrae. It is they, having the maximum- rotation is controlled by a powerful apparatus of muscles and tendons, equipped with "proprioceptive" sensors providing postural stability [8]. Meanwhile, the nature of degenerative changes in the spine in cervical osteochondrosis

excludes the defeat of the vertebrae of this localization simply because of the physiological absence of intervertebral discs at this level. In addition, in the process of ontogenesis, tonic occipital activity, which performs the function of "control" of postural equality, gives way to the main labyrinth reflexes [15]. Consequently, clinical patterns of vertigo in cervical osteochondrosis are characterized by mild or moderate postural instability (proprio – ceptive dizziness) in contrast to the dramatic "vestibular attack" in acute rotational vertigo observed in patients included in our study. The results of the manual and x-ray examination did not show any connection between the severity of dizziness and manifestations of pathology of the cervical spine.

We consider the diagnosis of "posterior cervical sympathetic syndrome", "cervical osteochondrosis, vertebral artery syndrome" in the case of isolated rotational dizziness to be incompetent. In the structure of ICD-10 rassmatrivaet – may, the pathology is classified as "peripheral th – lavorazione" (H 81.3). In most neuro – logical needed: children's hospitals, the equipment (for videonystagmography, elektronis – termografii, audiometry, cochleogram, etc.), traditionally within the sphere of interest of otolaryngology [16], trudnye for neurologists to establish the specific diagnostic for peripheral vestibular disorders: Meniere's disease, benign paroxysmal positioning – ing dizziness, vestibular neurons, etc. In connection with this, we consider it possible in patients hospitalized in neurological hospitals with isolated acute rotational dizziness to formulate di-agnosis as "acute peripheral vestibulopathy" and to recommend to these patients the consultation of an otoneurologist.

Thus, the majority of patients who are urgently referred to the neurological Department with a diagnosis of "acute violation of cerebral circulation in the vertebral – basilar system" or "cervical degenerative disc disease, vertebral artery syndrome" in connection with sharp rotational Guo – love-christian showed no structural changes of svi – delictuosa on a cerebral level vestibular disorders. Intermittent, recurrent, transient vestibular attack in a patient population, neither the timing nor the clinically – mi data is not associated with aggravation of cervical osteochon – rose. There is no correlation between the degree of degenerative processes and wild weakne – tion changes in the cervical spine and the frequency and severity of recurrent vestibular attacks.

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CONDITION OF THE AUDITORY ANALYZER IN PATIENTS WITH ACUTE SENSORINEURAL HEARING LOSS AFTER ACOUSTIC TRAUMA

Abstract. The irrational use of sound-amplifying equipment and portable audio devices leads to the development of acute sensorineural hearing loss, especially among the young people. The results of examination of 9 patients aged 18 to 30 years with acute sensorineural hearing loss are presented. All patients have gone through a comprehensive clinical and audiological examination. The cause of acute sensorineural hearing loss of these patients was the irrational use of portable audio devices.

Keywords: sensorineural hearing loss, portable audio devices, headphones.

Introduction. The problem of acute sensorineural hearing loss (SNHL) is of great social importance, due to the widely spread prevalence of this disease. Current statistics indicate a steady upward trend in the incidences of acute SNHL worldwide [1; 2].

SNHL is considered as a single unit disease with a polyetiological character. One of the common causes of SNHL is the effect of high intensity sounds on an auditory analyzer. According to World Health Organization (WHO), 1.1 billion young people (at the age of between 12 and 35) are at risk of hearing loss as a result of exposure to noise in places of recreation and entertainment.

Portable audio devices are now widely used, especially among young people and children. This fact is widespread in many countries of the world. The literature notes the highest risk of SNHL development in people who use headphones for three or more hours a day [2].

The above makes it relevant to study it in detail as a significant factor in the emergence of persistent acute SNHL.

Purpose. Analysis of the clinical and audiological manifestations of acute SNHL arising from the irrational use of portable audio devices.

Material and methods. The results of examination of 9 patients (the main group) are presented. In 3 (33,3%) patients had a diagnosis of "Bilateral acute sensorineural hearing loss" (H90.3 according to ICD-10) and 6 (66,7%) – "Unilateral acute sensorineural hearing loss" (H90.4 by ICD-10). The age of patients varied from 18 to 30 years old. Males accounted for 55.6% and females 44.4%. They pointed to the causal factor

of the sudden onset of hearing impairment with a sharp one-time short-term increase in the volume of sound in the headphones, as a result of incorrect handling of the volume control function of the mobile phone when listening to music. The latter in all patients at the time of ascertaining acute acoustic trauma was at the maximum value of the volume level.

In the presence of past ear diseases or their detection at the time of examination, patients were not included to the study. The control group consisted of 9 healthy individuals.

All patients have gone through general otorhinolaryngological examination included rhinoscopy, pharyngoscopy, indirect laryngoscopy, otoscopy and audiological examination. The study of the hearing organ included: the study of complaints, history of disease and life, acoumetry, pure tone audiometry, audiometry in the extended frequency range of air conduction (in the range of 10000–16000 Hz), SISI-test, tympanometry, registration of transient evoked otoacoustic emissions – TEOAE.

The diagnosis of SNHL followed the International Statistical Classification of Diseases and Health Problems of the tenth revision (ICD-10). The international classification of hearing impairment was used to assess the degree of hearing loss (WHO, 1997).

Measurement of the output sound levels at the headphones was carried out using the device "artificial ear" type 4152 and devices for studying the sound level type 2235 (Brüel&Kjaer, Denmark).

Calculated the value of the criterion of reliability of differences (p) was tested using Student's t-test.

Results and discussion. The study was performed at the ENT Department of the Tashkent Institute of Postgraduate Medical Education for the period from 2008 to 2018. Of the total number of patients, 78% used intra-channel vacuum headphones, the remaining 22% – overhead headphones.

In 36,4% patients had a diagnosis of "Bilateral acute sensorineural hearing loss" and 63,6% – "Unilateral acute sensorineural hearing loss". The predominance of unilateral hearing loss is due to the fact that most patients indicated that they used portable audio devices only on one ear. In a bilateral process, asymmetry in the degree of hearing impairment was not observed.

66.7% of patients with hearing impairment combined with tinnitus in the affected ear. In three cases, the noise had only a high-frequency character in the form of a whistle or a squeak, one – a low-frequency character in the form of a hum, and two patients noted a combination of several noises.

Hearing impairment at the level of I–IV degree of hearing loss was established in 9 patients. Their distribution, taking into account the degree of hearing loss, was as follows: the first degree – 50%, the second degree – 25%, the third and fourth degrees-25% each. In single case, it was found that the threshold increases only in the high-frequency zone (4000–8000 Hz) and the average level of hearing loss did not reach the minimum value of hearing loss of the first degree.

According to the pure tone audiometry, 9 patients had a descending character of audiograms, of which a slight-sloping – 40% and a steeply descending – 60% of cases.

According to the study of hearing in the extended frequency range audiometry, an increase the thresholds was observed by all patients, with the most highlighted at frequencies of 10000 and 16000 Hz. These changes were noted in one patient with the slightlyincrease in the thresholds of only the high-frequency zone (4000–8000 Hz).

From 77.8% of patients the index of the SISI-test, over 70% were positive, which indicates a defeat of the cochlea receptors.

TEOAE was not registered in 88.9% of cases.Registered in one (11.1%) patient in which the hearing threshold was increased only in the high-frequency zone.

At the time of treatment of patients, the clinic measured the output sound pressure level (SPL) of all devices that caused the hearing impairment. The device "artificial ear" was used to measure of the SPL at the output of the earphone, while in the mobile phone the volume level was set to the maximum value. The average output SPL of the devices under study was 101.2 ± 1.7 dB ($p < 0.01$ relative to the maximum permissible noise level). The minimum figure was equal to 99.2 dB, the maximum – 103.6 dB.

Conclusion. The results show that the irrational use of portable audio devices has become the substantial cause for the development of acute SNHL.

With the irrational use of headphones, acoustic trauma in patients developed suddenly in response to short-term powerful sound effects.

This hearing impairment is characterized by varying degrees of hearing impairment and predominant damage of the cochlear receptors, as evidenced by the results of the pure tone audiometry, SISI-test, registration of TEOAE.

Audiometry in the extended frequency range can be an important method of examination in the diagnosis of hearing impairment in the presence of clinical and anamnestic data and the absence of changes from other hearing studies.

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ON THE STIMULATION OF IMMUNITY FOR HYALURONIDASE – FACTOR OF PATHOGENICITY OF PARASITES

Abstract. The article presents data on the experimental study of immunostimulating properties of polyions – dextran sulfate and polyoxidonium – in hybrids mice. It was found that the Hyaluronidase antigen. possessed low immunogenicity. The use of dextran sulfate, polyoxidonium as an immune adjuvant to Hyaluronidase increased its immunogenic activity, which was expressed in enhancing the humoral immune response to Hyaluronidase in mice.

Keywords: immunity, Hyaluronidase, mice, dextran sulfate, polyoxidonium, immune response, edema index.

Hyaluronidase (Hyal.) – is a lysosomal enzyme, that cleaves hyaluronic and glucuronic acids. The latter is included as a compulsory component in the composition of many types of connective tissue, membranes and intercellular structures. Hyaluronic acid is an important structural element of the capillary wall [3; 4].

Hyal. produced by many microorganisms, in particular bacteria and parasites, and induces pathological changes in the host organism. This enzyme is considered as a factor of pathogenicity and aggressiveness of microbats. In view of the above it, thus "facilitates" the penetration and spread of parasites in the infected organism. Hyal. plays an important role in the pathogenesis of many parasitic diseases [1; 5].

Therefore, the search for ways to improve immunity to Hyal is urgent.

The purpose of the work is to study the possibility of improving immunity to Hyal in the experiment using compounds of polyionic nature.

Materials and methods. In the experiments, hybrid mice $(CBAxC_{57}Bl/_6)$ **F1** with a weight of 18–24 g were used. Hyal. was used as an antigen firm "Serva Finebiochem". Hyal. dissolved with 0.9% NaCl solution. Mice were immunized in the following variants: Hyal., Hyal. in combination with polyoxidonium (PO), Hyal., in complex with dextran sulfate (DS) ("Sigma Chem. Co"), Hyal. emulsion in Freund's Complete Adjuvant (FCA, Calbiochem) subcutaneously at the base of the tail, after 1 month the immunization was repeated. Secondary immunization was performed similarly to the primary one at the rate of 10 µg of Hyal./mouse. The dose of DS was 300 µg, PO – 200 µg per mouse. The number of specific to

Hyal. antibodies of classes M and G, as well as their isotypes were determined in the sera of mice by the method of immuno-enzyme analysis (IEA) in the variant A. Voller (1980).

To study the dynamics of antibody production, we simultaneously examined all the sera obtained 1, 2, 3, and 4 weeks after the first, and also after repeated immunization with the IEA method.

The intensity of reaction of hypersensitivity of delayed type (HDT) was evaluated by the conventional method [4] by the magnitude of the induced Hyal. swelling pads hind legs. The difference between the average values of the thickness of the left and right paws was taken as the amount of edema (AE).

The edema index (EI) was calculated by the formula:

$$EI = (AEexp – AEc) / AEexp,$$

where **AEexp** is the edema value in the experimental group, **AEc** is the edema value in the control group that received Hyal instead of antigen injection of 0.9% NaCl solution.

Results and discussion. Studies have shown that Hyal. proved to be a weak antigen (IEA titers in the dynamics varied from 1: 100 to 1: 300). In this group the maximal the minimal level of the cellular reaction of HDT (T-effectors of HDT) to Hyal. came for 4 weeks secondary immune response (EI = 2.0).

Immunization of mice with the polyanion complex of Hyal. + DS led to the induction of Hyal specific antibody response, ten times more intensive than with the introduction of Hyal antigen alone. After a single immunization, antibody synthesis was characterized by an IEA titer of 1: 900 (peak response for 2 weeks). The secondary production of antibodies (mainly IgG-type) was increased 90–fold to IEA titer values of 1: 25.000 (the response peak was 1 week after reimmunization). The range of isotypes of

antibodies to Hyal. was as follows: IgG1 (IEA titer to 1: 12000) > > IgG2a (IEA titer to 1: 5000) > IgG2b (IEA titer to 1: 2000) > > IgM (IEA titer to 1: 200).

The polyanion of Hyal. + DS did not intensify T-cell reactions specific for Hyal., while the rates of AEexp and EI were lower than those of mice immunized with Hyal only.

Co-administration of Hyal. mice in the composition of the covalent complex with polycation polyoxidonium (Hyal. + PO) stimulated only secondary synthesis of antibodies – from 5 to 20 times (IEA titers up to 1: 2000–1: 6000) with a maximum response of 1 week. after reimmunization.

At the same time, IgG1 isotype antibodies dominated (IEA titer up to 1: 2000), IgG2b isotype antibodies appeared (IEA titer up to 1: 100), and antibodies of other isotypes were not fixed at all (background level). In addition, with the help of software it was not possible to induce a specific response of DTH to this antigen – the AEexp was 0.10 mm, and EI = 1.5.

Use as a reference point a positive reaction of FCA, to Hyal. induced intensive production of antibodies in mice during the primary immune response – an IEA titer of up to 1: 4000 with a response peak at 4 weeks. The secondary synthesis of specific antibodies was more intense than the primary one. At the same time, a 200-fold increase in specific IgG synthesis was recorded compared to the response to Hyal antigen. (IEA titers – 1: 25000–1: 52000), their maximum level of IgG reached 4 weeks. secondary response. Under the influence of FCA, antibodies of all isotypes of antibodies to Hyal were produced, and their concentrations somewhat exceeded those of the group Hyal. + DS. Immunization of Hyal mice in

FCA, led to intensive generation of T-effects of HDT in the regional lymphoid tissue. In response to the Hyal injection in the pad of the hind legs of the paws, the reaction of HRT (EI = 4.0–7.5) developed 3–4 times more intense than in mice immunized with Hyal only. (EI = 0.8–2.0).

Our data suggest that the polyanion of DS really has a significant immune adjuvant effect on the immune system of mice against Hyal antigen. And what is especially important, Hyal. – highly weak immunogen for mice hybrids of the above line: even double immunization of Hyal mice did not induce in them a noticeable synthesis of antibodies to Hyal.

With entering of the Hyal. + DS complex into mice, it is possible in the latter to induce intense humoral reactions in comparison with the response only to the Hyal antigen (without adjuvant), however, it should be noted that the polyanion of DS did not affect the local reactions of HDT–type.

Polycation PO in the complex with Hyal. it was also able to increase the specific humoral response to Hyal. However, the level of IgG-class antibodies produced at the same time was significantly lower than those of the other two groups, Hyal. + DS and Hyal. + FCA.

Thus, in contrast to the polycation PO, the polyanion DS turned out to be a more effective immune adjuvant to Hyal. It induced a high level of anti-immune response in mice specific for Hyal. In terms of its immunogenic characteristics, diabetes approached FCA. These provisions can be further used to create effective protection against parasites, in particular when designing artificial antigens (vaccines) based on Hyal antigen. and polyions with high immunogenicity and no side effects.

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OUR EXPERIENCE IN THE SURGICAL TREATMENT OF CRYPTORCHIDISM IN CHILDREN

Abstract. The remote results of surgical treatment of cryptorchidism at 355 children in the age of 2–15 years are investigated. The efficiency is analysed. Orchiopexy was used. It is established, that optimal method of surgical correction of cryptorchidism at children is the modified Petriwalsky-Shoemaker. Despite of good clinical results achieved, ultrasonic research data of gonads demonstrate the preservation of morphological changes of germinative epithelium. The appropriate conclusions are made.

Keywords: cryptorchidism, undescended testis, orchidopexy, operation of Petriwalsky-Shoemaker, operation of Sokolov.

Introduction

Cryptorchidism is a common pathology of sexual development. Its incidence rate is 1–4%. The disease is also causes morpho-functional disorders of the sex glands, hypogonadism, infertility and impotence [1,2]. Most surgeons advice to peform surgery on the children under the age of 3 years, until the occurence of significant degenerative changes in the testicles [1, 2, 3].

Over time, the principles of surgical procedure has changed significantly. The traumatic surgeries [4] were replaced by new, more preserving methods [3, 5, 6, 7, 8]. Gonad fixation and its various method is considered the main stage of the surgical treatment of cryptorchidism. However, in case of orchiopexy, traction for the elements of the spermatic cord is unacceptable. This causes reflex spasm of the artery and veins of the gonad, leads to irreversible changes in the germinative epithelium and atrophy of the testicle and disruption of its reproductive function [7, 8, 9].

Materials and methods

To achieve optimal conditions for the testicle function after it is lowered into the scrotum and to improve the results of surgical treatment of cryptorchidism, we have divided the course of the applied methods in two stages — spermatic cord mobilization and gonad fixation after it is lowered into the scrotum. The first stage is identical for all types of surgery and provides maximal mobilization of the neurovascular bundle and vas deferens by wide dissection in the retroperitoneal space in the direction of the kidney and the posterior wall of the bladder. If necessary, the transverse fascia is dissected, and the lower epigastric vessels are tied. This does significantly shortens the path to the scrotum and lower the testicle without tensioning the spermatic cord.

It is the second stage that distinguishes the cryptorchism correcting methods currently used. The Petriwalsky-Shoemaker method is the most preserving, but we used the modified surgery method [1, 10], that is used in our department since 1992. According to this method, the testicle is lowered into the scrotum in the prepared bed between the skin and fascia dartos through a small incision in the dartos behind the remnants of the adductor canal. If the neurovascular bundle and the vas deferens are sufficiently mobilized, not stretched, the testicular membranes are simply fixed with a suture on the adductor canal to the scrotal septum. With a relatively short spermatic cord, tension of the neurovascular bundle, or vas deferens, two additional interrupted sutures are made, the membranes of the proximal areas of testicle are fixed to the dartos itself.

From 1990 to 2017, in the Department of Pediatric Surgery at the M. Iashvili Batumi Maternal and Child Central Hospital, 1256 surgeries were performed in 1198 patients aged from 2 to 15 years. 148 patients underwent surgery by Sokolov method [4] (prior to 1993), 296 — by classical method Petriwalsky-Shoemaker [3, 5], the modified Petriwalsky-Shoemaker [1, 10] method was used to perform surgery on 754 patients.

Results and discussion

Long-term results of cryptorchidism surgical treatment in 355 children were studied. 105 of them underwent surgery by

the Petriwalsky-Shoemaker method, 160 underwent surgery by the modified method, 90 boys underwent surgery by the Sokolov method (prior to 1993). The results of treatment in the compared groups were evaluated in 3–10 years after the surgical operation. Universally accepted anatomical criteria were used in their evaluation: gonad size, consistency, mobility, position to the scrotum. The structure of the operated testicle tissue was evaluated on the basis of ultrasound data, compared with the echogenicity of the contralateral gonad tissue.

58 of the 90 boys operated by the Sokolov method had right-sided cryptorchidism, 19 — left-sided, and 13 — bilateral. 82 of the 160 patients operated on using the modified method were diagnosed right-sided cryptorchidism, 64 — left-sided, and 14 — bilateral. 69 children operated by the Petriwalsky-Shoemaker method had right-sided cryptorchidism, 24 — left-sided, and 12 had bilateral cryptorchidism.

After the surgery that used the Sokolov method, out of 11 (12.22%) patients with unsatisfactory clinical results, 10 showed gonad atrophy and 1 had a relapse of the disease. The number of children with satisfactory clinical results clearly prevails over the number of patients with good clinical effect. The long-term results of Sokolov surgery method show that prolonged traction of testicular vessels causes their mechanical narrowing and reflex spasm, leading to atrophy of the genital.

The orchiopexy method of Petriwalsky-Shoemaker is more preserving. However, after suturing aimed at narrowing the hole in the dartos, relatively short spermatic cord leads to either an effect of mechanical compression of the testicular vessels (gonad atrophy in 7 patients out of 11 with an unsatisfactory result) or a recurrence if the gonad slips out of the bed (4 cases). Also, a small difference in the parameters of clinically good and satisfactory results of the surgery most likely indicates that the moment of narrowing of the opening in the datos is not always justified and is possibly dangerous.

Analysis of the long-term results of the modified Petriwalsky-Shoemaker method confirms our assumptions. Replacement of the narrowing suture with interrupted ones that fixate their own membranes to the dartos, has sharply decreased the unsatisfactory results leading to reduction gonadal atrophy rate to 0 (with 1 case of disease relapse in one patient). The increase in the number of patients with good clinical outcome should also be noted.

32 children aged 5–15 years underwent testicular ultrasound in 3–6 years after the surgery. Among them, 11 underwent surgery by a modified method, Petriwalsky-Shoemaker was used in 21 patients. All children with unsatisfactory results were examined (12 boys), as well as 5 patients with satisfactory and good clinical effect (total of 20). All patients with unsatisfactory and satisfactory results had a structural damage of the testicular tissue (increased echolocation) was found at the surgical region in comparisson to the contralateral. Ultrasound data of the children with a good clinical effect is more promising, because echolocation changes was detected in 1 boy out of five that underwent surgery using a modified method and in 2 children out of five that underwent surgery using the Petriwalsky-Shoemaker method. The results indicate that morphological changes in testicular tissue persist for many years after the surgical correction of cryptorchidism.

Conclusion

The method of choice in the surgical treatment of cryptorchidism in children is the modified Petriwalsky-Shoemaker method. However, the most extensive and wide dissection of the elements of the spermatic cord in the retroperitoneal space minimizes the significance of any method of orchiopexy. Children with cryptorchidism should be treated holisticaly. Surgical correction is one of the stage of the disease treatment. To make the effect of surgical operation permanent, stimulation and maintenance of reproductive function of the genital organ, all operated children need a comprehensive examination of the pediatric andrologist, as well as the observation of an endocrinologist in order to decide the necessity of hormonal therapy.

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RESULTS OF ENDODONTIC APPLICATION OF VARIOUS ANTIBACTERIAL AGENTS AND CLINICAL AND MICROBIOLOGICAL FEATURES

Abstract. In recent years, it has become apparent that the pathogenesis of periodontal diseases is more complex than the presence of virulent microorganisms. In fact, it is now widely accepted that susceptibility to periodontitis varies greatly between individuals who harbor the same pathogenic microflora. To date, the bulk of evidence points to the host response to bacterial challenge as a major determinant of susceptibility. In this review, we will assess the data implicating various inherited and acquired risk factors for susceptibility to periodontal diseases.

Keywords: periodontal diseases, inflammatory.

Actuality

Treatment of acute forms of periodontitis is one of the urgent problems of dentistry. Inflammation in apical tissues in 98–99% of cases is the cause of various forms of odontogenic infection (abscess, phlegmon, periostitis, etc.) representing a potential danger to the body [1; 3; 7]. The acute course of the periapical inflammatory process is accompanied by an adverse effect on the course of concomitant diseases of the body, causing their exacerbation [4; 8]. It was found that microbial contamination of apical periodontium occurs after pulp necrosis [5; 6; 8]. There are known data on the development of anaerobic bacterial flora capable of causing destructive changes in the periodontium and bone tissue in the conditions of communication of the root canal and oral cavity environment [3; 5]. Acute periodontitis and periapical abscess are accompanied by diffuse lesions, the analysis of patients ' referral to the clinic shows that in 32% of cases it is accompanied by the formation of purulent, in 16.8%- serous exudate [1; 4]. Many studies have found that the main source of colonization of bacteria in periodontitis is in the root canal system [2; 6]. However, the works devoted to the etiology of periodontitis are controversial, there are no patterns of microflora participation in different approaches to the treatment of the disease. It is important to note that in clinical practice, the methods of therapy of acute apical periodontitis are mainly reduced to trepanation of the crown, opening the tooth cavity, creating conditions for the outflow of exudate with leaving the tooth "open" for several days. Scientific data on changes mikrobiotsenoza during this period, we have not met. Then the traditional endodontic treatment using irrigants and permanent obturation of the canals. Meanwhile, many antibacterial agents have a short-term effect and are ineffective, which leads to complications and relapses of the disease [8]. The need for dental treatment is 3 times higher than the need for primary treatment [6; 7].The success of primary endodontic treatment in Russia is only 29%, and re-treatment is even lower [7]. All this explains the relevance of the search for new methods and drugs to improve the effectiveness of therapy of acute apical periodontitis and, above all, in the initial treatment of the patient. It is also important to explain the causes of complications of apical periodontitis in the long term after treatment, the role of microbial flora in the pathogenesis of recurrent inflammation in the periodontium, to determine the indications and develop rational methods of local and General therapy. In recent years, the market of dental materials, new antiseptics, as well as drugs with prolonged antibacterial properties, having a bactericidal effect on the intra-channel microflora. However, the issue of optimizing the choice of methods and endodontic antibacterial agents for the most

effective treatment of acute forms of periodontitis remains unresolved. This is the subject of this thesis.

Purpose of research

Improving the efficiency of diagnosis and treatment of acute periodontitis using the method of prolonged antibacterial sanation of the root canal system and periapical tissues based on the study of microbiological factors.

Survey materials and methods

The materials and methods of examination included 80 patients with acute forms of periodontitis. Microbiological studies were conducted in 51 patients (18–65 years) with acute forms of periodontitis, including against the background of General somatic diseases. Microbiological studies included: molecular genetic method using polymerase chain reaction (PCR), method of cultural (bacteriological) research, determination of bacterial cultures sensitivity to antibiotics and other drugs, including in the form of gels and pastes.

Results and discussions.

In the study of the prevalence of periodontal disease (analyzing orthopantomograms), it was noted that in the age group of 15–64 the number of teeth with radiological changes in the periodontium per person is 5.6 of them previously treated 2.5, and not treated 2.9. The highest level of growth of new foci of periapical pathology was observed even in the young age group (20–29 years). In the second visit, after the traditional treatment of tooth canals, microbiological studies of the contents of the root system of 17 teeth were carried out. Comparative frequency of detection of virulent anaerobic bacteria from the root canal by PCR before and after traditional antiseptic treatment (n= 17) After traditional endodontic treatment bacteria were found: A. actinomycetemcommitans – in 17.7%; B. forsythus – in 17.7%; P. intermedia – in 11.8%; P. gingivalis – in 11.8%; T. dentikola – in 11.8% (Fig. 4.1). These data show that traditional endodontic treatment of root canals is insufficient for antiseptic effect on pathogenic root canal infection present in acute forms of periodontitis.

In the clinical evaluation of traditional endodontic treatment of teeth and temporary filling, after 2 days, patients noted pain when biting in 5 cases (29.4%), including 2 patients teeth could not withstand hermetic closure (11.8%).

In this regard, additional antibacterial therapeutic measures are needed to sanitize the root canal system and periapical focus.

Clinical and microbiological evaluation of the effectiveness of endodontic application of the paste " Apexdent»

The main group is "A" subgroup. The results of microbiological examination before endodontic treatment of teeth showed that such types of bacteria as A. actinomycetemcommitans were found in 4 (36.4%), a B. forsythns, P. intermedia,

P. gingivalis, T. denticola – in 3 (27.3%). (table. 4.2, before treatment).

After 7 days of calcium hydroxide in the root canals, the percentage of detection of A. actinomycetemcommitans bacteria decreased by 18.2% and after 14 days by 27.3%; B. forsythus – by 18.2%, and after 14 days this species was not detected at all; R. intermedia, P. gingivalis, T. denticola after 7 days, the percentage of their detection decreased by 9.1% and after 14 days by 18.2%, respectively, P 0.05.

After 7 days of calcium hydroxide in root canals the percentage of detection of bacteria A. actinomycetemcommitans, Blforsythus decreased, 18.2% and after 14 days they were not found; while P. intermedia and T. denticola after 7 days the percentage of detection decreased by 9.1% and after 14 days 18.2%, respectively; the P. gingivalis neither 7 nor 14 days of stay; the canals of the drug "Apeksdent" not detected, P < 0.05.

It should, however, be noted a large antibacterial activity of calcium hydroxide after 14 days against bacteria such as A. actinomycetemcommitans, B. forsythus and P. gingivalis – this can be attributed to the fact that the root canals of the teeth in patients of subgroup "B" were not left open for drainage and as a consequence the lack of conditions for secondary infection. However, no effective bactericidal action of calcium hydroxide on pigment-forming microbes P. intermedia and T. denticola has been established.

However, the clinical picture of root after the introduction of drugs has evolved in different ways. Thus, in the near future after filling the root canals with Apexdent, there was a slight pain of 1–2 days when biting in one patient of subgroup "A" (9.09%). Then, as in subgroup "B" after the use of the drug Apexdent clinical pain reaction was observed in 2 patients (18.2%), including one patient noted pain for 5–7 days, docked with anti-inflammatory drugs with preliminary root canal filling. In the future, this patient underwent endocanal treatment in two visits with the use of the drug Collapse-K and clinical well-being was noted.

Summary

In patients with acute apical periodontitis in the content of the root canal system by the method of modern microbiological technologies, representatives of flora with both obligate-anaerobic and facultative-anaerobic and microaerophilic type of respiration were identified and a high frequency of detection of virulent anaerobic bacteria species was noted.

Traditional endodontic treatment of root canals in the treatment of acute periodontitis should be supplemented with temporary filling of root canals with calcium hydroxide or Collapse preparations, which contributes to more effective sanitation of the canal system and prevention of exacerbation of the inflammatory process.

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THE RESULTS OF THE ULTRASOUND AT THE STAGES OF SCREENING WHEN CONDUCTING PROPHYLACTIC DAYS FOR THE DETECTION OF BREAST CANCER

Abstract. The International Agency for Research on Cancer (IARC, Lyon) Breast Cancer (Breast Cancer) is the "ideal" tumor for population screening. This is the most common tumor in women, especially over 50 years. Of the 10 million new cases of malignant tumors of various organs detected in the world, 10% are in the mammary gland.

Over the past decades, there has been an increase in the incidence rates of breast cancer (BC) in the Republic of Uzbekistan. One of the main reasons for the lack of effectiveness of therapeutic measures is the unsatisfactory state of early diagnosis, the late differential diagnosis of nodules of the gland and early forms of cancer. Along with palpation and mammography, the ultrasound method is widely used to diagnose breast cancer. Due to the absence of radiation exposure, it can be used many times, in any age group, during pregnancy and lactation. Echographic screening helps to identify not only the pathology of various organs and systems but also to conduct a differential diagnosis of malignant tumors at subclinical stages, which allows you to choose an adequate amount of surgical intervention.

Keywords: prevention, decease of breast, breast cancer, ultrasound diagnosis.

The most common is the clinical (physical) examination of the mammary glands (CBE – Clinical Breast Examination) by medical personnel. According to Canadian researchers, the CBE method can have high specificity (95–99%) and sensitivity in the range of 47–80%. Based on 2740 studies, Ciatto and co-workers found that the sensitivity of CBE varies depending on the stage of the disease: 48% – cancer in situ, 70% – stage I, 90% – stage II, 89% – stage III, 93% – stage IV is 77% in the age group of 20–29 years old, 58% – 30–39 years old, 75% – 40–49 years old, 84% – 50–59 years old, 90% – 60–69 years old, 94% – are over 69 years old (Ciatto et al., 1991) The sensitivity of clinical examination of the mammary glands in early stages and at a young age decreases [2].

According to the Ministry of Health of Uzbekistan, the most common type of cancer in the country is breast cancer. This type of cancer is detected in 9.1 cases per 100 thousand population. According to experts, the hereditary factor is important in the development of breast cancer in women, namely on the maternal line. It is transmitted in 45–75% of cases if there are mutations in the BCA 1–2 genes [6; 7; 8; 9].

Materials and methods of examination. The basis of this study is the personal data of the applicants and the conclusion of the ultrasound study, which was conducted in the Andijan branch of the Republican Scientific and Practical Medical Center of Oncology and Radiology. Ultrasound examinations were performed by highly qualified ultrasound diagnostics specialists, as well as by breast examiners of this center. The examination was conducted among healthy women in 14 districts including cities from 17–49 years of age. The contingent convened for inspections by advertising through the media. After registration, each patient was given a questionnaire for completion, in which more than 20 questions were included for the collection of anamnestic data. After collecting the questionnaires and clinical examination by a mammologist, the patient was sent for an ultrasound examination (ultrasound) of the mammary glands and zones of regional lymph outflow.

Results

1116 women from various regions of the Fergana Valley were examined. Survey data showed the following results.

The findings of the ultrasound examination of the examined women gave the following, half of the examined 535 (49.7%) were healthy, with fibrocystic mastopathy 163 (14.6%), fibrous mastopathy 140 (125%), nodal mastopathy 64 (5.7%), diffuse mastopathy 30 (2.68%), cystic lesions of

the mammary gland 95 (8.51%), fibro adenoma 13 (1.16%), Mintz disease 13 (1.16%) and suspected malignant neoplasm 11 (0.98%). Other pathologies such as galactocele, atheroma, lipoma were found in 2 (0.26%) and 1 (0.089%).

Discussions Anatomical changes in various forms of mastopathy are diverse, but fibrous strands, intertwined and passing without clear boundaries into the surrounding tissue, are mandatory. Common to the three forms is the proliferation of connective tissue, atrophic lobules, small cysts with a uniform epithelium. Lots of nodular mastopathies did not look like nodules. They were distinguished by a more or less smooth contour, homogeneous echo structure, and deformation of the tissues around the nodal zone was not observed. When DDC vessels had a linear orientation, there were no signs of strengthening the vascular pattern. With qualitative elastography, the tumor stiffness cartogram had a green and red-green palette similar to the surrounding tissues.

The cysts had a picture of the anechoic homogeneous fluid formation of a round or ovoid shape, with a clear even contour, no reflection from the internal contents, lateral acoustic shadows and dorsal amplification of the signal. Blood flow was not recorded. With qualitative elastography, the cyst had a triple mapping, a layered blue, green, and red palette.

To interpret the data obtained during breast ultrasound, we follow the gradation according to the BI-RADS system. Planned tactics in each particular case can vary from dynamic observation with a survey interval of 1 year (in the absence of a pathological process) – category 1, to morphological verification of the pathological process to determine the histological and immunohistological features of the tumor – category 5 is established with obvious signs of cancer.

Category 1 is established in patients with no pathological process. Control tests are carried out 1 time per year.

Category 2 is established when identifying benign tumors (simple cysts, lipomas, atheroma, typical fibro adenomas, breast implants without signs of damage and traction), a control examination is carried out every 6–12 months.

Category 3 is established with benign changes with a probability of having a cancer of no more than 2% (first identified fibro adenomas without increased intra- and peritumoral blood flow, nodular hyperplasia of the parenchyma without calcifications, edematous-infiltrative forms of mastitis, breast abscesses, cysts with signs of inflammation). Control tests are carried out after a course of conservative treatment after 3 months. If after 3 months after a course of therapy, there is a negative trend, then the case is regarded as category 4, if there is a positive trend, the case is regarded as category 2.

Category 4 is established when detecting changes in the mammary glands suspicious of a malignant process with a probability of 3 to 94% (fibro adenomas larger than 3 cm (leaf-shaped fibro adenomas), fibro adenomas of any size with an increase in size of more than 5 mm in the course of dynamic observation for 6 months, fibro adenomas with increased blood flow, with uneven contour, fuzzy visualization of the posterior contour or the presence of calcinoses; atypical cysts with the presence of intracystic solid formations, intraductal papilloma, node s formation without accurate ultrasound picture, edematous infiltrative and other forms of mastitis without positive dynamics after treatment, nodular hyperplasia zone with the presence of calcification. In identifying this pathology requires morphological verification process using the percutaneous needle biopsy or trepan biopsy.

Category 5 is established with obvious signs of breast cancer.

Taking into account the above-described grades according to the BI-RADS system, the USP physicians must have indicated the category of pathology identified, taking into account all ultrasound criteria using the B-mode, DDC, EDC, elastography. Clinicians, focusing on the received ultrasound conclusion, planned their treatment tactics.

In particular, 60 women out of 202 (29.7%) were assigned 2 categories and re-attendance at the examination after 6 months was recommended. Category 3 was established in 65 patients from 202 (32.2%) was prescribed a course of conservative therapy with a subsequent attendance at the examination after 3 months, 6 women from 202 (3%) were assigned category 4. And 8 patients from 202 (4%) 5 category on the system BI-RADS.

All observations of focal pathology, 4.5 categories on the BI-RADS system, had a morphological verification in the form of a cytological conclusion of the results of fine-needle puncture. The diagnosis of breast cancer was confirmed morphologically, after surgical treatment on the basis of histological findings.

At the same time, in one woman out of 8 (12.5%), ultrasound diagnosis of breast cancer was not established cytological, however, after a morphological study of the postoperative material, the diagnosis of breast cancer was confirmed. And in one case out of 8 (12.5%) with the ultrasound diagnosis of fibro adenoma, also after the surgical manual, the diagnosis of fibro adenoma with malignancy was made cytological and histologically.

Findings. Thus, the complex as the data show that almost 50% of the surveyed have breast pathology. What can lay the foundation for the development of malignant neoplasms? If the world meets 2 cases per 1000, then in our case cancer is suspected in 11 (0.98%), which was confirmed by an aspiration biopsy and cytology. The number of precancerous pathologies like Mints' disease (intra-oral formations), nodular forms of mastopathy among the population of the Fergana Valley is high, which predicts an increase in the malignant pathology of breast cancer. This can be attributed to the population density in comparison with other regions of the Republic of Uzbekistan.

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MODERN VIEWS IN DIAGNOSTICS AND TREATMENT OF ESOPHAGEAL CANCER (LITERATURE REVIEW)

Abstract. Esophageal cancer (EC) has one of the leading positions in the structure of malignant diseases and holds even higher position on the aggressiveness of the process. This article briefly analyzes the current state of the EC problem, evaluates the modern aspects of early diagnosis, prognosis and complex treatment.

Keywords: esophagus cancer, squamous cell carcinoma, adenocarcinoma, fast track method, multimodal approach.

Epidemiology

EC is one of the most unfavorable diseases of the upper gastrointestinal tract (GIT). Quiescent initial stages of the disease significantly complicates early diagnosis and thereby worsens the outcome [12]. In the 2018, EC and cardioesophageal junction (KEJ) occupies the 9th place in the structure of new incidents of malignant tumors worldwide, accounting for 572,034 registered cases, and 6th in the structure of mortality among all cancers, killing 508,585 people annually (almost 1 person per minute) [7]. For comparison, it is equal to 600 air crashes with the maximum number of aircraft seats per year. According to statistical data, EC develops significantly more often in males than in females (70% of new incidents developed in men), and persons over 70 years old make up about 40% of the total number of cases, while the peak incidence is between 50–60 years old [34]. However, these figures vary by geographic region. For example, the highest incidence was found in Eastern Asia, Eastern and Southern Africa, while the lowest rate belongs to Central America [7; 12]. The index of aggressiveness of the EC in 2018 was 88%. Despite the intensive development of medicine, the presented figures are growing every year. So, if in 2008

identified new cases were 482300, by 2018, 572034 cases of EC were registered around the world. The increase in incidence over the past 10 years is 18% [12; 34].

Despite the widespread tendency to increase the incidence of EC (WHO 2018), according to Tillashaykhov M. N. et al. (2019) in Uzbekistan there was a decrease in this number. So if in 2008 the number of new incidents of the EC was 991 cases, in 2018 this figure is equal to 782 cases, decreasing for 26%. At the same time, the death rate also decreased, from 669 deaths in 2008 to 603 mortal cases in 2018. However, it should be noted, that the aggressiveness index for a given period increased from 67.5% to 77.1%.

The worldwide increase in the incidence rate is due to a number of factors and, first of all, to the low efficiency of treatment of patients with EC compared with distal forms of GIT cancer, which is explained by the later diagnosis of the disease and features of EC progression. All this, in turn, requires addressing the development of modern methods for early diagnosis of EC [34].

Histology

As it is known, two most frequent types of malignant tumors of the esophagus (90–95%) are distinguished,

depending on the type of cells from which they develop. Squamous cell carcinoma (SCC), which is the most common form of EC, mainly found in upper and middle sections of esophagus. Adenocarcinoma (AC) of the esophagus, the second most common tumor of the organ. It is usually found in lower part of esophagus, at the junction with the stomach and develops from glandular (secretory) cells, the source of which can be the esophageal glands or metamorphosed, under the regurgitation of gastric juice, cells of the lower part of esophageal mucosa (gastroesophageal reflux disease (GERD) and, as its consequence, Barrett's esophagus (BE)). It should be emphasized that these two main histological forms of EC have different clinical manifestations and, accordingly, different outcomes of special treatment [12]. Rare forms of malignant tumors of the esophagus include: choriocarcinoma, lymphoma, melanoma.

Recently, there has been a growth trend of AC of esophagus in Western countries. Currently, in the US, the frequency of AC has increased manyfold, while the number of patients with SCC of the esophagus has decreased slightly. The increase of AC in the United States at the beginning of the twenty-first century is 463% compared with 1975–1979's of last century [2]. Among all registered cases in the period of 2009–2013, 61.79% were AC and 32.8% SCC of the esophagus [36].

Genetic features

The identification of genetic changes associated with EC can play an enormous role in understanding the gist of pathology and develop molecular-based treatment. An expanded analysis of the entire genome showed that 83% of patients with SCC of the esophagus contain a mutation in the TP53 genome. In addition, in 46.4% of patients, have increased activity of the cell cycle regulatory gene CCND1. Epigenome changes such as DNA overmetilation also plays a role for early diagnosis of AC, and its increased degree means a negative prognosis [19; 36].

Risk factors and etiology

The risk factors and etiology of EC have regional features and depend on the histological type. According to demographics, people of the white race have 5 times more risk of EC than black and white Hispanics. Smoking is considered one of the main direct risk factors for SCC, while it is an indirect risk of AC (through GERD and BE). Alcohol, transforming under the influence of alcohol dehydrogenase on acetaldehyde, acts as a mutagenic factor for the DNA of the squamous epithelium. Therefore, alcohol is considered a risk factor mainly for SCC. GERD, subsequently causing BE, is considered to be a precancerous condition [6]. The presence of BE increases the risk of AC of esophagus 40 times. However, only 5% of patients with EC have a history of BE. Some sources report about the role of obesity in the AC of the esophagus, but this factor is not directly correlates with AC of the esophagus, but leads to GERD and through it may increase the risk of the disease [6]. There are also report showing the role of some regional behavioral addictions to certain foods and beverages that increase the risk of EC. Hot tea in many parts of Asia, Paraguayan tea (ilex of Paraguay), and chewable types of tobacco, in particular betel, are directly correlated with the EC [8; 12; 15].

Although a huge amount of research has been done on risk factors, neither of them is considered to be the etiological cause of the EC and, separately, seldom cause this pathology. The combination of these factors may increase the risk of EC occurrence for many times.

Screening and diagnostics

Timely diagnosis of both EC and other cancers is the whole ballgame when it comes to oncology [30]. Stage I and II of EC are asymptomatic, and, therefore, early diagnosis is difficult.

Despite the widespread expansion of EC, up to date there are no standardized screening methods. Pinnerua-Gonzalez et al. (2019), suggest using toluidine blue in combination with Lugol's solution. In high-risk groups, white light esophagoscopy is performed, sequentially esophageal mucosa sprayed with toluidine blue and Lugol solution from the esophagogastric junction, after which biopsies are taken from suspicious sites (uptake dye areas with toluidine and less-intense stained with Lugol solution) and examined by morphologists. According to the results presented by the authors, when detecting AC, the sensitivity and specificity of the method are 100% and 85.7%, respectively [32]. Also, chromoendoscopy with Lugol solution is considered the standard method for early diagnosis of esophageal SCC in Japan. The sensitivity and specificity for SCC are 91.9% and 94.0%, respectively [38].

However, Pam Harris (2018) and other North American scientists do not share the opinion of their southern colleagues and do not consider esophagogastroscopy as a screening method. "Endoscopy is not a screening method, you only do it for symptoms" emphasizes Stefan Meltzer (2018), a professor oncologist at the Medical School of the John Hopkins University. For effective screening, they offered a new device called "EsophaCap". This capsule-shaped device, measuring 16x9 mm, is attached to a thin catheter with a diameter of 2.16 mm. In the stomach, the gelatin cover of the capsule dissolves within 3 minutes and an internal polyurethane sponge, which, when pulled back, collects samples from a pathological focus located in the wall of the esophagus. The obtained sample, laden with DNA material that is subsequently extracted using a new technique known as methylation on beads (MOB). MOB identifies DNA methylation biomarkers – CCNA1 and VIM. The diagnostic accuracy of the method is 86.7%. The sensitivity and specificity

of this method for determining BE is 78.6% and 92.8%, respectively. The method does not require endoscopist specialization and special training, and it can be performed on outpatient departments for people at risk [28; 29].

However, according to reference data, even despite the presence of numerous screening methods, nowadays there is no consensus about the routine feasibility of any method for the risk group.

Modern methods of diagnosis of EC include imaging and endoscopic methods. It is not difficult to determine whether there is cancer or not, but the exact staging of the process requires careful approach [37].

Esophagogastroscopy with a biopsy from a pathological focus gives accurate information about the process localization, its type of growth, the nature of the tumor surface, its length and performed biopsy, provides information about the cell type and degree of differentiation (G) of the tumor [6; 19]. For early diagnosis, a magnifying endoscopy is also used with a narrow band imaging (NBI), which makes it possible to clearly visualize the microvascular structure of the mucosal layer and submucosa. The device uses a narrow spectrum of light with a magnitude of 410–430 nm (for the mucous membrane) and 540 nm (for the submucosa). According to Masayuki Watanabe et al. (2018), the method determines surface SCC in 97% of cases, while in traditional endoscopy, the sensitivity is 55% [38].

In addition, modern endoscopic ultrasound is highly sensitive for determining the depth of tumor invasion into the esophagus layers, adjacent structures (cT) and metastases in regional lymph nodes (cN). Also, the ability to perform fine needle aspiration from local lymph nodes under the control of endosonography provides additional information about the state of lymphogenous dissemination. It is these characteristics, that make this type of examination an integral part of the diagnosis of EC [21].

Not a few important stage of diagnosis is, of course, imaging methods. Computed tomography (CT) and positron emission tomography with 18F-fluoro-2-deoxy-glucose (FDG-PET/CT) are at the forefront of staging, mainly for cN and cM [36]. CT scan provides a detailed overview of the organs of the chest, abdomen and their pathological changes. CT with contrast enhancement allows to more accurately assess the intactness of adjacent main vessels. Although this plays an important role in determining the volume of the operation, CT scan as well as FDG-PET/CT have a disadvantage in setting up the initial stages of invasion (cT) [21]. FDG-PET/CT would seem indispensable for the diagnosis of distant metastases (cN and cM), but a large number of false-positive results lead to unnecessary examinations and thus an increase in the cost of diagnosis and treatment in general

[36]. In this regard, the routine use of PET/CT in oncological practice is limited. In the CIS countries for the diagnosis of tumors of the esophagus contrast x-ray of the esophagus is used. This method provides information about the existence of the process, its form, and the longitudinal length. Due to low specificity, radiography is rarely used in the developed countries [19; 21].

Among the non-invasive diagnostic methods are ultrasound of the abdominal cavity, pleural cavity and peripheral lymph nodes. Ultrasound together with body CT and Endo-ultrasound in the vast majority of cases can limit the indications for PET / CT, presenting all the necessary data. If the process is located in the upper and middle parts of the esophagus, bronchoscopy is additionally performed to exclude involvement of the respiratory tract in the process and, if necessary, to obtain biopsy from the focus [19].

Treatment

Endoscopic treatment: Accurate staging of the disease is very important for choosing an appropriate treatment method or a combination of them. In addition to the exact stage of the process, the functional state, nutritional status of the patient and comorbidities are assessed [12]. In modern oncology, an integrated approach to treatment is commonly accepted. Treatment is strictly depends on the stage of EC. When the tumor is located in the mucosa and submucosa (T1a-T1b), endoscopic mucosal resection (EMR) and endoscopic submucosal dissection (ESD) with radiofrequency ablation are performed. ESD compared with EMR has a high percentage of complete removal of the tumor (92.7 versus 52.7%) and less frequencies of local recurrence (0.3 versus 11.5%), respectively. Complications of this procedure can be stenosis (5%) and esophageal perforation (less than 1%), which can also be eliminated endoscopically [27]. ESD is the standard of treatment for high-grade dysplasia and cancer in the T1-N0M0 stage, and the T1bN0M0 stage is considered a relative indication for this procedure [27; 38]. However, diagnosing patients at an early stage is considered a rarity, moreover, an accurate determination of the cT degree is difficult and this increases the risk of incomplete removal of tumor cells. Therefore, some surgeons intend to perform resection of the esophagus in the initial stages rather than endoscopic treatment [19].

Surgery: Surgical treatment of EC is recognized as the central part of the complex therapy of early stages of EC. It basically means subtotal esophageal resection (ER). With the first successfully performed transthoracic ER (V.D. Dobromyslov in 1900 and F. Torek in 1913) more than a hundred years have passed and the surgery of the esophagus has undergone significant changes. Today, for cancer of the thoracic esophagus, two main types of simultaneous interventions have been widely recognized – subtotal ER through

a two-zone (abdominal-thoracic) access with anastomosis formation in the dome of the right pleural cavity (Lewis' operation) or through a three-zone (abdominal, thoracic and cervical) access formation of anastomosis on the neck (McKeown's operation). There is also a transhiatal (abdominoservical access) ER developed by W. Denk in 1913, however, the method is not sufficiently adequate from the point of radically oncological view, due to the absence of a visual lymph node dissection from the chest [9, 38]. Although this approach has its supporters, in favor of its low traumatism. Due to the volume of open ER, the frequency of complications after surgery is high. According to R. V. Khayruddinov et al. (2006), after 286 surgeries, following complications were noted – transplantat necrosis (0.7%), pneumonia (7%), partial anastomosis leak (8.75%), wound suppuration (9.44%), exudative pleurisy (5, 6%), myocardial infarction (0.7%), arrosive bleeding (0.7%), purulent mediastinitis (3.5%), insufficiency of esophagoenteroanastomosis (0.7%), cardiovascular insufficiency (2.8%), acute respiratory failure (1.7%), pulmonary edema (0.7%), pleural empyema (1%). A total number of complications 124 (43.4%), 31 (11%) of which were mortality cases [16]. Such frequency of postoperative complications led to the introduction of minimally invasive techniques to modern surgical oncology. The minimally invasive techniques of the presented operations were widely distributed among the developed countries of the western hemisphere and eastern Asia [36]. Minimally invasive resection of the esophagus (MIRE) in the early twentieth century was considered risky and had many intraoperative and postoperative complications. But recent studies have shown that these concerns were related to technical deficiencies and the limited experience of surgeons [21]. Today, minimally invasive methods of esophageal cancer surgery are generally recognized and are widely used by experienced thoracic surgeons in specialized centers [1; 19]. One of the biggest investigations, devoted to MIRE, belongs to Luketich et al. (2012). Based on MIRE performed on 1011 patients, the authors showed a clear example of the feasibility of MIRE with the formation of an anastomosis either in the pleural cavity or in neck, depending on the localization process [19; 20]. Concerns about interventions in chest shifted Japanese scientists to improve the mini-invasive trans-hiatal ER. During the laparoscopic stage, the en block of the lymph nodes is removed from the middle and lower third of the mediastinum; the lymph nodes from the upper mediastinum are removed through mediastinoscopy from a single port on the left neck [31]. The results of such operations strictly depend on the annual volume of operations performed by a single surgeon [38]. Minimally invasive surgical techniques can affect the patient's surgical status, postoperative complications (64.4% after open RP and 35.9% after MIRP), quality of life,

but have no effect on the overall survival of esophageal cancer patients [1; 5; 21].

Lymphadenoectomy in oncology is an inseparable part of the operation. The volume of lymph node dissection has been at the center of discussion for many years, although recent publications by Western scientists show that the removal of all regional lymph nodes compared to the tailored lymph node dissection does not significantly affect the overall survival of patients [18; 19; 22].

Despite the relentless improvement of surgical methods and the rational choice of the operation volume, postoperative changes in the patient's body significantly affect the quality of life of patients with EC. Frequently encountered are reflux, eating problems, malabsorption, dysphagia and others. Recovery after surgery and return to social life, often, is long [10; 23]. Chinese scientists were among the first in the world to solve this problem using the enhanced recovery after surgery technique (ERAS) on the esophagus. Li Yin is one of the founders of the *fast track* method for operable patients with EC, creating their own technique of forming esophagogastrostomy (Li's anastomosis) [39].

Multimodality approach: The vast majority of patients are treated with locally advanced EC. The strategy of treatment in such cases is debatable among advanced thoracic cancer centers in developed countries. A multimodal approach for the treatment of EC is a key point of therapy [24]. Western scientists use the tactics of neo-adjuvant chemo-radiotherapy followed by surgery [4]. For squamous cancer, carboplatin + paclitaxel is used in conjunction with radiotherapy (41.4 Gy in 23 fractions) and subsequent surgery (CROSS2012) [4; 14; 30]. For adenocarcinoma, neoadjuvant chemotherapy with a cisplatin + 5 fluorouracil regimen and subsequent surgery (OEO2, FNCLCC / FFCD) [3; 11; 13]. Opponents of this tactic (MAGIC) conduct various studies comparing the tactics of neoadjuvant chemoradiotherapy + surgery with the tactics of perioperative chemoradiotherapy + surgery and show that there are no significant differences between overall survival of the given approaches [3]. In consideration of the general condition deterioration of some patients [25] and the need for re-staging (additional costs) after neoadjuvant chemotherapyy and radiotherapy, the latter group of scientists prefer to resect the esophagus first, and initiate chemoradiotherapy next [6; 19].

Palliative treatment: With the invasion of tumor to adjacent structures or presence of distant metastases, the radical nature of therapy is excluded and in such cases, approach will be palliative. The goal of palliative therapy is to alleviate the symptoms of the disease, improve the quality of life of patients and prolong the patient survival. The dominant symptom in EC is dysphagia. Endoscopic stenting, with a self-expanding

stent followed by brachytherapy, is used to expand the lumen of the esophagus [19; 33]. This tactic for local therapy is considered optimal. There are stents with an iodine (125) seeds that act locally on the process [40]. The use of such stents for patients with an unresectable tumor prolongs the median survival [33].

Systemic palliative treatment involves chemotherapy. To date, there are no randomized 3rd phase studies associated with palliative therapy for esophageal squamous cell carcinoma and data are extrapolated from the esophageal AC [19]. Platinum-containing and fluoropyrimidine medicines are considered the first line chemotherapy, and in cases of satisfactory condition of patients, a third component (epirubicin or docetaxel) may be include [14]. Targeted therapy is used, once the chemotherapy failures. For esophageal AC, overexpression of the HER2 (Human Epidermal growth factor receptor 2) makes it possible to use trastuzumab together with chemotherapy, which prolongs the average survival rate up to 16 month versus 11.8 months for patients who received chemotherapy alone [26]. HER2 is the only oncological marker for EC, against which immunotherapy may signifi-cantly affect the overall survival of patients [19; 26]. In addition, according to Lagergen et al. (2017) its overexpression occurs in 59.6–76% of patients with esophageal SCC [19]. Studies are also underway on the effect of immunotherapy (nivolumab, pembrolizumab) against the Programmed death ligand 1 (PD-L1). An increase of PD-L1 protein is found in 43.7% of patients with esophageal SCC. D. Kollmann et al. (2017) suggest, that 12-month survival in patients, who receive immunotherapy with chemotherapy, regardless of the histological type, is 43%, versus 20% in those who received only chemotherapy [17; 35].

Conclusion

EC remains a significant cause of death from cancer worldwide. A "innocuous" onset, aggressive growth, rapid spread and high resistance to antitumor therapy make the disease insidious. The lack of available standardized screening methods, specific tumor markers and effective treatment strategy, including the extensional nature of the radical surgery for EC, which consists of the stages of resection and reconstruction, indicates the presence of an "underwater part of an iceberg" called EC.

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COMPLEX TREATMENT OF PAIN DYSFUNCTION SYNDROME OF TEMPOROMANDIBULAR JOINT

Abstract

Research objective: **i**s to increase quality of diagnostics and treatment of patients with a pain dysfunction syndrome of temporomandibular joint by the choice of diagnostic and medical actions.

Material and Methods: 172 patients with a syndrome of pain dysfunction of temporomandibular joint have been under the survey. All patients have been examined according to the scheme including subjective, objective and express methods.

Results: of the research allowed revealing that at 30% of patients the syndrome of pain dysfunction of temporomandibular joint has been caused by disk dislocation. Upon termination of the treatment which has been carried out by the scheme, the normalization of relationship of joint elements has been observed.

Conclusion: when the diagnosis of syndrome of pain dysfunction of temporomandibular joint is proved, it is necessary to apply complex treatment.

Keywords: temporomandibular joint, pain dysfunction syndrome, complex treatment.

Introduction:

Actual problems of modern dentistry are timely diagnostics and treatment of a widespread pathology of maxillofacial area – a syndrome of painful dysfunction temporomandibular joint (SPD TMJ). SPD TMJ has set of names: painful dysfunction TMJ, miofascial painful syndrome of face, dysfunction syndrome of TMJ, temporomandibular dysfunction, etc. Absence of a common opinion about an origin of the given disease, the combination of several symptoms and their inconstancy complicate diagnostics.

Symptoms of diseases TMJ meet at 35–55% of adult population. The majority of potential patients address to dentists concerning a syndrome of painful dysfunction TMJ. Thus sights at an etiology and pathogenesis the given clinical display are rather inconsistent that is one of the reasons of difficulty of diagnostics and treatment. At the same time anatomotografic features temporomandibular complex, complexity innervation, irradiation pains in various departments of an oral cavity, face, a head and a neck. Partly these circumstances it is possible to explain that differential diagnostics and, hence, accurate differentiation of a syndrome of painful dysfunction of this joint and others orofascial painful syndromes is rather not idle time for practical doctors. A large number of works are devoted to the diagnosis of diseases, but the basic methods till now remain clinical. In a clinical picture of disease allocate two periods – dysfunction TMJ and a painful spasm of chewing muscles. Disease can begin both with the first, and since the second period. However patients with SPD TMJ address to dentist in search of the decision of problems with a pain in maxillofacial area in the period of a painful spasm of chewing muscles, i.e. miofascial painful syndrome (MPS) more often. One of the diseases provoking the occurrence SPD TMJ, the dislocation of an intraarticulate disk TMJ which represents displacement of a disk from a surface of an articulate head and its jamming between elements TMJ is. Spasm of chewing muscles, especially lateral pterygoid muscles, the emotional and physical overstrain, stressful situations lead to functions of chewing muscles and further to a disk dislocation. In an etiology of a dislocation of a disk the trauma of articulate fabrics that is observed in the presence of premature contacts on separate teeth, non-uniform elusive occlusion off surface and other infringements tooth-jaw systems has great value.

The purpose: improvement of quality of diagnostics and treatment of patients with a syndrome of painful dysfunction TMJ by a choice of volume of medical events on the basis of an estimation of functional infringements tooth-jaw system and a general condition of patients.

Material and methods: The analysis of results of diagnostics and treatment of 105 patients with a syndrome of painful dysfunction TM is carried out the joint, arrived on

base of chair of surgical dentistry of Bukhara state medical institute in department of maxillofacial surgery of the Bukhara regional versatile medical centre, from them of 85% of women and 15% of men at the age from 19 till 48 years. All patients surveyed under the scheme including subjective, objective and special methods (studying of diagnostic models, occlusiograph, registration of movements of the bottom jaw, a computer tomography, electromyography). At collection of the anamnesis and survey of patients with complaints to pains in the field of chewing muscles and TMJ excessive mobility of the bottom jaw that is shown in the form of wide opening of a mouth at yawning, nibble the big piece of food etc., as a rule, is determined.

Diagnostic models studied an anthropometrical method. Estimated teeth, tooth alignments, a bite kind, occlusion contacts. Determine the direction of displacement of mandible, character occlusion a curve, super contacts, the sites causing blocking of movements of the mandible. Occlusiography conducted to all patients in central, forward and lateral occlusions for character studying closing teeth and tooth alignments.

For this purpose applied templates from basic wax which received by means of our device. At all patients registered movements in three directions: vertical, sagittal and transversal. Registration of movements was conducted from position central occlusion – for revealing of premature contacts of teeth-antagonists and, with is minimum separated tooth alignments, – for revealing of changes in elements TMJ and chewing muscles. Spiral computer tomography (SKT) conducted on spiral multiline tomography. Analysis SKT on sagittal reconstruction in position "a mouth is closed" conducted under the scheme. On sagittal reconstruction in position "the mouth is opened" studied structural changes and an arrangement of an articulate head in relation to articulate tubercle, degree of a disposition of a head of the bottom jaw. After carrying out of inspection at 30% of patients with a syndrome of painful dysfunction TMJ was the dislocation of an intraarticular disk TMJ is revealed. These patients have divided on two groups: control (25 persons) and the basic (37 persons). In control group of patients treated by the standard technique which included oral cavity sanitation, massage of chewing muscles, miogymnastics, alignment of the occlusal plane, rational prosthetics. Patients of the basic group treat by our technique.

Results: On the basis of the data received at inspection of 62 patients with a syndrome of painful dysfunction TMJ, the disk caused by a dislocation, have revealed the most typical complaints: a clicking arising suddenly at opening of a mouth on 2–3sm, restriction of opening of a mouth; a pain at lowering of the bottom jaw. Prescription of the beginning of disease at 74% of patients from 1 till 5 years, only 26% have addressed for the help on 2–7 day after the first blocking of a joint.

From the anamnesis founds out that 100% of patients repeatedly had a sensation of an obstacle in TMC at movements of the bottom jaw. Revealed at 82% of patients long unilateral chewing and bad habits prevailed. Stressful situations tested 5% of patients with a hypertonus of chewing muscles. The mental disturbances which have provoked a dislocation of a disk, diagnosed at 3% of patients. At objective inspection: opening of a mouth with deviation at 10% of patients; with defluxion in the sick party at 90%. Intact dentition observed at 57% of patients; partial absence of teeth at 43%, thus with secondary deformation of occlusion at 25%. Orthognathic bite 87% of patients had deep incisal overlapping of 13%. At palpation TMC and lateral pterygoid muscles on the amazed party have revealed a pain at all surveyed. Diagnostic models and oklyuziogram have revealed supracontacts in lateral occlusion at 64% of patients, in a lobby at 21% with vertical moving of teeth and at 15% of patients with intact dentition. At 100% of patients the amplitude of movements of the bottom jaw in contact to teeth-antagonists in the healthy party was less rates in 4 times and in the patient on 11.1%, forward on 24.4%; with is minimum separated tooth alignments in the healthy party there is less than rate on 27.6%, and in the patient of all on 12.6%, forward on 24.2%. On the basis of it is possible to draw a conclusion that in a joint there is a mechanic obstacle – the blocked disk limiting movements. According to a computer tomography, in slanting and face-to-face projections at 86% of patients with a dislocation of an intraarticular disk in position "the mouth is closed" and "the mouth is opened" contours of articulate surfaces accurate, equal, destructive changes of a bone fabric is not revealed and in 14% have found out morphological changes osteogenic joint elements. In complex treatment of such patients reasonably restriction of movement in a joint so that the head of the bottom jaw rotated on the longitudinal axis in relation to a disk and sliding of a head with a disk on a back slope was articulate tubercle minimum. One of the methods, allow to achieving it, the medical gymnastics is. Before mastering of all exercises of employment 3–4 times a day are conducted by the instructor or the doctor. Then the patient carries out exercises independently and number of employment lead up to 5–8 times a day. However curative measures not always are acceptable for the patient as demand a significant amount of free time, discipline and "cycling" of the patient on accomplishment of certain installations. Besides, for restriction of degree of opening of a mouth variety of orthopedic adaptations and designs is offered, however all of them have essential lacks. At electromyographic (EMG) researching in 86% of patients with a dislocation of a disk, changes of actually chewing and temporal muscles have not found out. After diagnosis confirmation start treatment. In comparison group (25 persons) patients treated by the stan-

dard technique which included oral cavity sanitation, massage of chewing muscles, alignment occlusion plane and rational prosthetics. Patients of the basic group (37 persons) conducted complex treatment. For pain and spasm elimination in lateral pterygoid muscle to all patients entered anesthetic solution. After anesthesia performed manual disk reposition. For this purpose it was necessary to rise behind the patient, a thumb of the right hand to establish on chewing surfaces of the bottom lateral teeth and other fingers on a body of the bottom jaw on the defeat party. Asked the patient to keep the bottom jaw in the weaken condition. With vibrating movements additionally weakened chewing muscles, took away the bottom jaw downwards and in the healthy party. These manipulations repeated until the disk returned in physiological position. Control was, free opening of a mouth without deviation (defluxion); plural contacts between teeth-antagonists. Thus eliminated the dislocation of the disk in 26% of patients, who applied on the first day (till 3 days), after disease origin. For relapse prevention diseases to patients recommended to limit lateral motions of the bottom jaw, to keep to a diet (acceptance of soft food) and to carry out myogymnastics within 2–3 months, for others 74% were prescribed a course of anesthesia (on 10 to the sick party in 1 day). Reposition conducted by the technique described earlier. After the tenth session of anesthesia and manual repositions of 70% of patients have solute physiological position of a disk, but 4% of patients did not manage to be made it, and they have been directed on a surgical treatment. Besides, to all patients recommended physiotherapeutic procedures (drug electrophoresis, laser therapy, massage of parotid-chewing area on 10 sessions). After treatment patients were on control survey (in 1, 3 and 6 months). 96% received a positive result.

Conclusion:

Being based on the data of inspection of 175 patients with a syndrome of painful dysfunction TMJ, to 62 patients the diagnosis has been exposed: "the Dislocation of an intraarticular disk of TMJ", 37 from them have appointed complex treatment. In the beginning conducted anesthesia lateral pterygoid muscles. In the first visiting normalization of mutual relations of articulate elements was recovered by 26% of patients. From 3 to 10 sessions it was required for reposition of a disk of 70% of patients. Simultaneously all have appointed myogymnastic and physiotherapy, 56% of patients have conducted the selective grinding. Sedative preparations have appointed 5% of patients, antidepressants and neuroleptics under supervision of the psychotherapist of patients of 3%. For prevention of relapse of disease recommended keeping to a diet, to limit opening of a mouth and regularly to conduct myogymnastics.

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EPIDEMIOLOGY, ETIOLOGY AND PATHOGENESIS OF INTRAUTERINE INFECTION

Abstract. In recent years, much attention is paid in the world literature placental growth factor (EDF), which are biologically active compounds that stimulate or inhibit the division and differentiation of various cells, including controlling the process c initial stages of placental development [1; 2; 4].

Keywords: placental growth factor, vascular endothelial growth factor.

In the development of the infectious process in the fetus, the type of pathogen, its virulence, ways of infection from mother to fetus, protective reserves of the mother's body and the ability of the fetus to immune response are important [11].

According to modern data [10; 12], the number of cases of IUI varies widely from 6 to 70%. Recently, the structure of infectious morbidity of pregnant women, parturient and puerperal, as well as the fetus and newborn has changed [5; 8]. It is proved that the causative agents of IUI are more than 27 types of bacteria, many viruses, parasites, 6 types of fungi, 4 types of protozoa and rickettsia. Thus, according to a number of researchers [8; 12], chlamydia (17–50%) and viruses (herpes simplex virus, HSV – 7–47%, cytomegalovirus, CMV – 28–91.6%) are considered to be the predominant pathogens of antenatal infections., enteroviruses – 8–17%). Pathogens of intranatal infections are group B streptococcus (3–12%), staphylococcus (1–9%), fungi of the genus Candida (3–7%). Associations of pathogens occupy a leading position (75–95%).

It is known that most bacteria exist in nature in the form of specifically organized biofilms (biofilms) [2; 5; 7]. This form of existence creates a host of advantages for bacteria. Bacteria in biofilms have an increased survival rate in the presence of aggressive substances, immune protection factors and antibiotics [2]. In this regard, one of the main problems of practical medicine is the problem of treating diseases of microbial origin.

In our study [5; 7], the results of bacteriological analysis of the species composition of the vaginal biotope revealed the strongest effect of Streptococcus faecalis (p = 0.00171), E. coli (p = 0.01424) and Staphylococcus epidermidis (p = =0.02714) for the implementation of intrauterine infection of the fetus. When evaluating pathogens detected in the cervical canal of pregnant women by the polymerase chain reaction (PCR) and enzyme-linked immunosorbent assay (ELISA), the following was established: in the group without IUI, mycoplasma, chlamydia and urea plasma were 8%, CMV – 20%, HSV – 36%, Candida – 3%, associations – 60%. In the analysis of the group of newborns with the implementation of IUI, the most frequent pathogens were identified. So, mycoplasmas, chlamydia and HSV were found in 50%, CMV infection was detected in 45% of cases, urea plasmas (20%) and candida

(15%) were less common, associations were observed in 95%. The frequency of detection of pathogenic pathogens in newborns with signs of IUI was higher than in patients without infection.

In the pathogenesis of IUI, there are "maternal", "subsequent", "fruit" stages of development [2]:

The "maternal" stage reflects the beginning of the infectious process within the lower parts of the urogenital tract.

"Sequential" stage occurs with hematogenous spread of the inflammatory process, occurs when bacteremia and viremia.

At the "fruit" stage, the infection process spreads to the organs and tissues of the fetus. This occurs when the uteroplacental and placental-fruiting antimicrobial barrier is insolvent, the boundary of which is the layer of the chorale epithelium.

The main source of infection with IUI is the mother of the child, from which the pathogen enters the fetus (vertical transmission mechanism). In this case, infection occurs both in the ascending, trans placental and transovarial ways, and by contact and aspiration (directly during childbirth) ways. Moreover, for antenatal infections, hematogenous is the most typical, and for intrapartum infections, the ascending infection pathways [4; 10].

The impact of IUI on the embryo and fetus is the effect of a complex of the following factors [22]:

1. Pathological action of microorganisms and their toxins (infectious disease, fetal hypoxia, delayed development of the fetus).

2. Violation of the process of implantation and placentation (low placentation, placenta previa).

3. Reduction of metabolic processes and immune protection of the fetus.

In the pathogenesis of the emergence and development of IUI, the duration of pregnancy is of particular importance [3; 6]. A fetus up to 14 weeks of pregnancy does not respond to infectious antigens, since it lacks immunocompetent cells, immunoglobulins and does not show immune reactions. With the onset of the second trimester of pregnancy, the mechanism of the impact of an ascending infection changes due to the fusion of decidua vera and decidua's capsular is into a single decidua's parietals complex. At this time, an ascending

infection can penetrate to the fetus from the vagina or cervical canal. From this period of pregnancy, the internal pharynx of the cervical canal comes into contact with the water membranes of the fetus and, in the presence of infection, microorganisms penetrate into the amniotic fluid. The antimicrobial properties of the amniotic fluid acquire only after the 20th week of pregnancy, when an inflammatory proliferative reaction develops in response to the effect of an infectious agent, limiting further infection penetration, due to the appearance of lysozyme, complement, interferons, immunoglobulins [1; 7]. In the third trimester of pregnancy, antibacterial protection of amniotic fluid increases. During this period, the role of the exudative component prevails in the inflammatory reaction of the fetal tissues, when inflammatory leukocyte reactions develop in the fetus (encephalitis, hepatitis, pneumonia, interstitial nephritis) in response to infection penetration [6].

Especially dangerous when IUI in the II and III trimesters of pregnancy is damage to the fetal brain, which can lead to mental retardation, delayed psychomotor development of children [3; 7]. Intrauterine infection by the pathogens of the CNS structures in the fetus is accompanied by various severe abnormalities in the formation of the brain (hydrocephalus, sub ependymal cysts, cystic degeneration of the brain substance, abnormalities of the cortex, microcephaly). It is also possible the development of ventriculitis (deformity of the choroid plexus, heterogeneity or doubling of reflection from ependymal of the ventricles) [11].

Thus, infection of the fetus in the later stages of pregnancy does not, as a rule, lead to the formation of gross malformations, but can disrupt the functional mechanisms of cell and tissue differentiation [10; 11].

Changes in the state of the fetus and the functioning of the fetoplacental system, caused by intrauterine infection of the fetus, affect the composition and properties of the amniotic fluid [1; 9; 26; 30]. When injected into the amniotic fluid of an infectious agent, its unhindered reproduction occurs with the subsequent development of chorioamnionitis [1; 9]. The fetus finds itself in an infected environment, which creates favorable conditions for the infection of the fetus by contact, i.e. through the skin, mucous membranes, respiratory and gastrointestinal tracts.

The syndrome of "amniotic fluid infection" develops, the mechanism of its occurrence is as follows [2]:

1. Upon ingestion and aspiration of infected water in a newborn, signs of intrauterine infection appear (pneumonia, enter colitis, vesicles, omphalitis, conjunctivitis, etc.).

2. At the same time, microorganisms, spreading through the membranes or between them, reach the basal plate of the placenta (deciduitis). The further spread of the inflammatory reaction leads to the development of choronitis (placentitis),

manifested by leukocyte infiltration of intravillus space and endovascular ties in the chorial plate. Vasculitis in the decidua membrane, stem and terminal villi lead to vascular obliteration, the appearance of heart attacks, calcifications, massive fibrinous deposits, which may manifest as "premature maturation of the placenta."

3. Polyvascular infection during intrauterine infection is usually secondary and is a manifestation of kidney or urinary tract infections of the fetus. The reason for its development is the change in the ratio of the processes of production and resorption of amniotic fluid by the cells of the amniotic epithelium against the background of amnionitis.

4. In the genesis of the symptom complex of placental insufficiency with IUI, the main role belongs to vascular disorders.

5. A typical manifestation of intrauterine infection are miscarriage and premature birth [24]. Premature development of labor and untimely rupture of the fetal membranes are caused by the action of bacterial phospholipases that trigger the prostaglandin cascade and the damaging effect of inflammatory toxins on the fetal membranes.

6. Due to the fact that the phospholipases of gram-negative bacteria contribute to the destruction of surfactant in the lungs of the fetus, the newborn develop respiratory disorders.

In the modern literature [4; 9] there are many works devoted to the study of the relationship of immunological parameters and the severity of the infectious-inflammatory process during pregnancy. Increasingly, in the foreign and domestic literature, data appear on the relationship of bacterial invasion and cytokine synthesis by the cells of the amnion, chorion, decidual and fetal tissues [5]. The reproduction of microorganisms in the amniotic fluid leads to an increase in the level of lipopolysaccharides, which activate the synthesis of cytokines by fetal trophoblast cells. The study of changes in the cytokine system, which provides the processes of intercellular cooperation, growth and differentiation of lymphoid cells, hemopoiesis and neuroimmune-endocrine interactions, seems promising for IUI. In the pre-implantation period and during the development of pregnancy, cytokines are actively produced by a multitude of maternal and fetal cells, in particular, by deciduae cells of the uterus and trophoblast cells. It has been established that cell cultures have unequal ability to synthesize cytokines under the influence of lipopolysaccharides. Thus, tumor necrosis factor (TNF) is produced by amnion cells, interleukins (IL) –6 and IL-8 are produced by amnion and chorion, and IL-1 is produced only by chorion [9]. According to N. V. Ordzhonikidze [14], from a variety of pro-inflammatory (IL-1, IL-2, IL-6, IL-8, IL-15, TNF, etc.) and anti-inflammatory (IL-4, IL-10, IL-13, transforming growth factor and others. Cytokines are considered to be the

main markers of the inflammatory process in human tissues and organs: IL-1, IL-6, IL-10, TNF [9].

Modern methods of diagnosis of intrauterine infections

The prevalence of IUI among the causes of adverse outcomes, the high level of infection in pregnant women and puerperas necessitate the search for reliable methods for its diagnosis. The no specificity of the clinical manifestations of IUI creates diagnostic difficulties, which dictates the need for the combined use of clinical and laboratory research methods. In the last decade, bacteriological and immunological methods have been the main diagnostic methods for IUI [10; 11].

There are 3 stages in the diagnosis of intrauterine infection: 1) diagnosis during pregnancy; 2) early diagnosis at the time of childbirth; 3) diagnosis in the development of clinical signs of infection in the early neonatal period [11].

Of the non-invasive methods of prenatal diagnosis of IUI, the most informative are ultrasound and Doppler sonography [6; 7]. Direct methods of laboratory diagnostics (cordocentesis, dark-field microscopy, PCR, ELISA, culture) can detect the pathogen in biological fluids or tissue biopsies of an infected child. Indirect methods of diagnosis of IUI include the clinical symptoms of the mother, ultrasound and help only to make a presumptive diagnosis of IUI [10]. Screening tests of IUI in newborns include examinations of smears of amniotic fluid, placenta, umbilical cord blood culture and contents of the stomach of a newborn, sometimes blood culture [6; 7; 10]. The "gold standard" of post-diagnosis of IUI is a histological examination of the placenta, umbilical cord and fetal membranes [4; 10].

Any changes in homeostasis in the mother's body are reflected in the cellular and chemical indicators of the amniotic fluid, which very subtly characterize the course of the pathological process, and therefore the amniotic fluid can serve as an important diagnostic material [1; 6]. According to I. V. Bakhareva [1], the most significant in the diagnosis of IUI is the determination of the antimicrobial activity of amniotic fluid, based on the migration of leukocytes in it when bacteria accumulate in the amniotic membrane, exceeding 103 CFU / ml. The appearance in the amniotic fluid of a large number of leukocytes, an increase in cytosis due to epithelial cells without the detection of microflora may indicate IUI.

Currently, great importance is attached to ultrasound research methods, which can be used to determine indirect signs of fetal IUI (polyhydramnios, ventriculomegaly, microcephaly, hepatomegaly, an increase in the thickness of the placenta, fine suspension in the amniotic fluid) and structural changes in various organs [4; 11].

We have developed the necessary list of diagnostic measures for the early detection of IUI [19].

The complex survey of pregnant women included:

1. General clinical and biochemical blood and urine tests with the definition of standard indicators.

2. Determination of TORCH-complex pathogens using PCR in vaginal smears, amniotic fluid.

3. Determination of antibodies in the blood to chlamydia, mycoplasmas and ureaplasmas, CMV and HSV by ELISA.

4. Conducting amine test, pH-metry vaginal contents.

5. Bacterioscopic examination of the contents of the vagina, cervical canal and urethra.

6. Bacteriological examination of the maternal surface of the placenta, amniotic fluid, intestinal contents.

7. Determination of the level of pro-inflammatory (IL-1β, TNF) and anti-inflammatory (IL-10) cytokine in the amniotic fluid, maternal venous serum and fetal umbilical cord blood.

8. Ultrasound scan of the fetus, amniotic fluid and placenta.

9. Histomorphological study of the placenta.

The complex examination of newborns included:

1. Apgar score, measurement of body weight and length at birth, dynamics of increase in body weight before discharge from the maternity hospital.

2. Determination of antibodies in the blood to chlamydia, mycoplasmas and ureaplasmas, CMV and HSV by ELISA.

3. Bacteriological examination of scrapings from the conjunctiva, posterior pharyngeal wall and vulva.

4. Identification of clinical signs of IUI together with a neonatologist.

A comprehensive study of the species composition of microorganisms of the birth canal, amniotic fluid, placenta, newborn, determination of antigens and antibodies to the suspected causative agent in cord blood and amniotic fluid, histological examination of the afterbirth can determine the pathway of infection of the child, the nature of the pathogen and clarify the amount of additional diagnostic studies in IUI also identify therapeutic and preventive measures in the early neonatal period.

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RISKS OF SMALL FOR GESTATIONAL AGE BABIES: STUDY IN UZBEKISTAN

Abstract. Intrauterine growth restriction (IUGR) is an important cause of fetal, perinatal and neonatal morbidity and mortality. Neonates with IUGR experience acute problems in the perinatal and early neonatal period that can be life-threatening. The identification and description of maternal and newborn risk factors associated with an increased risk for SGA in a particular country is of obvious interest. The aim of this paper is to quantify and to describe risk factors of small for gestational age birth in Uzbekistan as one of developing countries.

Keywords: small for gestational age, risk factors, cohort study.

Background

Intrauterine growth restriction (IUGR) is an important cause of fetal, perinatal and neonatal morbidity and mortality. Neonates with IUGR experience acute problems in the perinatal and early neonatal period that can be life-threatening. Small for gestational age (SGA) is considered as an indicator of intrauterine growth restriction, and has been associated with neonatal mortality and morbidities as well as with major medical problems across the life course. Long term follow up studies have shown that IUGR babies are more likely to develop coronary artery disease, hypertension and diabetes [2; 9], the so-called insulin-resistance syndrome or syndrome X [7].

World over, IUGR is observed in about 24% of newborns; approximately 30 million infants suffer from IUGR every year [3; 10]. The incidence of IUGR is six times higher in underdeveloped/developing countries when compared to that in developed countries, and this incidence can be further high in lower- and middle-income countries, as many infants are born in home with no birth records. The burden of IUGR is concentrated mainly in Asia which accounts for nearly 75% of all affected infants [5].

Multiple maternal and newborn characteristics have been identified as risk factors for SGA and it is well known that they vary between different populations. Risk factors may be related to population variations in nutrition, education, family income, smoking habits, drug use, domestic violence, marital status, age and race [4]. Therefore, the identification and description of maternal and newborn risk factors associated with an increased risk for SGA in a particular country is of obvious interest.

The aim of this paper is to quantify and to describe risk factors of small for gestational age birth in Uzbekistan as one of developing countries.

Patients and methods

We performed historical cohort study involved 3793 singleton birth that have taken place between 2010 and September 2014 in Tashkent.

We excluded cases with multiple pregnancies (n = 23), congenital malformations (n = 12), cases with birth weight less than 500 g, (n = 46) and low quality medical records (n = 190). At final analysis we had 3522 cases. Thereafter, we stratified the population by gestational age into preterm (< 37 gestational weeks), term (≥ 37 and < 42 gestational weeks) and post-term babies (≥ 42 gestational weeks). Small for gestational age babies were defined if they had birthweight was less 10th percentile. In the frame of our study we select maternal and fetal factors that commonly associated with low birthweight.

All variables were analyzed by Student's t-test. Association between studied factors and outcomes of interest were assessed by calculation of odds ratios (ORs) and 95% CIs. Statistical significance was assumed at $P < 0.05$. Statistical analyses were performed using STATA V.14.0 (College Station, StataCorp LP, Texas, USA).

Results

Studied risk factors and SGA rate according to gestational age strata are presented in Table 1. SGA babies were more likely were born among preterm (14.96%), than among term (9.64%) and posterm categories (10.99%). Interestingly, preterm girls were slightly more likely to be SGA than posterm girls. Meantime male newborns were by 94,7 g heavier than female newborns (p < 0.000), and after correction for gestational age this difference increased to 102.86 g (p < 0.000).

Being first born was associated with higher risk of SGA regardless newborn's gender. First- and second-born SGA rates were 14.3% and 10.1%, respectively; compared with the firstborn, the second-born had a lower risk of being SGA (OR = 0.71).

Short inter-pregnancy intervals (less than 1 year) in comparison to inter-pregnancy intervals of 1–2 years, were followed more often by preterm birth (11.1% versus 6.3%; OR – 1.86; 95% CI 0.86–4.04) and small for gestational age babies (15.79% versus 14.08%; OR1,14; 95% CI 0.38–0.43).

The rate of preterm and small for gestational age babies among group of women younger 25 years of age with interpregnancy intervals less than 1 year was 14.81%. In comparison, in referral group involved women aged 25–29 years and interpregnancy interval of 1–2 years, these figure was 15.52%. In category of oldest pregnant women (more than 35 years) with short interpregnancy intervals the rate of preterm and small for gestational age babies was registered at the level of 22.22%.

Additionally we found, that hypertension (all types of hypertensive disorders in pregnancy) delivery of low birthweight baby was more likely in the case of preterm than posterm pregnancy.

Vast majority of women in cohort were married or living in civil marriage (n = 3073). Among no-married (i.e. divorced/widowed, single) probability of giving birth SGA baby was higher and absolute percentage difference was 2.01 for divorced/widowed and 2.19 for single women. Odds ratios

for these categories was – 1.24 (95% CI = 0.79–1.92) and 1.26 (95% CI = 0.84–1.89) respectively.

Among women with SGA firstborns, 28% had recurrent SGA infants. This recurrent SGA group made up 4% of all second births and contributed to 40% of all SGA second births.

Rate of SGA was not significantly differ from male and female newborns. Meanwhile, subsequent deliveries were associated with decreased risk of birthweight deficit. Compared to siblings born later, firstborns were more likely develop birthweigh deficit in the case of term or posterm deliveries. SGA rate was higher if interpregnancy intervals were less than 1 year, and this was irrespective of gestational age at delivery. Women with history of low weight births had high risk of reccurence SGA babies, and this was either irrespective of gestational age at delivery. The study also found that risk of SGA is higher in women older 35 and younger 25 years as well as smokers, passive smokers and women who were not in family relations.

Table 1.– Studied risk factors and SGA rate in cohort

	General N = 3522	Preterm N = 177	Term N = 3154	PostermN = 191
	SGA_{gen} (n = 351; 9.96%)	SGA_{pret} (n = 26; 14.69%)	SGA_{term} (n = 304; 9.64%)	SGA_{post} (n = 21; 10.99%)
1	*2*	*3*	*4*	*5*
Gender				
Male	1863(8.48)	90(14.44)	1676 (8.17)	97 (8.25)
Female	1659 (11.63)	87 (14.94)	1478 (11.30)	94 (13.83)
Birth order				
First	1390 (11.58)	59 (15.25)	1244 (11.33)	87 (12.64)
Second	1129 (8.41)	69 (10.14)	1009 (8.33)	51 (7.84)
Third and more	1003 (9.47)	49 (20.41)	901 (8.77)	53 (11.32)
Interpregnancy interval (years)				
<1	571 (27.32)	38 (15.79)	486 (28.40)	47 (25.53)
1–2	1205 (8.22)	71 (14.08)	1039 (8.18)	89 (5.62)
>2	1746 (5.50)	68 (14.71)	1629 (4.97)	55 (7.27)
History of SGA				
No	3442 (9.70)	170 (13.53)	3088 (9.49)	184 (9.78)
Yes	80 (21.25)	7 (42.86)	66 (16.67)	7 (42.86)
Maternal age (years)				
<25	1530 (11.90)	81 (14.81)	1360 (11.69)	89 (12.36)
25–29	1216 (8.31)	58 (15.52)	1094 (7.68)	64 (12.50)
30–34	548 (7.85)	29 (10.34)	496 (8.06)	23 (0.00)
>35	228 (10.96)	9 (22.22)	94 (22.34)	15 (13.33)
Hypertensive disorders				
«yes»	233(30.04)	14 (42.86)	210 (29.05)	9 (33.33)
«no»	3289 (8.54)	163 (12.27)	2944 (8.25)	182 (9.89)
Smoking				
Non-smokers	3037 (9.61)	144 (13.89)	2722 (9.33)	171 (10.53)

1	*2*	*3*	*4*	*5*
Smokers	52 (13.46)	12 (16.67)	32 (12.50)	8 (12.50)
Passive smokers	433 (12.01)	21 (19.05)	400 (11.50)	12 (16.67)
Marital status				
Married/civil marriage	3073 (9.70)	121 (14.05)	2811 (9.43)	142 (11.27)
Divorced/widowed	205 (11.71)	25 (16.00)	159 (11.32)	21 (9.52)
Single	244 (11.89)	31 (16.13)	184 (11.41)	28 (10.71)
Nationality				
Uzbek origin	2632 (10.03)	130 (14.62)	2355 (9.43)	147 (10.20)
Others	890 (10.00)	47 (14.89)	799 (10.26)	44 (13.64)
First trimester vaginal bleeding				
«yes»	260 (21.15)	20 (50.0)	227 (16.74)	13 (53.58)
«no»	3262 (9.1)	157 (10.19)	2927 (9.09)	178 (8.43)

Table 2.– Associations between maternal and fetal characteristics and SGA
in the whole population of babies and in gestational age strata

	SGA(general) OR (95% CI)	SGA (preterm) OR (95% CI)	SGA (term) OR (95% CI)	SGA (posterm) OR (95% CI)
Gender: male (reference)				
Female	1.42 (1.14–1.77)	1.04 (0.45–0.39)	1.43 (1.13–1.82)	1.79 (0.70–4.53)
Birth order: first (reference)				
Second	0.70 (0.54–0.92)	0.63 (0.22–0.80)	0.71 (0.54–0.94)	0.59 (1.77–1.95)
Third and more	0.80 (0.61–1.04)	1.43 (0.53–0.85)	0.75 (0.56–1.01)	0.88 (0.31–2.54)
Interpregnancy interval:1–2 years (reference)				
<1	4.13 (3.14–5.44)	1.14 (0.38-.43)	4.45 (3.31-.99)	5.76 (1.89–17.57)
>2	1.59 (1.19–2.12)	0.95 (0.37–0.45)	1.70 (1.24-.33)	0.76 (0.20–2.96)
History of SGA: "No" (reference)				
"Yes"	2.55 (1.48–4.42)	4.79 (1.01–0.81)	1.91 (0.99-.69)	9.28 (1.74–49.41)
Maternal age: 25–29 (reference)				
<25	1.46 (1.11–1.93)	1.35 (0.46–3.97)	1.47 (1.09-.98)	1.37 (0.46–4.04)
30–34	0.97 (0.65–1.43)	0.81 (0.18–3.69)	1.04 (0.69-.57)	
>35	1.40 (0.87–2.25	2.00 (0.32–12.46)	1.36 (0.81–2.29)	1.35 (0.24–7.81)
Hypertensive disorders: "No" (reference)				
"Yes"	4.60 (3.39–6.24	5.36 (1.69–17.06)	4.55 (3.29–6.30)	4.56 (1.05–19.79)
Smoking: Non-smokers (reference)				
Smokers	1.46 (0.65–3.27	1.24 (0.25–6.08)	1.39 (0.48–3.99)	1.21 (0.144
Passive smokers	1.28 (0.94–1.76	1.46 (0.45–4.78)	1.26 (0.91–1.76	1.70 (0.35–8.38)
Marital status: Married/civil marriage (reference)				
Divorced/widowed	1.24 (0.79–1.92)	1.17 (0.36–3.81)	1.23 (0.74–2.04)	0.83 (0.18–3.89)
Single	1.26 (0.84–1.89	1.18 (0.40–3.48)	1.23 (0.77–1.97)	0.95 (0.26–3.49)
Nationality: Uzbek origin (reference)				
Others	1.11 (0.87–1.42)	1.39 (0.50–3.83)	1.10 (0.84–1.44)	1.39 (0.50–3.83)
First trimester vaginal bleeding: "No" (reference)				
"Yes"	2.69 (1.95–3.71)	3.39 (3.19–24.38)	3.10 (1.39–2.91)	3.39 (4.04–6.26)

Discussion

Our study reassessed well known maternal and newborn risk factors for SGA applicable to Uzbekistan population. Generally we could conclude that risk factor for our population is not differ from other regions of the World. Meantime, in our study we found difference in the incidence of SGA infants depending on gestational age strata. Especially high incidence of SGA we found for preterm strata. It is in line with other studies where authors indicate that high incidence of preterm SGA can have multiple causes and one of them the way antenatal care provided [12]. The other is gender-based difference. It has been reported that boys are more likely to be born before term in a different of populations [15]. In our cohort we registered reversal findings. Odds ratio to be SGA is higher for female newborns.

We also find that short IPI of les than 1 year is a major risk factor for SGA in general cohort as well as in strata. We fully agree with authors who suggest that adverse neonatal outcomes after short IPI arise due to insufficient recovery of depleted maternal folate levels and other nutrients prior to the second pregnancy [11; 13].

The massive of evidence indicates that smoking is a major risk factors not only for low birthweight but for others serious perinatal complications. Traditionally the rate of smoking among women in Uzbekistan is quite low and according to local authorities data is less than 1%. While the low smoking rate among women can be explained cultural features, the rate of passive smoking remains quite high. In our study we registered that passive smoking exposure was associated with SGA and we can suggest that severity of this condition has a dose-response relationship to the number of smokers in the home. In fact this reliance was confirmed by Ko TJ et al. [8] and Fantuzzi G et al. [6].

Among major risk factors of perinatal and obstetrical complications for our population we would like to mention hypertensive disorders in pregnancy. In our study, the SGA rate in women with hypertensive disorders was significantly higher, which is consistent with the results of various studies in the literature [1; 14].

In conclusion, our study aimed to describe risk factors associated with SGA for Uzbek population. We could confirm that majority of maternal and newborn characteristic, as well as abnormalities, generally associated with SGA, are applicable for women, living in Uzbekistan. At the same time we found that short interpregnancy intervls, passive smoking and hypertensive disorders are most significant factors. pregnancies and mothers with known this conditions might be followed-up more closely with respect to the increased risk of SGA.

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SPEECH INTELLIGIBILITY AS A CRITERION OF THE FUNCTIONAL CONDITION OF THE CENTRAL PARTS OF THE AUDITIVE ANALYZER IN PATIENTS WITH OTOSCLEROSIS

Abstract.

Keywords:

Introduction

Speech intelligibility analysis (SI) is an important criterion in assessing the functional state of the organ of hearing and the effectiveness of therapeutic and rehabilitative measures [2]. In the literature on otosclerosis, one of the clinical key symptoms of otosclerosis indicates a violation of SI. Along with this, it is not specified in what form it can often be found. There is no need for an in-depth explanation of the presence of this symptom of otosclerosis in a cochlear form or in a mixed form with a predominance of impaired sound perception. Observations from practice show that a violation of SI can be one of the earliest manifestations of the tympanic form of otosclerosis. All this confirms the opinion of many authors about the presence of abnormalities in all parts of the organ of hearing, as well as other systems of the body in otosclerosis. Analysis of the literature of recent years has shown an increase in research devoted to the study of the central parts of the auditory analyzer with the predominant lesion of the sound-conducting part of the organ of hearing [6]. The presence of central hearing disorders significantly reduces the effectiveness of hearing-improving operations and limits the possibilities of surgical treatment. Their timely detection, on the one hand, allows to avoid excessive expectations from surgical treatment by the patient, and on the other hand, serves as the basis for the appointment of special drug therapy [4].

Only speech, as a social category, can serve as the final criterion for the functional assessment of hearing. Speech audiometry is an improved form of studying the perception and intelligibility of whisper and colloquial speech, has a certain value in the diagnosis of various forms of hearing loss. It is widely implemented to diagnose hearing loss and as a control to restore socially adequate hearing in patients after a reconstructive hearing-improving operation to assess its effectiveness [3]. The purpose of this study was to study the diagnostic significance of speech audiometry in assessing the functional state of the central parts of the organ of hearing in patients with operable forms of otosclerosis.

Materials and research methods

We examined 193 patients with otosclerosis aged 20 to 52 years (mean age 36 ± 7.5). Depending on the form of otosclerosis, the patients were divided into 2 groups: 1 group – patients with tympanic otosclerosis – 129 patients, 2 group – patients with mixed form otosclerosis – 64 patients. The level of SI was evaluated depending on the duration of the disease and the degree of hearing loss. In this regard, each group is separately divided into 3 subgroups: the 1st subgroup is patients with a disease duration of not more than 3 years, the 2nd subgroup is for patients with a disease duration of 3–7 years, and the 3rd subgroup is for patients with a disease duration more than 7 years. A total of 193 ears were examined. In the distribution of patients into groups, taking into account the duration of the course of otosclerosis, was based on the recommendation of F. Syroezhkina et al. [4]. According to them, the compensatory mechanisms of the auditory system in a period of up to 3 years allow stabilizing the effects of reducing auditory stimulation. Subsequently, signs of sensory impairment of the auditory system of the central level appear. A significant deterioration, a kind of decompensation of higher auditory functions, occurs in patients suffering from hearing loss for more than 7 years. Each subgroup was analyzed separately, depending on the degree of hearing loss. At the same time, subgroups of patients with tympanal and mixed otosclerosis were also studied depending on the degree of hearing loss.

The control group consisted of 20 with normal hearing (12 women, 8 men) aged 25 to 50 years (mean age 35 ± 8.2).

All patients underwent the necessary clinical and audiological examination (examination of complaints, anamnesis,

otomicroscopic examination, tone threshold audiometry, impedancemetry, speech audiometry).

Speech intelligibility in patients was assessed using speech audiometry monaurally via headphones. The thresholds for 100% speech intelligibility were determined. To perform a speech audiometry, an installation was used that included: an AD-629e audiometer from the company "Interacoustics" (Denmark), into the input jack of which an audio player was connected, TDH39 headphones, discs with recording tables. Used the phonogram "Test of words of real speech" by G. I. Greenberg and L. R. Zinder, and for the Uzbek population "Test words in the Uzbek language" S. K. Agzamova [1]. The words pronounced by the speaker were recorded on a CD using high-quality acoustic technology. All words were pronounced equally loudly, which in the conditions of studio recording is controlled by special equipment. The speaker was a woman.

When registering the results, only the exact reproduction of all phonemes of the heard word by the subject was taken for the correct answer. At the end of the study, the percentage of correctly reproduced words was calculated. In our study, where 50 words were used, each correctly repeated word corresponded to 2%.

Research results

Based on the tonal threshold audiogram, the average level of hearing at speech frequencies before the operation in the group with the tympanic form of otosclerosis was 52.8 dB, in patients with a mixed form of otosclerosis – 64.3 dB. The average level of hearing in the control group was 5.2 dB.

In the control group, 20 percent (%) SI of words and phrases was achieved when the volume of the sound was increased to 24.5 dB, 50 percent of the SI at gain of up to 30.5 dB, and 100% of the SI at a sound level of 46.5 dB. In the group of patients with tympanal and mixed forms of otosclerosis, 50% SI was achieved with a 25–40 dB increase in sound from the average hearing threshold, and in the group with a mixed form of otosclerosis – by 35–45 dB. In order to achieve 80 SI, high and low frequency words and phrases were amplified in patients up to 40–60 dB.

On average, the index of SI in patients with tympanic otosclerosis was 92.7%, in patients with a mixed form – 78.8%.

In patients with the tympanic form of otosclerosis, with the first degree, SI was 99%, with the second degree – 95.9%, and with the third degree – 87.2%.

In patients with a mixed form of the second degree, the SI was 88%, with the third degree – 81%, with the fourth degree – 71.8%.

In patients with tympanic otosclerosis, 98–100% SI was achieved in 33 patients, SI ranging from 90 to 96% was detected in 62 patients. In 31 patients, SI was reduced from 88 to 80%, and in 3 patients, speech intelligibility was 70–78%.

In the group of patients with a mixed form of the disease, 100% SI was not achieved in any case. Those. further amplification of sound did not improve intelligibility. In 13 patients with a mixed form of the disease, it was not possible to raise the volume of the words delivered to a sufficient level in order to assess the maximum intelligibility of speech due to a sharp decrease in the hearing threshold. In this group, only one patient had a maximum SI of 90%. SI ranging from 80 to 88% was detected in 23 patients, in 25 patients, SI was 70–78%, and in 2 patients, SI was 68%.

A sharp decrease in SI in patients with a mixed form is also due to the fact that they did not experience first-degree hearing loss, and 3rd and 4th degrees of hearing loss were also more common. And among patients with the tympanic form of patients with a fourth degree of hearing loss was not.

We analyzed the dependence of the degree of SI on the duration of otosclerosis at different degrees of hearing loss. At the same time, indicators indicating a certain correlation were identified (if this term is used, it is necessary to calculate the correlation coefficient) (Table 1).

Thus, in patients with tympanic otosclerosis with a disease duration of less than 3 years, the SI was 98%, whereas in patients with a disease duration from 4 to 7 years – 93.3%, and among patients with a disease course of more than 8 years – 86.1%. Among patients with a mixed form of otosclerosis, these indicators were – 87.3%, 79.7% and 75.7%, respectively.

Table 1. – Speech intelligibility in the group with the tympanal form of otosclerosis depending on the duration and degree of hearing loss

The duration of the hearing loss	Levels						AS
	I		II		III		
	NP, abs	SI,%	NP, abs	SI,%	NP, abs	SI,%	
1	2	3	4	5	6	7	8
Till 3 years of age	2	100	15	100	1	98	
			9	98	2	96	
			3	96	4	94	
					1	92	
Medium SI				98.8		94.7	98%

1	2	3	4	5	6	7	8
Age 4–7	2	98	4	98	1	92	
			19	96	7	90	
			13	94	6	88	
					4	86	
Medium SI				95.5		88.5	93.3%
Age 8 and up			2	94	1	90	
			5	92	5	88	
			3	90	3	86	
			1	88	3	84	
			1	86	4	82	
					4	80	
					3	78	
Medium SI			91			83.5	86.1%

AS- average in subgroups;
NP – the number of patients.

As can be seen from table 1, in the group with the tympanic form of otosclerosis, a direct correlation was observed between the deterioration of SI depending on the duration of hearing loss. These changes were most pronounced in the third degree of hearing loss. Thus, in patients with a third degree of hearing loss with a hearing loss of up to 3 years, the SI remained at a normal level, averaging 94.7%. With the duration of hearing loss from 4 to 7 years, the degree of SI on average decreased to 88.5%, and with a duration of more than 8 years, the SI decreased to 83.5%.

Among patients with a second degree of hearing loss with a duration of up to 3 years, the SI was 98.8%, with a duration of 4–7 years – 95.5%, and with a duration of the second degree of hearing loss more than 8 years, the SI was 91%. Thus, long-term and severe hearing loss led to a violation of SI, even in patients with the tympanic form of otosclerosis.

In patients with mixed-type otosclerosis with a disease duration of less than 3 years, the SI was 87.3%, whereas in patients with a disease duration from 4 to 7 years – 79.7%, and among patients with a disease course of more than 8 years – 75.7%.

In this group, with a second degree of hearing loss with a hearing loss duration of up to 3 years, the SI was 90%, in one patient with a hearing loss duration of 4 to 7 years, the SI degree was 86%.

Among patients with a mixed form with a third degree of hearing loss: with a hearing loss duration of up to 3 years, SI was 86.8%, with a duration of 4–7 years – 81.8%, and with a duration of more than 8 years – 78.1%.

Among patients with a fourth degree of hearing loss: with a duration of 4–7 years, the SI was 71.6%, and with a duration of more than 8 years, 72%.

Thus, in the group of patients with a mixed form of otosclerosis, the degree of deterioration of SI depended not only on the degree, but also on the duration of hearing loss (Table 2).

Table 2. – Speech intelligibility in a group with a mixed form of otosclerosis
depending on the duration and degree of hearing loss

| Duration | Levels of hearing loss | | | | | | AS |
| | II | | III | | IV | | |
	NP, abs	SI,%	NP, abs	SI,%	NP, abs	SI,%	
1	2	3	4	5	6	7	8
Till age 3	1	90	3	88	–		
			1	86			
			1	84			
Medium SI				86,8			873
Age 4–7	1	86	1	88	1	76	
			5	84	2	72	
			4	82	1	70	
			3	80	1	68	

1	2	3	4	5	6	7	8
Age 4–7			3	78	No	5	
Medium SI			81.8		71.6		79.7
Age 8 and up	-		1	86	3	74	
			1	84	4	72	
			1	82	1	70	
			1	80	1	68	
			3	78	No	8	
			5	76			
			2	74			
Medium SI			78.1		72.0		75.7

It should be noted that if in order to achieve maximum intelligibility of speech in the group of patients with a tympanic form of otosclerosis, 48.9 ± 4.18 dB were added to the average level of the hearing threshold, in the mixed form this figure was 54.7 ± 3.56 dB, whereas the control group, this figure was significantly less, amounting to 42 ± 2.4 dB. At the same time, to achieve the maximum level of speech intelligibility in patients with a tympanic form, the presented sound pressure level averaged 103.7 dB, and in patients with a mixed form, to achieve maximum speech intelligibility, the sound pressure level increased to 110.5 dB.

The resulting SI curves of patients with otosclerosis indicate that, with prolonged hearing loss, speech intelligibility improves with relatively greater amplification of sound than is normal. The manifestation of this phenomenon in patients with a tympanic form with the course of the disease for more than 4 years, and in patients with a mixed form indicates the involvement of the central parts of the auditory analyzer in otosclerosis.

These data indicate that patients with otosclerosis with a long course of both tympanic and mixed forms show not only a decrease in the SI value, but also an increase in the sound pressure level to achieve maximum SI, which can be considered as the possibility of hearing loss in these patients centers. Thus, the results of the study indicate that in otosclerosis, there is a violation of speech intelligibility. At the same time, speech intelligibility suffers in the group with a long course of otosclerosis, and at the same time has a dependence on the degree of hearing loss.

In the occurrence of violations in the SI matters not only the form of the disease, but mainly the duration of its course. It should also be noted that violations of these indicators in the mixed form are observed already during the first three years of the course of the disease, which indicates an earlier involvement of the central parts of the auditory analyzer.

The results of the study require further study of this issue in comparison with other methods of studying the pathways and central parts of the auditory analyzer.

Conclusion:

Disturbance of speech intelligibility in otosclerosis is observed both in tympanic and mixed forms. In patients with otosclerosis, speech intelligibility is 92.7% for the tympanic form and 78.8% for the mixed form.

The speech intelligibility rate correlated with the duration of the disease. With a hearing loss of up to 3 years, speech intelligibility with a tympanic form is 98%, with a mixed form 87.3%, with a hearing loss of 4–7 years – 93,3% and 79.7%, and with a hearing loss duration of more than 8 years – 86.1% and 75.7%, respectively, to the forms of the disease.

At the same time, in the mixed form, the disturbance of speech intelligibility was manifested already in the initial stages of the disease, and in the tympanic form, the speech intelligibility appeared after 4 years of the onset of the disease in the presence of a second degree of hearing loss.

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Section 7. Pedagogy

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ROLE OF THE HUMANITIES IN PROFESSIONAL MEDICAL EDUCATION

Abstract. Reforms of the system of higher education in Russia do not always entirely meet the goals of teaching future specialists. The target of training a sympathetic, compassionate doctor with the necessary amount of general cultural and general professional competencies can hardly be achieved in the conditions of constant reduction of the number of humanitarian disciplines and classroom hours allocated to their acquisition in the curriculum of medical students. As a result of the analysis of foreign experience of training future doctors the author of the article confirms the necessity and importance of studying the Humanities by students of medical schools in Russia.

Keywords: medical students, medical humanities, medical ethics, deontology, empathy, communicative competence, professional activity.

The medical school curriculum undergoes significant modifications as a result of constant reforms of the system of higher education in Russia. Nowadays there is a trend towards the reduction of the humanities in the syllabus of future doctors. The Ministry of Higher Education of the Russian Federation treats these changes as the "enforced measures," justifying all the transformations by the process of globalization, hence, the Russian system of higher education following the foreign models of training doctors should not lag behind the Western and European medical school. That is why the reforms will continue going.

Do we really deal with the devaluation of the Humanities? Is it possible today to train a humane doctor teaching only sciences? In order to answer these questions we will analyze the works of foreign authors and compare their viewpoints on the problem in focus.

50 years ago an English scientists and writer, Charles Percy Snow, initiated a debate on whether medicine could be treated as a science or an art, or an inseverable alliance. He did not see any progress of the society without the unity of science and the humanities [1].

Another outstanding American educationist, Abraham Flexner, the person who carried out the reform of the medical education in the United States of America one hundred years ago, wrote: "a professional physician is not the one who treats the illness, but who heals the human being." It was Abraham Flexner who insisted on the necessity to train future doctors both as scientists and humanists [3].

Modern medicine has achieved tremendous results in its development. It goes without saying that the scientific evolution goes along with the evolution of the society. The system of health care is getting more and more complicated due to a wide range of factors influencing its changes. Firstly, it is the process of commercialization of the modern medicine, secondly,– consumerism of modern patients. The increasing number of court trials, and the constant growth of demands which modern patients place on doctors impose additional responsibilities on medical workers. For a modern physician is not enough to be merely a highly-qualified specialist, he must know the laws, possess cognitive, communicative and behavioral skills, and the last but not least, he should also have managerial qualities. Needless to say that it is impossible to be a good doctor without the accurate knowledge of anatomy, physiology, histology, and a wide range of other major disciplines but the Humanities integrated into the medical curriculum will help to bring up empathetic and compassionate medical practitioners with the necessary complex of general cultural and professional competencies.

At one of the meetings of the General Medical Council of Great Britain, dedicated to the problem of training

of future doctors, the necessity of a fundamental change in the medical school curriculum was recognized. As soon as the requirements of the society to the modern doctors have changed the following resolution was taken: "the modern doctor must be able to build relationships with patients at a high professional level, possess the skills of critical thinking, be unbiased, show compassion and care for patients, show respect for lives, rights, dignities of patients and their families" [2]. The solution to this problem becomes possible due to the inclusion of various humanities into the curriculum of medical students.

The term "medical humanities" coined by European scientists, should be interpreted as an interdisciplinary cluster that includes the Humanities (literature, philosophy, ethics, history, religion), social sciences (anthropology, culture studies, psychology, sociology, medical geography) and art (theater, cinema, visual arts), which form the basis of medical education and practice.

K. Wachtler differentiated between two functions of the medical humanities in the medical school curriculum: instrumental and non-instrumental ones. The instrumental function of the Humanities can be directly applied to the daily routine of doctors. Thus, for example, the study of visual arts can be used to develop the skills of the future doctors to recognize the clinical signs of diseases in their patients [4].

The legacy of the arts left by the outstanding artists of the past who skillfully portrayed crippled bodies, defects and deformities of the sick can be used nowadays with the educational purposes. For example, the canvases of famous painters represented in the Louvre allow carrying out "physical examinations" of the bodies of people and get the glimpses of the specific features of the state of medicine during a particular era when those works of art were created. The Louvre Collection is full of the portraits of naked women. The work "Naked Bathsheba" created by Rembrandt in the XVII century presents a special attention from the point of view of medicine. The pits and bulges on the left breast of the woman demonstrate the clinical signs of breast cancer. The archival data indicate that the model has lived 9 years after the creation of the picture, and her health noticeably deteriorated year by year. She died of a severe cachexia and this proves that the breast cancer was the cause of it. Based on this example, we can conclude: the picture created by Rembrandt illustrates the natural history of breast cancer, proves that this disease is not new and confirms the fact that patients can live for about 10 years even without getting any treatment [1]. This example proves that the visual arts as one of the powerful teaching tools should be included into the medical school curriculum.

In a similar manner, literature study will help in teaching the students to avoid impersonalization of the patients – the typical feature of physician-patient relationship according to the engineering model proposed by R. Veatch.

The pieces of literature have a drastic teaching potential. The stories and novels created by the writers who had medical education and solid experience such as A. P. Chekhov, V. V. Veresaev, M. A. Bulgakov, A. J. Cronin, W. S. Maugham, etc. affect the readers even nowadays due to the acute relevance of the problems raised in their works. In their books various mental states of the characters are depicted, general medical problems are analyzed; the "diseases of the societies" are highlighted, and from some of them our society still continues suffering. In their works without the excessive shyness, falsification, and exaggeration the authors share their experience, give pieces of advice, and warn against repeating the same mistakes. The books written by doctors do not only capture readers with scientific knowledge, they also contribute significantly to the development of medical thinking. Moreover, they can help teachers to develop the students' skills of making responsible decisions in non-standard situations, develop social and ethical responsibility for the decisions made, and therefore, they will lead to success in the process of developing the students' general cultural competencies. From the viewpoint of psychology literary works contribute to the development of empathy as one of the main principles of deontology.

The science and the Humanities are the pillars of "good medicine". The development of communication skills occupies the central place in the medical school curriculum, the success of which depends on the depth of empathy of the future doctors. Through the prism of medicine empathy implies the faculty of a physician to "penetrate" into the patient's mind, his thoughts, feelings, fears, and sufferings, in short, empathy is an ability that even the most sensitive doctors find extremely difficult.

Another question arises: can a person's culture and his empathy be considered as identically equal? The answer is in the following example.

Among the doctors of the Third Reich accused of the atrocities against the humanity in 1946 there were honorable professors, clinical directors, A. Hitler and G. Himmler's personal doctors, the president of the German Red Cross K. F. Gebhardt, and a lot of other medical professionals who were interested in conducting biomedical experiments on human beings. Most of them were known as the representatives of the refined culture. Historical documents prove the fact that the music composed by Richard Wagner and Ludwig van Beethoven used to be broadcast over the loudspeakers of the fascist concentration camps. However, the classical music did not stop either the "Angel of Death" or his colleagues, and this fact lets us make such a conclusion that the doctor's humanism is not based only on his culture.

The main task of teaching the humanities to medical students is to strive to bring up more humane doctors who are ready to do their best and even sacrifice themselves trying to save the patients' lives. The role of deontology, bioethics, and medical ethics can hardly be underestimated in achieving the curricular goals.

Medical ethics is a kind of code of conduct for doctors. The laws of medical ethics are flexible, open to changes and reforms, and unfortunately not always it can be treated as an advantage. Historical events, cultural characteristics of various ethnic groups have had a significant impact on the content of medical ethics. In connection with the outstanding achievements in the field of biomedicine and the introduction of innovative medical technologies the modern doctor is forced to make decisions which may contradict the norms of classical medical ethics. The law is a tool by means of which the authorities can respond with a significant delay to the most severe violations of medical rules, or it can be passed a posteriori as a response to an event that has received the public resonance. All ethical codes of conduct for medical practitioners originate in philosophy and theology. For instance, the Hippocratic Oath was written as a response to the respect for human rights and dignities during the heyday of democracy in Athens in the 5th century BC.

It is known that the mental activity of a doctor differs from the similar activity of other specialists due to the specific peculiarities of the profession which involves close communication with people. In this regard, the formation of students' communication skills is of a particular relevance. It is impossible to overestimate the role of teaching philosophy to future doctors in order to achieve the curricular goal. Studying philosophy students acquire the skills of listening to patients; they get ready to respect the different beliefs and values, to make tolerant decisions and to justify their viewpoints giving reasonable arguments; they acquire the skills of critical analysis, contributing to the development of clinical judgments – the basis of the process physician-patient relationship.

The humanities, having a non-instrumental function, contribute to the acquisition of common knowledge, promote students' self-development, and form new ways of thinking that go beyond biomedicine. Sharing K. Wachtler's viewpoint we note that it is the study of the Humanities that stimulates the development of self-reflection and self-analysis, and also contributes to the awareness of professional functions and duties in society [4]. In a word, the humanities have enormous potential, which makes it possible to bring up the future doctors with the stable system of values, the necessary set of general cultural and professional competencies which will allow them to fulfill the professional duties.

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Section 8. Agricultural sciences

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SORTER OF COCOONS BY SPECIFIC VOLUME

Abstract. For the determination of the silkiness of live cocoons in 1980 the PTI-1 device was created by Burkhanov Sh.D. with other colleagues, which determined the silkiness by the specific sample volume loaded into the measuring chamber of the device. The device PTI-1 got into the State Register of measuring devices under the number #9878–80.

The error in the operation of the PTI-1 device was associated with low automation of the process of measuring the silkiness, as well as the penetration of cocoons with a dead and sometimes dried caterpillarinto the measured sample. Such cocoons had a large specific volume and overestimated the measured silkiness. In this paper, it is proposed to sort out such cocoons from the sample using an airstream. A diagram of the installation of a cocoon sorter according to the specific volume (CSSV) is given, the results of sorting the cocoons of the Tetrahybrid-3 breed are given. After the rejection of the bad cocoons, the accuracy of determining the silkiness with the PTI-1M device increased from 0.32% to 0.25% on average compared with an incision. It is indicated tha cocoon sorter t the CSSV system can also be applied at the butterfly egg factory to sort the perse from aperse cocons, from which the butter flies did not come out.

Keywords: silkiness, specific sample volume, cocoon sorter, speeds of aerodynamic air flow.

The task of improving the quality of cocoons includes the correct assessment of the quality of live cocoons taken from coco-collectors. The work [1] took into account the percentage of grouse cocoons and their influence on the PTI-1M device when determining the silkworm of live cocoons. The principle of operation of the device PTI-1M consists of the directly proportional dependence of the silkiness to the specific volume of living cocoons. Grouse cocoons with a dead and most often dried-up caterpillar have a significantly larger specific volume, which leads to an overestimation of the measured silkiness and, therefore, they must be separated from the total mass of living cocoons.

Below it is shown how, using the cocoon sorter according to the specific volume (CSSV) [2], and air stream to separate the grouse cocoons from the sample, which will be further loaded into the working place of the PTI-1M device.

Sorting is carried out by oriented supply of cocoons into the air stream with an uneven velocity profile. At the same time, the gradient of air flow velocities is equal to 18–26 m/s * m. In the work [3] the cocoons were divided into groups by specific volume by orientally loading them into the air stream. After separation of cocoons with a large specific volume, samples of living cocoons of the Tetrahybrid-3 breed loaded into the PTI-1M device gave an average deviation from the incision less than 0.25%. Without prior separation of the grouse cocoons, the deviation from the incision was 0.32% on average on the same batches of live cocoons.

Improving the quality of sorting cocoons by specific volume is done by more precise orientation of the supplied cocoons for sorting them in the air flow with a uniformly decreasing velocity profile of the air layers. Below are the graphs of the dependence of the range of flight of the cocoon X in

the working place of the CSSV on the specific volume m/V of the cocoons at two speeds of aerodynamic air flow υ :

$$X = \frac{K \cdot \rho \cdot \upsilon^2 \cdot S}{m \cdot g} \cdot (2\sqrt{H} - \sqrt{h}) \qquad (1)$$

Where, K – is the momentum transfer coefficient ($= 0.8$ m$^{1/2}$ curves 1 and 2), υ – is the horizontal component of the cocoon velocity, approximately equal to the speed of the air flow, S – is the area of the longitudinal section of the cocoon, ρ – air density, H – height of the cocoon falling from the edge of the working place to the upper edge of the receiving cells, h – height of the diffuser.
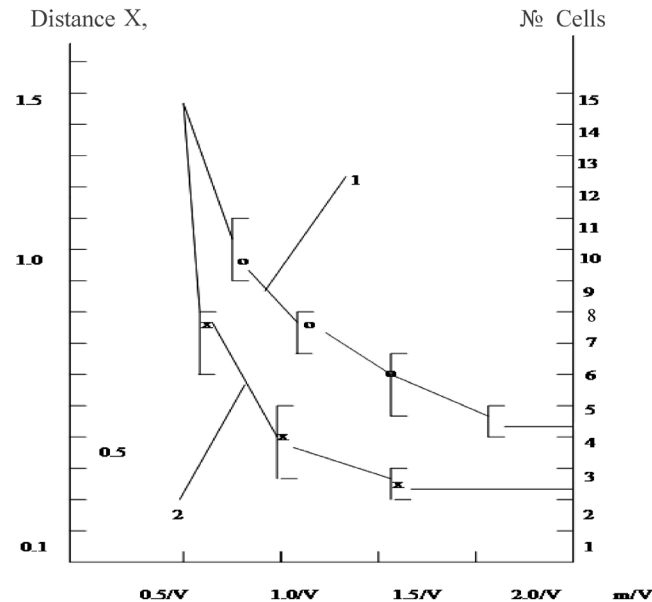
Figure 1. Distribution of cocoons by the cells in the place of CSSV depending on their specific volume m/V: curve 1 – v = 9.2 m/s. k = 0.8 m$^{1/2}$; curve 2– v = 6.7 m/s k = 0.8 m$^{1/2}$

Figure 1 shows the experimental results obtained on the CSSV when tested in the mode of sorting of live cocoons.

Experimental data showed that with the same power of the air flow at the moment when cocoons get into it, it should be as powerful as possible and weaken gradually as the cocoons fall under the action of gravity, i.e. the gradient of the speed of the air flow should be such that the air flow weakens from the upper to the lower layers. This allows the cocoon to impart a force impulse corresponding to its specific volume, and, accordingly, more or less acceleration in the horizontal direction. Then, meeting in its movement with the rest of the air layers, which have a gradually decreasing velocity, the cocoon gains an additional acceleration, and, coming out of the range of the air flow, continues free falling in the sorter receiving-distribution chamber already sorted by its specific volume. Thus, the initial position of the cocoons at the entrance to the sorting chamber plays a decisive role in effectively sorting them by specific volume [2].

(Figure 2) presents a schematic diagram of the mechanism of the dosed supply of cocoons to the sorting node, side view. The device consists of a bunker 1 with pitched walls, a detachable attachment 2, which is adjacent to the corpus 3 of the elevator 4, made in the form of a belt conveyor with bars 5, located at an acute angle to the elevator belt, pitched tray 6 with snare drum 7 and horizontal drum 8 with cell-grooves for supplying cocoons in the oriented state to the sorting unit through the slotted window 9 in the corpus 10 under the air stream from the fan 11 through the diffuser 12, ensuring the distribution of the cocoons in the corresponding storage capacity of reception and distribution chamber 13, depending on their size and weight. On the path of the air jet perpendicular to it in the diffuser 12, a device 14 is installed, ensuring the creation of a velocity gradient of the air flow over its cross section.

The air flow rate is measured by an anemometer.

The device works as follows. The cocoons are loaded into the bunker 1, from where they arrive at the dismountable console 2, where they are cleaned of cotton wool – to remove flowability, then to the elevator, made in the form of a belt conveyor 4, where they are caught by strips 5, which are removed from the conveyor belt by excess and accidentally hooked cocoons and ensure their single-layer distribution. Next, the cocoons fall on the snare drum 7, roll down the inclined tray 6 into the slot cells of the drum 8, being caught by the blades, which orientally load them into the receiving-distribution chamber 10 through a slotted window 9 with a capacity of approximately 200 pcs/min. They are going here into the CSSV working place through a device for regulating the speeds of the air flow and, meeting with the air flow, are sorted by specific volume.
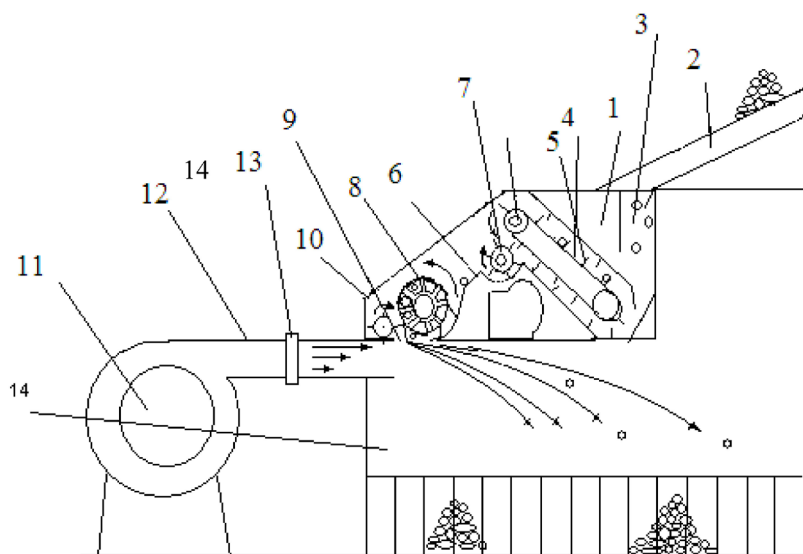
Figure 2. The device sorter cocoons by specific volume

The CSSV device is serviced by one operator.

The CSSV was also tested on the Tavaksai butterfly egg factory to separate whole cocoons – aperse from the total mass of the perse, i.e. cocoons from which butterflies came out.

The economic effect was 15 million soums per year, as 1 CSSV replaced the work of 5–6 sorters for separating aperse from the total mass of the perse.

Conclusion: To improve the accuracy of the PTI-1M device, it is necessary to separate the grouse cocoons with a large specific volume from the sample to be measured. For this you can use the proposed cocoon sorter by specific volume (CSSV). In addition, the CSSV can be used at the butterfly egg factory to separate entire cocoons –aperse, out of which butterflies did not come out from the holey empty shells – perse.

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REMOVING ASTRINGENCY OF SUBTROPICAL PERSIMMON (*DIOSPYROS KAKI* L) BY MEANS OF FREEZING FOR THE INTENTION OF CONSERVATION

Abstract. Numerous experiments conducted on making industrial product from persimmon fruit has been a failure. While being processed persimmon substances are undergoing desorption, and the fruit obtain the astringnent taste. The taste remains in the product, making it inedible. The experiments have shown that the process of absorption is an ongoing process even during frostation and defrostation. Such kind of fruit do not have the taste of astringency and is absolutely edible. After being processed at 75 °C astringent taste is resumed.

Keywords: Subtropical persimmon, substances, frostation, defrostation.

Subtropical persimmon has gained popularity in Georgia due to its features, taste and high rank of population, but numerous experiments conducted on making industrial product from persimmon fruit has been a failure [1]. Before preserving the fruit several procedures are required for processing the fruit in a proper way to avoid improper diffusion of sugar in the fruit. After thermal procession persimmon becomes inedible due to the desorption of essential substances, the taste remains astringent[2]. Persimmon fruit contain some specific phenolic content. The substances are either independently scattered in the fruit or are tightly chained. Astringent taste of persimmon is caused due to the phenolic content, that is tangible after procession of the fruit [3; 4].

Experiments were carried out using the wide-spread type of persimmon- Hachiya [5]. Besides the fact that persimmon has one tangible flaw- an astringent taste, this breed has high level of sugar, has a specific aroma, is quite pretty with its visual features, all the characteristics make it an interesting product for preservation.

During the experiment the hard, astringent fruits of Hachiya were placed and frozen in the fridge from −35 °C to −50 °C. After desfostation the product changed orange color to yellowish color, consistency became quite soft, the taste remained a bit astringent.

Therefore, the process of defrostation caused total eclipse of cells. The substances responsible for color were completely changed after intensive rusting. The defrosted fruit does not have astringent taste, but after thermal procession, tannins are desorpted, giving bitter taste to the product- the astringent taste [6]. Dried and cleaned slices of Hachiya were placed in the sugary syrup of 40%.

After the process of desorption the fruit still maintained its initial form and color, but the taste became a bit astringent, but after being thermally processed and put in water and the sugary syrup of 100 °C for 7–10 minutes astringency still reappeared in the taste.

After frostation of the fruits of Hachiya, Ichi-Ki-Kei-Jiro, Sidle and Zenji Maru, they were kept to freeze among pieces of ice. They were put in special forms, water was put on it and was frozen at −35 – 50 °C for 4–5 days. Then they were melted. After defrostation the color turned to dark yellow, the cover of fruit were split, consistency became soft and taste became a bit astringent.

Therefore, experiments of freezing the fruit have revealed that frozen products still maintain the astringent taste, after complete defrostation they do not have the taste, but through thermal processes they attain the astringent taste.

The experiment of freezing the product in ice cubes did not show positive results, visual features of the product are bot good. The color of persimmon is changed from light orange to dark yellow.

Further experiments were conducted in order to show the effects of oxygen on changing the color and consistency of persimmon.

1. Frozen fruit was placed in hot paraffin. The intention was to create the paraffin screen, in order to avoid the penetration air.

2. Frozen fruit was placed in the Vaseline oil, that does not consist of oxygen.

3. Frozen fruit was put in the airless space. Exsiccator was used, which was connected to the vacuum-pump. The pirogalol was placed on the bottom.

Table 1. – Characteristics of Hachiya

Organolepric properties			Chemical Features						
Ripe-ness	Taste	Color	Substances	Acidity	Pectin	Substances			
						Free	Adsorpted	Chained	Total
Raw Persimmon									
Hard	Astringent	Orange- Yel-lowish color	15.0	0.15	0.9568	0.3508	0.8680	0.4380	1.6568
Soft	Non-astringent	Orange color	15.0	0.08	0.1310	0.1490	0.4030	0.6808	1.2328
Frozen at –15 °C									
Hard	Light Astrin-gency	Yellowish-orange color	15.0	–	0.4906	0.0314	0.4323	0.3570	0.8207
Soft	Light Astrin-gency	Yellow-Green-ish	13.5	–	0.6164	0.0713	0.2363	0.4300	0.7376
Frozen at –35 °C									
Hard	Non-Astringent	Orange color	15.0	–	–	0.0454	0.3280	1.1610	1.5340

Peeled, frozen fruit of persimmon was placed in the open-air, to compare the results of two different experiments.

In 24 hour after starting the experiment, the product was darkened. In the third case the color remained light.

After another 24 hours the color turned to dark (brown). Conduced experiments revealed that rusting process is on inside the fruit dui to the existing oxygen.

Characteristics of raw and frozen fruit of Hachiya and Persimmon are given in the (Table number 1).

It is well-known that blanching process of persimmon is not effective. Vice versa it makes the fruit look worse. Thus, we omit thermal procession.

Table 2. – Changes in the Concentration of Dry Substances, after being kept in the syrup

Time	Concentration Options							
	I		II		III		IV	
	Fruit	Syrup	Fruit	Syrup	Fruit	Syrup	Fruit	Syrup
Temperature of syrup 20 °C								
0	17.0	40.0	–	–	17.0	60.0	17.0	70.0
12	–	35.6	–	–	–	52.0	–	60.2
23	26.0	29.0	–	–	26.0	45.0	30.0	49.4
41	26.0	27.6	–	–	36.2	44.6	31.2	48.0
Temperature of syrup 50–55 °C								
0	17.0	40.0	17.0	50.0	17.0	60.0	17.0	70.9
17	26.0	27.2	29.5	35.9	35.5	41.5	39.0	45.0
23	25.0	26.0	29.5	34.0	36.8	39.1	41.043.5	44.0
41	26.4	26.0	33.6	33.8	36.8	39.0		44.0

Experiments were carried out on concentration of the fruit of persimmon. Speed and the concentration temperatures are introduced in the table N2, 20˚C, 50–60˚C.

The concentration of fruit with syrup happens in the first 24 hours. Then during another procedure concentration in the sugary syrup is slightly changed, at both 20˚C, and 50˚C. 50˚C. the color of fruit is changed from light orange to dark yellow.

The concentration of dry substances in the fruit is up to შეადგენს 31–36% at 20˚C; and 37–43% at 50–55˚C. After the concentration of fruits with sugar, weight and volume of the fruit was changed.

Its negative in case the volume of fruit is decreased. This process means that soft part of fruit is wrinkled and hardened.

It is indicated in the table N3 that the fruit of persimmon decreases in the volume (60–70%) and weight after being kept for one day. The substances transfer from fruit to the syrup. The tissue of product is tightened and prevents sugar from penetrating the soft part. The speed of diffusion of sugar in fruit is a slow process, whilst transferring of water from fruit to syrup is a faster process. This process is very important due to the coloide structure of persimmon tissue and becomes the main factor responsible for the hard consistency of the product.

Table 3.– Changes in scope and volume of persimmon while being kept in the syrup

Concen-tration of Syrup,%	Data before being kept in the syrup		24 hr.				48 hr.			
			Wight		Volume		Weight		Volume	
	weight, kg.	volume, cm³	Gr.	%	cm³	%	Gr.	%	cm³	%
Temperature 20 °C										
40	8.26	9.0	3.76	45.5	3.0	33.3	3.49	42.2	3.0	33.3
50	9.20	9.0	3.93	42.7	3.5	38.8	3.15	34.2	3.0	33.3
60	8.72	8.9	3.30	37.8	2.5	27.8	2.53	29.0	2.0	22.4
70	8.00	8.7	2.62	32.7	2.5	31.2	2.9	28.7	2.0	25.0
Temperature 55–60 °C										
40	9.20	9.0	4.25	46.1	3.5	38.8	4.09	44.4	4.0	44.4
50	8.16	8.0	2.94	36.0	2.9	36.2	2.85	34.9	2.9	36.2
60	8.25	8.0	2.50	30.3	2.0	25.0	2.50	30.3	2.0	25.0
70	9.14	8.5	2.50	30.0	2.0	29.4	250	27.3	2.0	22.0

Measuring the volume and weight of fruit required the following procedures. The fruit of persimmon was cut into cubes of 1cm³, they were weighed and measured considering the amount of extracted water. Later they were put in different concentrations of sugary syrup. After a while cubes were taken out of syrup, then were dried at the filter paper, than were weighted and the volume was measured. Decrease of weight and volume were marked with percentage.

The study carried out using the product has shown that:

Free adsorption of substances happen while both frostation and defrostation processes. Such products do not have astringent taste and are edible. After thermal procession of fruit at 75°C astringent taste is resumed.

Further experiments are necessary, in order to improve the quality of processed persimmon fruit and to free it from an astringent taste.

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OPTIMIZATION OF CROPS, TAKING INTO ACCOUNT WATER AVAILABILITY IN THE IRRIGATED AREA IN THE LOWER REACHES OF THE R. AMU DARYA

Abstract. In this item are given materials and analysis about Amu Darya River downstream and also given recommendations for optimization of the main crop rotation on farm areas depending on the level of water availability without negative substantive impact for functioning of the agricultural sector in conditions of water deficiency.

Keywords: optimization of crops, irrigated area, water deficiency, reducing the acreage of cultivated crops, natural pastures.

In the lower reaches of the Amu Darya, sustainable agricultural production, other things being equal, agrotechnologies of cultivated crops mainly depends on the level of water supply of the territory. In the current water situation, when due to the depletion of water resources, river run off there is a steady shortage of water with a certain cyclical nature depending on the water content of the river. Amu Darya, planning and organization of agricultural production should be linked to the predicted level of water availability in the basin.

In recent years, the problem of the functioning of the entire water management complez in the Syr Darya and Amu Darya basins has become extremely acute due to the unsatisfactory quality of flow forecasts. This problem manifested itself most acutely in the dry 2000 year, but it also occurs during high-water years. Thus, according to forecasts, in 1998, the vegetation in the Syr Darya basin was expected to be about 81% normal, and actually amounted to 124%. As a result of this error, an crroneous plan of the cascade of reservoirs, and in June 1998, an additional 1km³ of water was dropped into the Arnasay decrease, which is an extremely exceptional case for the growing season.

Even worse, if the forecasts are not justified in the dry years, especially when the mistake is to overstate expectation. A comparison of the forecast and actual values for the key reservoirs of the Amu Darya and Syr Darya for the period from October 1999 to September 2000 indicates a significant scale of the error.

Forecasts are given twice, in October, for non-vegetation and tentatively for the whole coming year and clarification for the growing season- in April does not allow changing the composition and placement of crops and even more so the water change, which makes all irrigated agriculture extremely risky. Moreover, the approved water limits for vegetation in April based on these forecasts are difficult to adjust with the upper unregulated water, users and, as a result, there is a certain disproportion in the distribution of waters, which took place in the Amu Darya in 2000. During the growing season of 2000, the water deficit(the exess of the established water in take limit over actual use) in the Amu Darya basin was 11.1 km³ or about 30% of the limit, and in the lower reaches the water deficit is 52% (Table1).

Table 1. – Territorial uneven of water deficit within the Amu Darya basin in 2000

Plot of the pool	Deficit compared to the limit	
	Km³	% from limit
Upper course	0.7 km³	11
Average course	2.7	17
Lower course	7.7	52
In the whole basin	11.1	30

From the presented data it is clear that the lower reaches of the Amu Darya River were in the most critical situation during the growing season of 2000.

In May 2000, water availability in the Republic of Karakalpakstan was 45–50% in May, and in the subsequent months of the growing season in decreased from 48% to 19% of the required and 43% of the allocated limit. The level of water supply in 2001 was even worse in May, July, in August it was 12.9–19% of the need. During the growing season, only 1.853 million. m³ of water.

Were allocated for needs of agricultural production, which is 964 mln.m³ less than in 2000 or 25% of the required volume (Table 2).

Unfortunately, when planning the composition and structure of sown areas of agricultural crops, a possible scenario of the development of the situation with the level of water availability in dry 2000–2001 was not taken into account, that errors of predicted calculations were also noted with a total land area of 419 thousand. Hectares for cotton crops were set aside 125 thousand ha, winter wheat 28–30 thousand ha, for forage crops 78–75 thousand ha and for other crops 74.5–108

thousand ha. As a result, the agrarian sector of the economy suffered heavy losses in the production of crop products. So,

in 2000 with a planned sown area of 125 thousand ha, 129,8 thousand ha was actually allotted for cotton.

Table 2.– Level of water availability during the growing season 2000–2001. In the republic of Karakalpakstan

| Months | Years | Water in take in mln.m^3 | | | Water availability | |
		Need	Limit	Actually	From the need	From limit
1	*2*	*3*	*4*	*5*	*6*	*7*
IV	2000	359	265	245	68	92
	2001	346	201	240	69	119
V	2000	1069	1180	530	50	45
	2001	1331	774	154	12,9	20
VI	2000	7542	4384	1853	25	42,7
	2001	1700	1883	824	48	59
VII	2000	1572	914	623	39	68
	2001	2434	1895	557	23	29
VIII	2000	2318	1348	452	19	34
	2001	1850	1370	354	19	26
IX	2000	1557	905	248	16	27
	2001	1049	307	246	23	80
Total	2000	418	242	159	38	66
	2001	8463	6400	2757	32	43

Because of the lack of water in the areas of 34.3 thousand ha, the plants died and the crop was not harvested. Under the rice, it was planned to allocate 113.5 thousand ha, and the actual area was reduced to 60 thousand ha due to the expected low water levels, however, due to the lack of water in the area

of 52.1 thousand ha, rice plants died. In 2001, with the actual cultivated area of 83.4 thousand ha, of cotton plants, they died by 7.3 thousand ha. Although rice crops in terms of 80 thousand ha, nevertheless, on an area of 3.81 thousand ha of rice plants completely died due to lack of water (Table 4).

Table 3.– Some indicators characterizing the loss of agricultural production due to low water in 2000–2001 in the republic of Karakalpakstan

| Cultural years | Cotton plant | | | | Rice | | | |
	Plan pot. Platy thousand ha	Fact. Sown thousand ha	Thousand of them died	At%	Plan, pot. Platy thousand ha	Fact. Sown thousand ha	Of them died about thousand ha	At%
2000	125	129.8	34.3	26	113.5	60	52.1	86
2001	125	83.4	7.3	9	80	4.74	3.81	80

According to our calculations, made on the basis of materials of operational organizations of the management of irrigation systems, departments of the Moscow Inland Water Service, the total damage to the agricultural sector due to low water in 2000–2001. amounted to about 15 billion soums.

From the above, the need to revise the existing procedure for planning the composition and structure of the sown area for the current year's crop is quite obvious. At the same time, the main criterion should be the expected level of water availability, on the basis of which the area of irrigated land allocated for sowing major crop rotation crops should be adjusted annually and promptly.

In order to streamline the use of available water resources in the republic, differentiated distribution among water users within the annually allocated limit optimal areas of main crop

rotation crops and the required amount of water for sustainable agricultural production depending on water availability have been established. It is taken into account:

– preferential prorision of water for areas under crops of cotton and winter wheat, which are of strategic importance and cultivated be the state order;

– differentiation of the determination of the required volume of water for main crop rotation crops, according to hydro-mode zoning;

– the need for a proportional distribution of the established water limit among water users within the established limit;

When establishing the optimal areas and composition of crops, taking into account the level of water availability, the long-term data of the operational and planning organizations of the Moscow region of Karakalpakstan were used.

The calculations were performed using a model and algorithm developed jointly with specialists from the Nukus branch of the Tashkent Information Technology University.

The task of optional use of the productive resources of irrigated agriculture is formed by the following restrictions:

a) The area of irrigated land can bevariable and determined in the process of solving the problem, depending on the level of water availability.

b) Crop water consumption is limited to the value of the water supply corresponding to the technical option under consideration.

v) Restriction on the structure of crops of various crops.

Comparing the three main restrictions, comparing the model that allowed determining the structure (location) of crops and the area with fixed resources, taking into account the shortage of water resources.

As a result, mathematical modeling was tested on an example: MIS, canals, WUAS and administrative districts.

Recommended procedure for reducing the acreage of cultivated crops, depending on the level of water availability. (Table 5) should be permanent in time and space, carried out promptly without significant negative consequences for the functioning infrastructure of agricultural production. To mitigate the effects of low water and maintain the current level of crop production, it is advisable to place the main crop rotation crops in the years of low water availability on lands with a relatively high productive capacity (bonitet score). Lands with a relatively low bonitet score should be set aside for drought crops and salt-tolerant crops and used as natural pastures, plantations for the procurement of raw materials for the pharmaceutical industry.

Table 4. Recommended acreage and composition of crops, taking into account the level of water availability in the Republic of Karakalpakstan

Payment order	Water availability level%	Cotton-plant		Winter wheat		Rice		Alfalfa and feed crops		Other culture		Total in the republic	
		Acreage thousand ha	Water consumption, $mln.m^3$	Acreage thousand ha	Water consumption, $mln.m^3$	Acreage thousand ha	Water consumption, $mln.m^3$	Acreage thousand ha	Water consumption, $mln.m^3$	Acreage thousand ha	Water consumption, $mln.m^3$	Acreage thousand ha	Water consumption, $mln.m^3$
1	95–90	145	1342.6	60	377.8	70	2903.7	65	601.8	40	333.3	380	5559.2
2	90–80	140	1296.3	60	377.8	50	2074.1	55	509.2	40	333.3	345	4590.7
3	80–60	120	1111.1	50	314.8	30	1244.4	50	462.9	50	416.6	300	3549.8
4	60–50	110	1018.5	40	251.8	10	414.8	40	370.3	50	416.6	250	2472
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EFFECT OF TILLAGE METHODS ON PRODUCTIVITY OF DOUBLE CROPPED MUNGBEAN IN THE IRRIGATED CONDITIONS OF UZBEKISTAN

Abstract. Population growth has led to decrease in crop land per capita and competition for land and water resources is increasing causing increased food insecurity in Uzbekistan. There is an urgent need to pilot changes in agricultural practices in the region in order to increase grain output and productivity (efficiency) in the region. Double cropping or adding a second crop to existing single crop per year systems can address above mentioned challenges. In the irrigated areas of Uzbekistan farmers usually finish harvesting of winter wheat and barley during the period mid-June through mid-July and undertake next planting of these crops during the first fortnight of October. In double-cropping, timing of planting the second crop becomes limited along with pressures of harvesting the mature crop. Conservation Agriculture (CA) system reduces the time constraint while conserving soil moisture that may be present in the soil at the time of harvest of the winter cereal crop, and reducing runoff, soil erosion and soil evaporation; and increasing total grain production per year. Thus, this study compares the performance of mungbean (*Vigna radiata*) as double crop under different tillage options in the irrigated conditions. This crop is warm season annuals, highly branched and having trifoliate leaves and can fix air nitrogen and can improve soil fertility like the other legumes. The main objective of this experiment is to study effect of different tillage method on productivity of double cropped mungbean in the rainfed conditions of Uzbekistan. The research results shows that there was no significant difference no-till mungbean grain yield between minimum and conventional tillage methods against to year in the irrigated conditions of Uzbekistan.

Keywords: Double cropping, mungbean, conservation agriculture, no-till, grain yield.

Introduction

The latest agricultural policies, in Uzbekistan, aimed at promotion of crop diversification and environment friendly production systems offering high quality products with better access to the markets. Since 1991 year, Uzbekistan has been researching ways of introducing grain crops into existing crop rotation mainly with cotton and lucerne. The Government set out a longer-term strategy to diversify and intensify crop production in the country in Presidential Decree "Measures for agricultural reform and promotion from 2016 to 2020" No. 2460 dated 29 December 2015, whereby between 2016–2020 about 170,000 ha of cotton and about 50.000 ha of wheat will be diversified towards cultivating potatoes, vegetables, intensive orchards, fodder, oil and other crops. Uzbekistan has progressed well in agriculture and has attained not only food self-sufficiency but also a big potential for export of many agricultural products including vegetables, fruit and wheat.

The area of double cropped crops after winter wheat harvest was much more higher in 2017 compared to previous years. In addition, through conservation agriculture practices such as no-till in the irrigated conditions of Uzbekistan three crops can be grown easily, late summer planting of different crops such as cabbage, reddish are options to get third harvest within a year. Double cropping where sufficient water is available could help to prevent soil erosion and to break pest cycles currently encouraged by monocultures, and thus to reduce pesticide use.

Materials and methods

The experiment was laid out in randomized complete block design with four replicates. Plot size was 200 m²(25 × × 8 m). There were three different tillage options; conventional tillage (CT), minimum tillage (MT) and no-till (NT).

Analysis of variance (ANOVA) using replicated trials in randomized complete block design was used to study the relationship between tillage and yield. All statistical analyses were performed with GenStat 17th edition.

Monitoring over the crop growth and development was conducted from the time of the starting (10%) and full completion (75%) of the different stages during crop season. Field observations on germination, number of grains per pod, number of grains per m2, thousand kernel weight, plant height, days to heading, days to flowering, days to maturity, dry matter and grain yield.

Soil sampling done in October 2014 in two different depth 0–20, 20–40 and 30–60 cm (table 1). In selected samples the identification was conducted on following – humus on I. V. Turin method, GOST 26213–91, easy hydrolyzed nitrogen, on Kornfield ("Methodical directions…, 1985), mobile compounds of phosphorus and exchange potassium on Machigin method, GOST 26205–91, pH-water extract according to GOST 17.5.01.-84.

Table 1. – Soil parameters of experimental site in irrigated site in Gissar (2014–2015)

Soil type and texture	Soil layer	Humus content,%	N (%)	P (%)	N-NO$_3$, mg/kg	P$_2$O$_3$, mg/kg	K$_2$O, mg/kg
Light sirozem and heavy loamy	0–20	0.612	0.045	0.141	12.87	27.84	380
	20–40	0.457	0.061	0.114	10.87	24.57	365
	40–60	0.211	0.016	0.101	9.24	13.05	300

Ammophous 30 kg/ha was applied before and during planting. Ammonium nitrate was used as a nitrogen fertilizer (34%) depending on weather conditions. Field observations were recorded on seed germination, days to heading, days to maturity, plant height, thousand kernel weight, dry matter yield and grain yield. The yields were recorded before harvest at one square meter from each plot.

Results

Multi-cropping offers much opportunity to provide additional production from present land resources. This system can be described as growing two or more crops in one growing season, utilizing climatic patterns in different geographic areas to increase total production per unit of land. The multi-crop potential may be the most important of today's modern agricultural developments. The (table 2) presented ANOVA for grain yield. There was no significant difference in double cropped mungbean grain yield between the various tillage methods and tillage against to year in the irrigated conditions of Uzbekistan (0.078).

Table 2. – Analysis of variance of grain yield

Source of variation	d.f.	s.s	m.s	v.r.	F pr
Tillage	2	1815421	907710	2.95	0.078
Tillage.Year	3	581458	193820	0.63	0.605
Residual	18	5542999	307944		
Total	23	7939878			

Remarks: d.f – Degree of freedom; m.s – means square; v.r – variance ratio; F – F-test statistic.

Table 3. – Least significant differences of means (5% level)

	Treatment	Treatment. Year
rep.	8	4
d.f.	18	18
l.s.d.	582.9	824.4

Remarks: d.f – Degree of freedom; l.s.d – least significant difference.

In double cropping system, decreasing tillage is very important due to limited time for seedbed preparation and to keep the production cost low Limon-Ortega et al. [2], Wilhelm et al. [6]. Application of CA cropping systems can reduce the time element while retaining any soil moisture that may be present at harvest of the winter cereal crop, and reducing runoff, soil erosion and soil evaporation; and grain production per year can be increased. There is also the possibility that double cropping can help break pest cycles that are encouraged by monocultures, and thus reduce pesticide use (Nurbekov et al., [3]). Mungbean grain yield increased with tillage methods. The greatest grain yield response was recorded with no-till mungbean 1898 and 2365 kg/ha in 2014 and 2015 year respectively. Conventional tillage had lowest 1595 and 1365 kg/ha in 2014 and 2015 year (Figure 1). The differences in the mungbean grain yields between conventional till and no-till is not clear yet, but we hypothesize that soil moisture content could have been a cause yield increase.
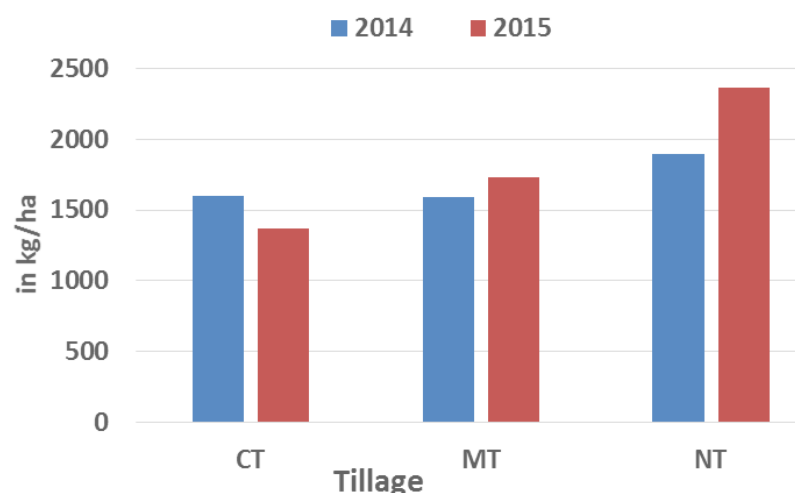
Figure 1. Double cropped mungbean grain yield

Economic information on double-cropped no-till mungbean cultivation is not readily available for Uzbekistan. Although no significant effects of reduced soil disturbance on cotton or wheat yields had been observed for instance in Uzbekistan, the initial yield loss that allegedly occurs when introducing CA was also not observed, while savings in operational costs were achieved immediately (Egamberdiev [1], Tursunov [5]).

Table 4. – Economics of planting methods on winter wheat productivity

Cost items	CT	MT	NT
Yield kg/ha	1610	1780	2370
Crop price per kg/USD	1.1	1.1	1.1
Yield USD	1771	1958	2607
Total variable costs USD	845	775	605
Profit USD	926	1183	2002

The highest net income (1293 USD ha) was obtained from no-till treatment and the other two treatments conventional and minimum tillage with disking had 550 and 812 USD net income respectively (Table 3). The maximum (2002), medium 1183 and minimum 926 net revenue was obtained with no-till, minimum tillage with disking and conventional tillage methods respectively. It can be concluded that no-till treatment is the best on the basis of cost benefit analysis of the present study.

Discussion

Cotton, wheat, barley and maize continued to be the major crops grown by private and public sectors in Uzbekistan. In the irrigated areas of Uzbekistan, farmers usually finish harvesting winter wheat and barley during the period mid-June through mid-July, and they undertake next planting of these winter cereals during the first fortnight of October.

Thus, the land remained idle for more than three months after the wheat harvest, and efficient of the land could be made through double cropping for example with legume crops. Climatic conditions of the Uzbekistan allow growing two crops per year. In this case multi-cropping (growing two or more crops in one growing season) offers much opportunity to provide additional production. Multiple cropping (growing two or more crops in one year or a single growing season) offers a good opportunity to increase annual crop production. Multiple cropping is one of the most important modern agricultural developments for production intensification. In double-cropping, timing of planting of the second crop becomes limited along with pressures of harvesting of the mature crop on time.

Mungbean is one of the best second crop that can be grown after winter wheat harvest not only in Uzbekistan but also in entire southern part of the Central Asia. The introduction of cereal or legume crops into the existing cropping systems in Central Asia as a second crop after wheat and barley harvest could be a promising alternative for increasing total grain production. The evidence from Central Asia indicates that CA practices are suitable for the existing major cropping systems. Research results from all Central Asian countries have shown that CA is suitable for the heterogeneous local conditions; and can provide similar or higher crop yields while saving considerable production resources, including fuel, seeds, water, agrochemicals and labour (Nurbekov et al. [4]).

In double-cropping, timing of planting the second crop becomes limited along with pressures of harvesting the mature crop (Nurbekov et al. [4]). No-till system reduces the time element while retaining soil moisture that is already present, and reducing run-off, soil erosion and soil evaporation.

Fuel for producing agricultural products has become expensive and no longer is available in unlimited supply. By

using no-tillage and multiple cropping technique, two crops can be planted with the same fuel required for one conventional crop. Fuel for harvest, processing and transportation would be higher than in single crop production owing to increased production and extra harvest. Farmers and researchers agree that double cropping can add grain or forage production in the project countries.

Conclusions

The research results shows that there was no significant difference no-till mungbean grain yield between minimum and conventional tillage methods against to year in the irrigated conditions of Uzbekistan.

No-till mungbean had higher grain productivity than conventional and minimum tillage mungbean over two years of the experiment in exponential site which is very important conclusion to wider adoption of double-cropping in Uzbekistan.

Cost benefit analysis shows that returns under no-till is almost double higher compare to the conventional and minimum tillage method.

Through double-cropping two crops can be planted with the same fuel required for one conventional crop, output will be increased, while overall cost of production is reduced, and equipment will be used more fully and labor requirements are spread more evenly through the year.

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RESEARCH OF DYNAMIC CHARACTERISTICS OF ELECTROMAGNETIC CURRENT TRANSDUCER

Abstract. An analytical equation for the transient characteristic of the developed electromagnetic current transducer is obtained. By the analysis of the transient response equation and their curves at different values of the ratio of the modulating voltage $\omega_{\text{м}}$ to the frequency of the converted current ω_x have been shown that at harmonic input quantity, the transient characteristic of the developed current transducer is a harmonic function with amplitude, decreasing exponentially and consisting of three components, varying with frequencies respectively ω_x, $(\omega_x - 2\omega_{\text{м}})$ and $(\omega_x + 2\omega_{\text{м}})$. It has been defined that transient time decreases with increasing of $(\omega_{\text{м}}/\omega_x)$ relationship.

Keywords: electromagnetic current transducer, parametric block diagram, dynamic characteristic, complex sensitivity, physical-technical effect, modulation.

In practice, in many cases controlled (convertible) current I_x changes in time quite quickly and in a large range. In these cases, the electromagnetic current transducer (EMCT) operates in a dynamic mode. If the law of change of the converted current $I_x(t)$ is specified, then substituting it into a differential equation describing the dynamic state of EMCT, and solving this equation allows us to find the type of output voltage $U_{вых}(t)$. Knowing the form of the $I_x(t)$ and $U_{вых}(t)$ functions, we can find specific values of the output voltage for any moment of time.

Analytical expression of the dynamic characteristics of the new EMCT can be find using the method of parametric structural schemes (PSS) [1; 2], compiled for its dynamic mode (Fig. 1).

In the PSS involved the following (PTE), parameters and values:

1) the effect of ampere-turns – interchain PTE between the converted electric current $I_{эx}$ and magnetic voltage $U_{\mu x}$ with a conversion factor $K_{I_{эx}U_{\mu x}} = w_x$, $[-]$; w_x – the number of turns of the winding (bus) with convertible current; 2) Interchain PTE between the magnetic capacitance $C_{\mu м}$ and the magnetic voltage $Q_{\mu м}$ in the magnetic circuit of modulation with a conversion factor $K_{Q_{\mu м}C_{\mu м}} = \dfrac{\mu_0}{l_{\mu м}} \cdot \dfrac{d\mu}{dB_{\text{м}}}$, $\left[\dfrac{H}{Wb}\right]$; μ – differential relative magnetic permeability of the material of magnetic conductor, $[-]$; $l_{\mu м}$, $[\text{m}]$ – average length of magnetic flux in the magnetic modulation circuit; 3) $C_{\mu м} = \dfrac{Q_{\mu м}}{U_{\mu м}}$, $[\text{H}]$ – magnetic capacitance of the modulation magnetic circuit in the path of magnetic flux; 4) $U_{\mu\delta} = Q_{\mu x}W_{\mu\delta}$, $[\text{A}]$ – magnetic voltage drop in the working gap from magnetic flux $Q_{\mu x}$, generated by convertible current $I_{эx}$; $W_{\mu\delta} = \dfrac{\delta_p}{\mu_0 S_{\mu\delta}}$ and $S_{\mu\delta}$ – respectively, the magnetic rigidity (magnetic resistance by the classical analogy of the chains) of the working gap δ_p and the area of this gap in the path of the magnetic flux $Q_{\mu x}$; $\omega = \omega_{\text{м}}$, $[\text{rad/s}]$ – angular frequency of supply voltage $U_{эм}$;

$Q_{\mu\Sigma}$, [Wb] – resulting magnetic flux created by convertible and modulating currents; $I_\mu = \dfrac{dQ_\mu}{dt}$, [V] – resulting magnetic current;
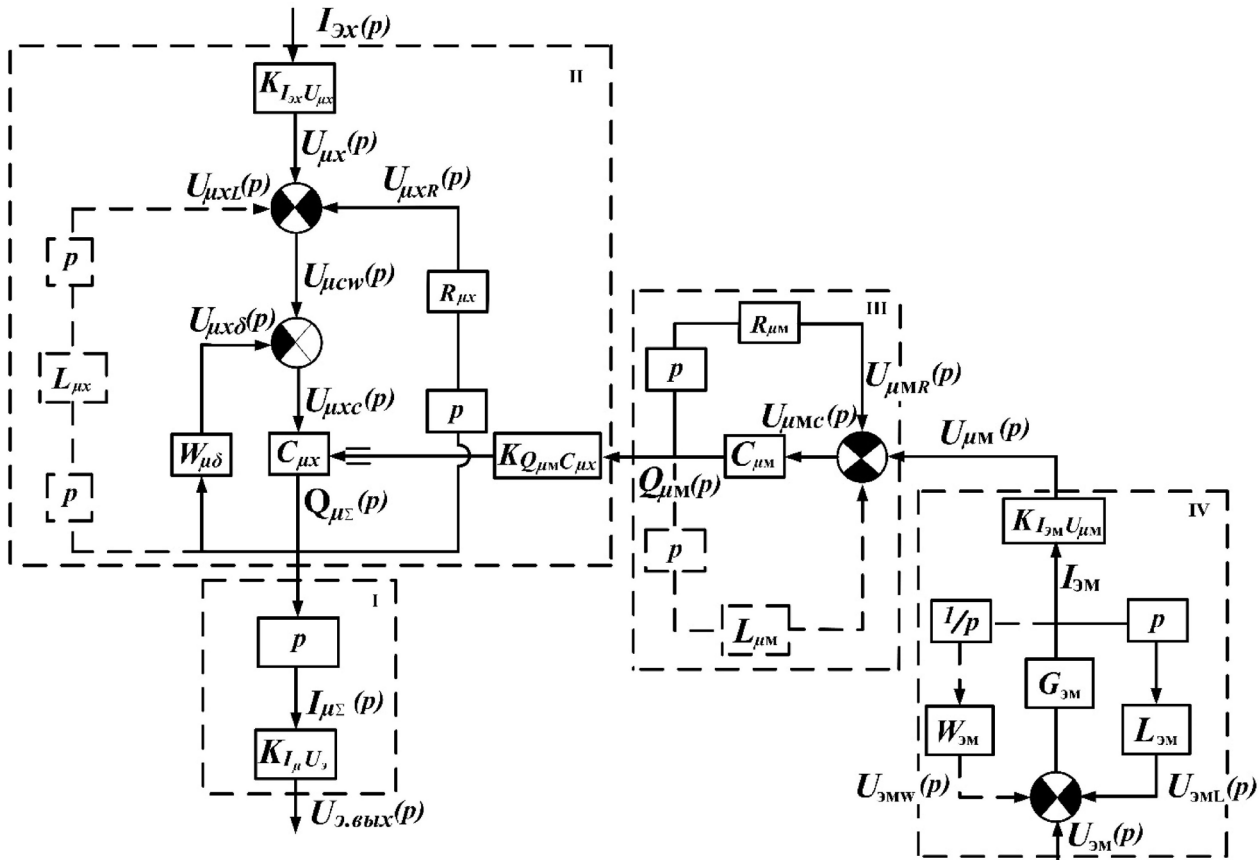

Figure 1. Parametric block diagram of the developed EMPT to determination of its dynamic characteristics

5) interchain PFE of electromagnetic induction between the resulting magnetic current $I_{\mu\Sigma}$ and output voltage $U_{\text{э.вых}}$ with conversion factor $K_{I_\mu U_э} = w_u$, [–]; $w_u - I_{\mu\Sigma}$ and output voltage $U_{\text{э.вых}}$ with conversion factor $K_{I_\mu U_э} = w_u$, [–]; w_u – the number of turns of the measuring winding; 6) interchain PTE of ampere-turns between electric current $I_{эм}$ and magnetic voltage $U_{\mu M}$ in a modulation circuit with a conversion factor $K_{I_{эм} U_{\mu м}} = w_u$, [–]; 7) $G_{эм}$, [S] – electrical conductivity of modulating winding; $U_{эм}$, [V] – supply voltage of modulating winding.

We will write the system of equations for the PSS, describing the developed EMPT in a dynamic mode. To facilitate the generation of equations for the PSS sensor, we divide it into four (I–IV) sections. In order to simplify the calculation of the dynamic characteristics of EMPT in the first approximation, we can neglect the magnetic inductances (electric capacitances in the path of eddy currents in the magnetic conductor) $L_{\mu м}$ and $L_{\mu x}$ of magnetic circuits of modulation and convertible current, as well as electric capacitance $C_{эм} = \dfrac{1}{W_{эм}}$

of electrical circuit modulation due to the smallness of their values (in the PSS branches with these parameters are indicated by dotted lines).

For the I section of the MSS we have the following:

$$U_{\text{э·вых}}(\rho) = K_{I_\mu U_э} \, I_{\mu\Sigma}(\rho) = \rho K_{I_\mu U_э} Q_{\mu\Sigma}(\rho), \qquad (1)$$

p – complex variable (operator).

The following equations can be written for the II section of the PSS:

$$Q_{\mu\Sigma}(p) = C_{\mu x} U_{\mu xc}(p) = C_{\mu x}\left[U_{\mu cw}(p) - U_{\mu x\delta}(p)\right] =$$
$$= C_{\mu x}\left[U_{\mu x}(p) - U_{\mu xR}(p) - U_{\mu x\delta}(p)\right] =$$
$$= C_{\mu x}\left[K_{I_{эx} U_{\mu x}} I_{эx}(p) - p R_{\mu x} Q_{\mu\Sigma}(p) - W_{\mu\delta} Q_{\mu\Sigma}(p)\right]$$

From here we find $Q_{\mu\Sigma}(p)$:

$$Q_{\mu\Sigma}(p) = \frac{K_{I_{эx} U_{\mu x}} C_{\mu x} I_{эx}(p)}{1 + \left(p R_{\mu x} + W_{\mu\delta}\right) C_{\mu x}} =$$
$$= \frac{K_{I_{эx} U_{\mu x}} K_{Q_{\mu м} C_{\mu x}} I_{эx}(p) Q_{\mu м}(p)}{1 + \left(p R_{\mu x} + W_{\mu\delta}\right) K_{Q_{\mu м} C_{\mu x}} Q_{\mu м}(p)}. \qquad (2)$$

The magnetic flux expression $Q_{\mu\text{м}}(p)$ is found from the PSS II section as:

$$Q_{\mu\text{м}}(p) = \frac{U_{\mu\text{м}}(p)C_{\mu\text{м}}(p)}{1 + pR_{\mu\text{м}}C_{\mu\text{м}}(p)}. \qquad (3)$$

For the IV section of the PSS we have:

$$U_{\text{э.вых}}(p) = \frac{pK_{I_\mu U_\text{э}} K_{Q_{\mu\text{м}}C_{\mu x}} K_{I_{\text{эм}}U_{\mu\text{м}}} K_{I_{\text{эх}}U_{\mu x}} G_{\text{эм}} U_{\text{эм}}(p) C_{\mu\text{м}}(p) I_{\text{эх}}(p)}{\left(1 + pR_{\mu\text{м}}C_{\mu\text{м}}\right)\left(1 + pL_{\text{эм}}G_{\text{эм}}\right) + \left(W_{\mu\delta} + pR_{\mu x}\right) K_{Q_{\mu\text{м}}C_{\mu x}} K_{I_{\text{эм}}U_{\mu\text{м}}} U_{\text{эм}} G_{\text{эм}}}. \qquad (5)$$

From (5) we find one of the dynamic characteristics of the EMPT – the transfer function, which has the following form:

$$U_{\mu\text{м}}(p) = \frac{K_{I_{\text{эм}}U_{\mu\text{м}}} G_{\text{эм}} \cdot U_{\text{эм}}(p)}{1 + pL_{\text{эм}}C_{\text{эм}}}. \qquad (4)$$

Sequentially substituting (4) to (3), (3) to (2), and (2) to (1), we finally obtain an analytical equation for the output voltage of the developed EMPT in the operator form, i.e.:

$$K(p) = \frac{U_{\text{э·вых}}(p)}{\text{L}\{\frac{d}{dt}[C_{\mu\text{м}}(t)I_{\text{эх}}(t)]} = \frac{K_1}{F_2(p)}, \qquad (6)$$
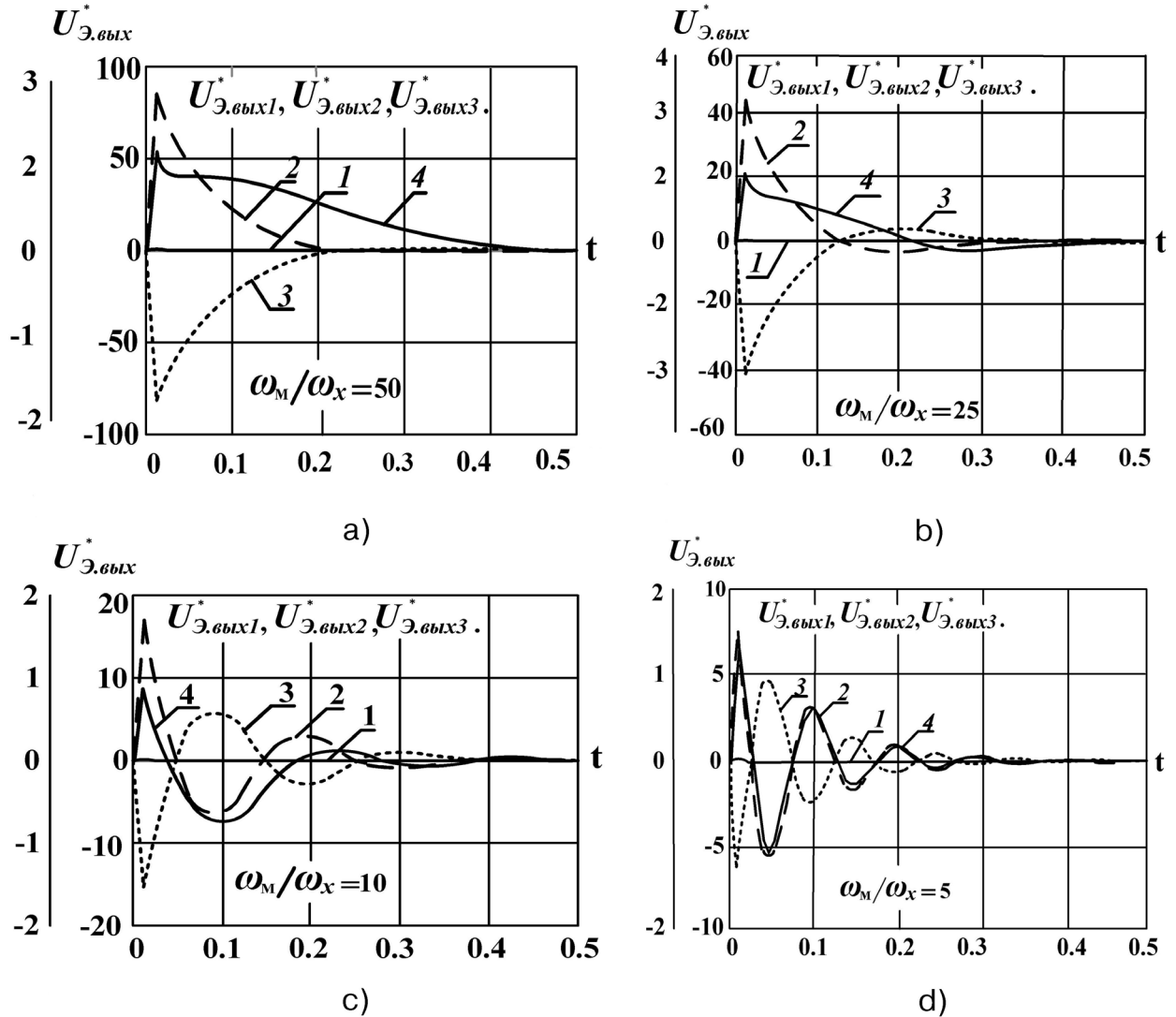
Figure 2. Curves of dependence $U_{\text{э·вых}}^* = f(t)$ and their components at different values of the ratio $(\omega_\text{м}/\omega_x): 1 - U_{\text{э.вых.1}}^*; 2 - U_{\text{э.вых.2}}^*; U_{\text{э.вых.3}}^*; 4 - U_{\text{э·вых.}}^*$.

where $K_1 = K_{I_\mu U_\text{э}} K_{Q_{\mu\text{м}}C_{\mu x}} K_{I_{\text{эм}}U_{\mu\text{м}}} K_{I_{\text{эх}}U_{\mu x}} G_{\text{эм}} U_{\text{эм}}$, $[-]$ – proportionality factor; $\text{L}\{\frac{d}{dt}[C_{\mu\text{м}}(t)I_{\text{эх}}(t)]\}$ – Laplace image of function $\frac{d}{dt}[C_{\mu\text{м}}(t)I_{\text{эх}}(t)]$;

$F_2(p) = R_{\mu\text{м}}C_{\mu\text{м}0}L_{\text{эм}}C_{\text{эм}}p^2 + (R_{\mu\text{м}}C_{\mu\text{м}0} + L_{\text{эм}}C_{\text{эм}} + K_{Q_{\mu\text{м}}C_{\mu x}} K_{I_{\text{эм}}U_{\mu\text{м}}} U_{\text{эм}} G_{\text{эм}}C_{\mu\text{м}0} \times$
$\times R_{\mu x}p + K_{Q_{\mu\text{м}}C_{\mu x}} K_{I_{\text{эм}}U_{\mu\text{м}}} U_{\text{эм}} G_{\text{эм}}C_{\mu\text{м}0}W_{\mu\delta} +1$ – denominator of proper fraction $K(p)$; $C_{\mu\text{м}0}$ – average value $C_{\mu\text{м}}(t)$.

In expression $F_2(p)$ we will introduce following designation:

$T_1 = K_{\mu\text{м}} C_{\mu\text{м}0}$, $\qquad$ [s]; $\qquad$ $T_2 = L_{\text{эм}} G_{\text{эм}}$, $\qquad$ [s];

$T_3 = K_{Q_{\mu\text{м}} C_{\mu x}} K_{I_{\text{эм}} U_{\mu\text{м}}} U_{\text{эм}} G_{\text{эм}} C_{\mu\text{м}0} R_{\mu x} = T_3$, [s]; $T_4 = \dfrac{R_{\mu x}}{W_{\mu\delta}}$, [s].

Subject to above mentioned designations for $F_2(p)$ we have:

$$F_2(p) = T_1 T_2 p^2 + (T_1 + T_2 + T_3) p + \frac{T_3}{T_4} + 1. \qquad (7)$$

In consideration of (7), operator equation (6) will have following expression:

$$K(p) = \frac{K_1}{T_1 T_2 p^2 + (T_1 + T_2 + T_3) p + \dfrac{T_3}{T_4} + 1}. \qquad (8)$$

Transfer function $K(p)$ in calculating measuring technology often calls as complex sensitivity of measuring converter [3]. It is a complex value and is the main function of the transducer, fully defining dynamic characteristics.

Find the original (8) using the decomposition theorem [4]:

$$K(t) = \frac{K_1}{T}\left(e^{p_1 t} - e^{p_2 t}\right), \qquad (9)$$

where $p_{1,2} = \dfrac{-(T_1 + T_2 + T_3) \pm \sqrt{(T_1 + T_2 + T_3)^2 - 4 T_1 T_2 \left(\dfrac{T_3}{T_4} + 1\right)}}{2 T_1 T_2}$ –

roots of the characteristic equation $F_2(p) = 0$;

$T = \sqrt{(T_1 + T_2 + T_3)^2 - 4 T_1 T_2 \left(\dfrac{T_3}{T_4} + 1\right)}$.

In view of (9), we write the equation for the output voltage $U_{\text{э·вых}}(t)$ depending on the change in the converted current $I_{\text{эх}}(t)$ in the following form:

$$U_{\text{э·вых}}(t) = \frac{K_1}{T}\left(e^{p_1 t} - e^{p_2 t}\right) \frac{d}{dt}\left[C_{\mu\text{м}}(t) I_{\text{эх}}(t)\right]. \qquad (10)$$

The law of change of variable parameter of magnetic capacitance $C_{\mu\text{м}}(t)$ in magnetic modulation sensors at $\dfrac{B_m}{B_s} \approx \dfrac{1}{2}$ has the following expression [5]:

$$C_{\mu\text{м}}(t) = C_{\mu\text{м}o} sin^2 \omega_\text{м} t = \sqrt{\frac{1}{2} C_{\mu\text{м}o} (1 + \cos 2\omega_\text{м} t)}, \qquad (11)$$

where $\omega_\text{м}$ – angular frequency of power supply voltage of modulation winding.

We assume that in the dynamic mode convertible current $I_{\text{эх}}(t)$ varies according to the following sinusoidal law:

$$I_{\text{эх}}(t) = I_{\text{эхо}} sin \omega_x t, \qquad (12)$$

where ω_x – angular frequency of current change $I_{\text{эх}}$ n the dynamic mode.

Taking into account (11) and (12), the transition equation of the developed EMPT (10) takes the following form:

$$U_{\text{э·вых}}(t) = \frac{K_1 C_{\mu\text{м}o} I_{\text{эхо}} \omega_x}{4T}(e^{p_1 t} - e^{p_2 t})\left[\cos \omega_x t + \left(1 - 2\frac{\omega_\text{м}}{\omega_x}\right) \times\right.$$
$$\left.\times \cos(\omega_x - 2\omega_\text{м})t + \left(1 + 2\frac{\omega_\text{м}}{\omega_x}\right)\cos(\omega_x - 2\omega_\text{м})t\right]. \qquad (13)$$

Turning to dimensionless quantities, we have:

$$U_{\text{э·вых}}^* = (e^{p_1 t} - e^{p_2 t})\left[\cos \omega_x t + \left(1 - 2\frac{\omega_\text{м}}{\omega_x}\right)\cos(\omega_x - 2\omega_\text{м})t +\right.$$
$$\left. + \left(1 + 2\frac{\omega_\text{м}}{\omega_x}\right)\cos(\omega_x + 2\omega_\text{м})t\right] = U_{\text{э·вых.1}}^* + U_{\text{э·вых.2}}^* + U_{\text{э·вых.3}}^*. \qquad (14)$$

In (fig. 2) are shown the graphics $U_{\text{э·вых}}^* = f(t)$ and their components at different values of the ratio $(\omega_\text{м} / \omega_x)$.

Thus, the analysis of the obtained equation of the transient response (13) and their curves at different values of the ratio of the frequency of the modulating voltage $\omega_\text{м}$ to the frequency of the converted current ω_x shows that with a harmonic input value, the transient response of the developed EMPT is a harmonic function with amplitude, decreasing by exponential law and consists of three components, varying with frequencies, respectively ω_x, $(\omega_x - 2\omega_\text{м})$ and $(\omega_x + 2\omega_\text{м})$. It have been established that transient time decreases with increasing of ratio $(\omega_\text{м} / \omega_x)$

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DEVELOPMENT AND DEFINITION OF REQUIREMENTS FOR SMOOTHNESS CALCULATIONS THE COURSE OF TRACTORS WHEN AGGREGATING WITH WIDE-GRIP MACHINES

Abstract. Stable movement at a given operating speed is a prerequisite for ensuring the quality of the work of the machine units. When moving aggregates, impacts in the form of various irregularities of the profile and obstacles affect its dynamic properties. Stability must also be ensured when making turns at the ends of corrals and turns.

The quality of the execution of technological processes of aggregates largely depends on and is characterized by the level of vibrations and vibrations that occur. The development of design models or schemes in the design, will determine the initial properties, characteristics and analysis of dynamic stability, as well as to establish the degree of vibration intensity and the development of remedies.

These issues are relevant in the development and design of high-clearance portal tractors aggregated with wide-gripping machines – sprayers, cultivators and others.

Keywords: aggregation, stability, smoothness, requirements, high clearance portal tractor, dynamic processes, vibrations, oscillatory movements.

One of the necessary conditions for ensuring the quality of the work of machine units with maximum performance is their steady movement at a given operating speed.

When moving aggregates in the field, appearing random kind of impact, in the form of various irregularities of the profile and obstacles, have an impact on its dynamic properties. Similar questions on sustainability are also raised when cornering at the ends of pens in the field and when cornering on roads in the transport position. The quality of the process is determined by the choice of mechanical and technological parameters of machines. In particular, these issues are relevant in the development and design of high-clearance portal trac-

tors aggregated with wide-gripping machines, such as sprayers, cultivators and others.

Providing mobile units of high dynamic qualities allows the implementation of working movements with the least deviations from the theoretically given straight motion. The implementation of the stable movement of the aggregates is carried out by selecting appropriate values of linear dimensions, mass, moments of inertia, used tire brand with stiffness coefficients.

Under certain functional conditions with given speeds used in tractor units, their constructive perfection, workmanship, quality of technological processes performance and in

many respects depend on the level of the resulting vibrations and vibrations.

As shown by preliminary studies [1; 2; 3], in the issues affecting the dynamic properties and safety of tractors and machines, the main sources of vibrations and vibrations are their engines.

Dynamic processes occurring under different operating conditions determine the performance and durability of the engines and the tractors themselves. A detailed examination of the tractors revealed that the main source of regular oscillations are disturbances arising during the working process in an internal combustion engine.

Analysis of studies [2; 3; 4] showed that in order to solve the problems of the dynamics of tractors and their dynamic loading from power effects, it is necessary to develop rational ways of schematization of disturbing properties.

The used aggregate method of assembling the power plants, in which the individual units making them (engine, transmission mechanism and other working units) are designed, calculated and tested independently and determine the relevance of dynamic calculations.

The tractor is an oscillatory system with its particular features and properties, consists of several masses [4; 5; 6]. The design includes elements, the gravity of which is not transmitted through the elastic device of the suspension: – non-suspended elements-frame (wreck), wheels, semi-axes on which all main components are mounted.

Wheeled tractors have semi-rigid under-spraying systems, we have to take into account trailed implements and other features.

Theoretical studies and methods for calculating the mechanical vibrations (vibrations) and the stability of modern equipment are of great importance in the field of mechanical engineering and, in particular, for the development and design of new agricultural machinery and tractors.

The areas of technology in which oscillations play a particular role are quite numerous. As in any object of technology, in any engineering design, real machines have a variety of physical properties and imperfections of all kinds, in connection with which may arise

"Harmful" vibrations – the occurrence of them leads to large stresses in the elements and nodes of the machine, which lead to loss of stability or harmful effects on people.

Therefore, the development of design models or schemes in the design of new equipment or machines will allow:

– to determine the initial properties and characteristics (for the oscillatory system, amplitude-frequency or phase-frequency characteristics) and the analysis of dynamic stability;

– establish the degree of vibration intensity for developing ways to eliminate or reduce their amplitude oscillations to prevent buckling.

In internal combustion engines, torsional vibrations of the crankshaft associated with a piston group are essential. The design model of the motor shaft is a torsional system of discretely located massive elements and elastic elements between them. To obtain a model corresponding to reality, it is necessary to consider a more complex design scheme, in which the engine has a somewhat limited power, and the working bodies of the machine in the process of work overcome considerable resistance forces. In the study a tractor can be represented as a system of elastically coupled solids.

In the study of cab torsional vibrations, tractor transmissions and other components, the crankshaft (elastic or rigid) with forces acting on it, the clutch, gearbox shafts, propeller shaft, axles and wheels are included in the calculation scheme. It was determined from the studies that the interdependence and interaction of these oscillations is due to the fact that the radii of the drive wheels change with the vertical oscillations of the body, the torsional and vertical oscillations are interrelated and the state of the system is determined by the balance of the oscillatory mode.

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POSSIBLE USE OF SECONDARY ENERGY RESOURCES IN THE GAS COMPLEX OF THE REPUBLIC OF UZBEKISTAN

Abstract. The article analyzes the possibility for electricity generation without burning fuel by expanding high-pressure natural gas at gas distribution stations with lower specific energy costs.

Keywords: main gas pipeline, transported natural gas, gas distribution station, high pressure, gas expansion, power generation, technological pressure drop.

Energy saving solution development is one of the pressing issues of developed countries, and in Uzbekistan it is the most urgent.

The growth of economy and living standard increases the energy demand. In response to it, the generating capacities of the country were increased. A 300 MW power unit was commissioned at the Novo-Angren Thermal Power Plant (TPP), a 800 MW unit at the Talimarjan TPP, a project to expand the Navoi Thermal Power Plant with a 478 MW combined-cycle gas turbine plant (CCGT plant) was implemented, and a cogeneration gas turbine plant was installed at the Tashkent Thermal Power Plant with a capacity of 27 MW. Expander generator units were installed at the Syr Darya and Talimarjan TPPs for the projects on the use of unconventional and renewable energy sources. At the beginning of 2019. Epsilon Development Company began workover of well No.2 Khujum (Kultak-Kamashi investment block), and performed perforation at the depth of 3660–3718 meters. After well acidizing, average industrial daily flow of natural gas is about 145–180 thousand cubic meters.

The supply of gas to the head facilities of Shurtanneftegaz LLC was started from Khujum well to the Nazarkuduk gas pipeline assembly point using the newly constructed 5.1 km gas pipeline. The company also received an industrial gas flow from two wells of the Talimarzhan field. The total hydrocarbon production by the company is expected to be 1–1.25 million cubic meters per day.

At the same time, Epsilon continues exploration work on the Kultak-Kamashi block and is developing the Shimoly Girsan, Devkhona, Chigil, Nazar-Khuduk and Ernazar fields.

Defining the prospects for improving the gas transmission system of the republic, the joint-stock company Uztransgaz (based on technical properties of transit transportation) can function in stages using various options for modernizing production and improving technological processes [1].

In this regard, to achieve the aforementioned objectives, a strategy has been developed to fulfill the main priorities in the field of transportation and supply of natural gas for 2011–2020, which envisages an increase in transportation capacity, diversification of transportation routes and rational use of natural gas resources.

Maintaining a high level of power capacity of the national economy can lead to the fact that unsatisfied demand will constitute a significant part of the current energy consumption in the republic. It will not be possible to cover this demand, given the depreciation of the key assets of the existing energy system, its high capital intensity and inertia.

Energy saving can be achieved by the use of expander-generators units (EGU) for the generation of environmentally friendly electricity (without burning fuel) through the use of technological gas pressure drop in the systems of main pipeline transport and distribution of natural gas. With the existing gas supply system in the country, the pressure of the transported natural gas is usually reduced in two stages – at gas distribution stations (GDS) and at distribution pressure

regulating station (DPRS) and is carried out through pressure reduction.

Currently, projects to use the excess energy of gas pressure during its reduction in gas distribution and consumption systems in a number of EU countries are aimed at generating electrical energy. However, to date no practical measures have been taken for the large-scale and effective practical use of this technology in the republics of Central Asia, including Uzbekistan.

The level of useful output generated by the EGU will be determined by the turbine flow and the pressure drop. With the increase in these values, the generated electrical power increases.

To summarize, for uninterrupted power supply on the linear part of gas pipelines, gas metering devices for GDS and MS, and other gas supply facilities (nearby DPRS), the authors consider it appropriate to use (EGU) to generate environmentally friendly electricity by utilizing the energy of compressed natural gas.

The recent technical literature proposes many layouts for the use of EGU at GDS and DPRS. These layouts differ in the way the gas is heated – before and/or after the expander; sources of heat used for heating, and the resulting products. For example, EGU can produce only electricity, or in addition to electricity, liquefied natural gas, air separation products and generate cold (Fig. 2).
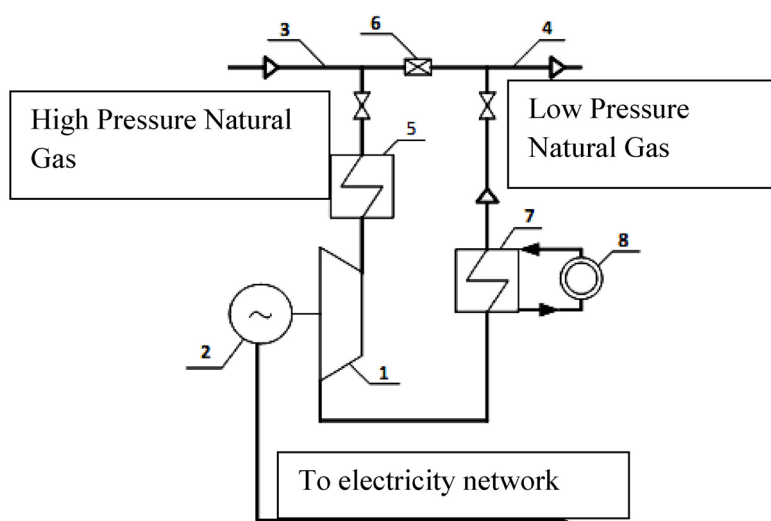
Figure 2. EGU installation layout: 1 – expander; 2 – generator; 3, 4 – high and low pressure pipelines; 5 – heat exchanger; 6 – gas pressure reduction site; 7 – heat exchanger; 8 – cold disposal

In this regard, it is necessary to conduct studies of thermodynamic laws during the operation of expanders, with different heating systems: before the expander; before and after the expander; in front of the expander and in the interval between the steps; in front of the expander, between the steps and after the expander. These studies would show how, at the same unit capacities, how the fuel consumption would change if the gas preheated before and after the expander compared to heating before the expander. The difference in costs will be determined by the amount of heat obtained directly from the low-potential source. It will be possible to choose the best way to heat the gas to improve efficiency.

One of the features of the turbo-expander developed by the authors is the placing of the turbine and compressor wheels on the same shaft, which determines the predominant use of impellers of radial or radial-axial types in order to simplify the design of the supply and dispose of the working medium. Therefore, to use the physical energy of the gas obtained by reducing the pressure on the GDS and DPRS,

instead of the traditional throttle devices, it is advisable to use EGU, which allow producing electricity using the gas pressure drop [2, P. 24–25].

The pressure of the transported natural gas is reduced at two steps. At the first – at gas distribution stations – the gas pressure decreases from the pressure in the gas pipeline from 5.5 MPa to 1.2 MPa, at the second – at DPRS – from 1.2 to 0.15 MPa. In the process of expansion of high-pressure natural gas in EGU, its pressure decreases to 1.2 MPa and temperature to 10 °C [3, P. 28–36].

Based on the above, the formulation of the optimization was created and presented in the following form: annual electricity generation

$$\max E = f(P, G), \qquad (1)$$

where $P \in [P_1, P_2]$; $G \in [G_1, G_2]$.

Limits $T_2 = 0$; $T_1 \le T_{max}$; $Q_{HE} \le Q_{max}$; $N_{EG} \le N_{max.}$ (2)

Due to the fact that the expansion performed by expander leads to a more significant decrease in the gas

temperature, for economic comparison, the consumption of fuel gas for a fired heater with a characteristic thermal h = 40% was used.

The calculations were performed using the GazKondNeft thermodynamic calculations software [4], and the results are presented in (Table 1).

Table 1.– Comparison of parameters for natural gas expansion in the throttle and the expander

Type	Parameter	Gas outlet pressureMPa		
		0.3	0.6	1.2
Throttle	The temperature of the transit gas after the throttle, °C	−11.8	−9.6	−6.2
	The amount of heat for the transit gas heating after the throttle (t_a = 10 °C), kJ/h (kW)	693000 (190.5)	639700 (170.7)	532500 (140.0)
	Fuel gas consumption for heating the transit gas after the throttle (h = 40%), mn³	50	46	40
Expander (heated after)	Transit gas temperature after expander, °C	−102.4	−81.2	−50.3
	Expander power, kW	830	650	450
	The amount of heat for the transit gas heating after expander (t_a =10 °C), kJ/h (kW)	3700790 (1025)	3027500 (835)	2186600 (600)
	Fuel gas consumption for heating the transit gas after the expander (h = 40%), mn³	270	220	160
Expander (heated before)	The amount of heat for the transit gas heating after before (t_a =10 °C), kJ/h (kW	5948900 (1650)	4341900 (1200)	2795800 (770)
	Expander power, kWs	1400	1000	600
	Fuel gas consumption for heating the transit gas after the expander (h = 40%), mn³	440	320	200
	Transit gas temperature before the expander, °C	160.5	120.2	83.5

In summary, the calculations and operating experience of the expander-generator sets confirm the value of the relative power generation in the amount of 40…60 kW/ths. mn³ and provide an opportunity not only to introduce into the economic turnover of secondary energy resources and to ensure the production of electricity, but also to ensure the reduction of harmful emissions compared with traditional technologies.

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A SEDIMENT TRANSPORT MODEL FOR IRRIGATION CANALS OF UZBEKISTAN

Abstract. This paper describes a dynamic morphological sediment transport model for determining the bed slope of dynamic stable irrigation canal. The model is supposed to help in designing process of irrigation canals.

Keywords: cohesive and non-cohesive sediments, dynamic stable irrigation canal, deposition, erosion rate.

1. Introduction

Currently, there are more than 196 thousand kilometers irrigation canals for around 4.3 million hectares of irrigated lands in Uzbekistan. Operation of big irrigation canals, like Mirishkor, Karshi that deliver water from Amudarya River, is requiring more and more expenses year-by-year. Parameters of the cross sectional geometry have changed and the capacity of the canals has decreased due to sedimentation problems.

On a worldwide scenario, sediment transport predictors of Ackers-White, Brownlie, Einstein, Engelund-Hansen, Van Rijn, Yang and others are available. However, the predictability of these methods is still poor [3, 142].

Many scientists, such as Karaushev, Poslavskiy, Chekulaev, Xorst, Gostunskiy, Xachatryan, Zamarin, have developed a lot of empirical and semi-empirical formulas to evaluate sediment transport capacity having accuracy varying from 15% to 100% [10, 189]. Zamarin`s formulas are being used to determine sediment transport capacity and permissible minimal velocity in the construction regulations of Uzbekistan. The fact that sedimentation has occurred in the main canals leads us to suspect that the canal design method in the construction regulations of our country lacks precision.

The existing canal design methods are based on the interrelation of equations for specific water flow and sediment transport conditions, leading to the design of stable canals. However, the input variables generally vary widely during the irrigation season and during the lifetime of the irrigation network. Most of the time, non-equilibrium conditions prevail in irrigation network and therefore, the basic assumptions for a stable canal design are no longer valid [3, 74].

The canal design methods do not directly use available information on sediment characteristics, such as the sediment size and its concentration. Nowadays, the design of irrigation canals involves complex and difficult to determine parameters such as water flow, required water levels, sediment load, control structure and operation and management strategies. No design package is available that deals with all these parameters at the same time. When analyzing the impact of one parameter, others are either ignored or assumed to be constant. Therefore, it is obvious that a mathematical model to take into account important multiple parameters, specified for design of canals, will be an important tool for designers and managers of the irrigation systems [3, 75].

2. General description of the model

According to Van Rijn, depending upon whether the computation is for a single time step or multi time step, the combined model may be divided into two types:

– initial or sediment transport model that computes the sediment transport rate and bed level change for one time-step;

– dynamic morphological model, which computes the flow velocity, the sediment transport rates, the bed level change and computes again the new flow velocity: the process is continued for the next time step [5, 47].

A one-dimensional dynamic morphological model is being developed in JAVA programming language, which is used to find optimal bed slope to design an unbranched irrigation canal. One of the main peculiarities of the model is the usage of extensive available information such as properties of each sediment size class, flow and sediment parameters of every time interval. Sediment transport methods of Ackers – White and Brownlie are used for non-cohesive sediments. The calculations are carried out separately for every particle size class to get more accurate results. For cohesive sediments, however, equations of Krone (1962) and USDT Federal Highway administration report, (2015) are used.

After each time interval, the total volume of deposition or erosion is calculated. Then, based on this volume, the morphological changes are applied to the canal cross section by distributing equally the deposited/eroded sediment volume throughout the length of the canal and wetted perimeter. Calculations are repeated considering the changed canal cross-section and the new flow parameters of each time step.

General concept of the model is depicted in the flow diagram of (Fig. 1).

3. Input data to the model

One of the main purposes of the current model is to use as much available information as possible to get more accurate results. Therefore, in this part, after inputting constant data that does not change during the calculation period, a year is divided into number of time intervals. For each time step, long-

term average parameters, such as sediment concentration and water discharge are specified. Then, sediment size analyses, diameters and fall velocities of each size class are entered. Afterwards, from the topography of the canal construction site, possible canal bed slope values are inputted.

4. Cross section and flow parameters

Computations of the cross section and flow parameters for any bed slope starts from the first time-interval in which the biggest water discharge is observed over a long term.
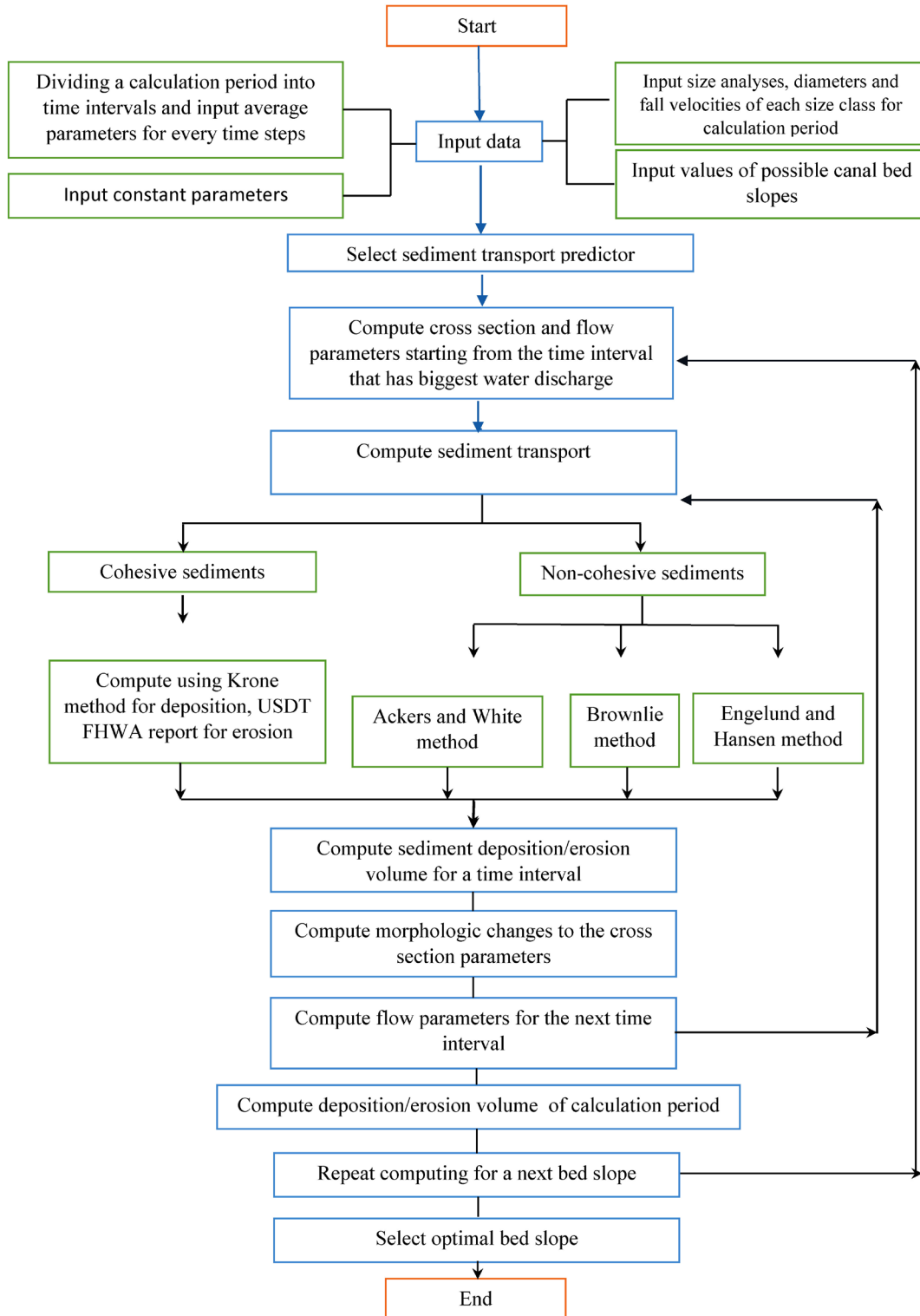

Figure 1.

Relative width that is $\beta = b/h$ ratio is computed with Girshkan's formula [1]. Shterenlicht's method is used to calculate the canal bed width and water flow depth [9]. The van Rijn method is implemented as bed roughness predictor, because, the van Rijn method shows good results over the whole range of measured friction factors [3, 119].

Calculation order is as follows:

1. $\beta = b/h$ ratio with Girshkan's formula, dimensionless, [1, 243];

$$\beta = 3 * Q_{max}^{0.25} - m; \qquad (1)$$

where:

Q_{max} – design flow discharge, m^3/s;

m – side slope;

2. Maximum water depth h_{max} and canal width b [9, 332].

$$Q_{max} = \frac{h_{max}^{2,5+y}}{n}(\beta + m)\left(\frac{\beta + m}{\beta + 2\sqrt{1 + m^2}}\right)^{0,5+y}\sqrt{s}; \qquad (2)$$

where $y \approx 1/6..$

From here we find the flow depth h_{max}:

$$h_1 = h_{max} = \left(\frac{Q_1 \cdot n}{(\beta + m)\left(\frac{\beta + m}{\beta + 2\sqrt{1 + m^2}}\right)^{2/3}\sqrt{s}}\right)^{3/8}; \qquad (3)$$

$$b = \beta \cdot h_1; \qquad (4)$$

where

b – canal bed width, in m;

h_{max} – design water flow depth, in m;

h_1 – water flow depth in first time interval, in m;

3. Then standard canal width is selected rounding the value of b to a next higher value of b_{st} according to building regulations of Uzbekistan [1, 248].

4. Flow parameters are computed for first time interval assuming that there is a uniform flow.

5. Computing sediment transport

5.1. Computing cohesive sediment transport

Erodibility of cohesive sediment cannot be predicted on the basis of environmental parameters. Therefore, researchers have developed various test apparatus to empirically measure sediment erodibility [4, 371].

However, quantitative guidance for predicting erosion in cohesive soils has been presented by USDT Federal Highway Administration, so that erosion testing is not required for every project. Estimates of critical shear stress are based on the water content, fraction of fines, plasticity index, and the unconfined compressive strength. Coefficients and exponents of the method require to be calibrated to get more accurate results when applied at new places [7, 78].

In the model, for cohesive sediments, we use the equations of Krone (1962) and USDT Federal Highway administration report (2015). Values of settling velocities for cohesive sediment should be predetermined as input for each time interval. They can be determined from settling column measurements [2, 15].

Calculation order for first time step is as follows:

1. Critical shear stress for each time step, N/m^2; [7, 72].

$$\tau_{cr} = \alpha_d \left(\frac{w}{F}\right)^{-2.0} PI^{1.3} q_u^{0.4} \qquad (5)$$

2. Coefficient C_1 for each time step, [7, 74];

$$C_1 = \alpha_d (q_u)^{-1.0} PI^{-1.1} \qquad (6)$$

3. Bed shear stress, N/m^2, [4, 316];

$$\tau_{b1} = \rho_w gRs \qquad (7)$$

4. Probability of deposition, dimensionless [8, 13];

$$p_{d1} = 1 - \left(\frac{\tau_{b1}}{\tau_{cr}}\right) \qquad (8)$$

5. Friction velocity;

$$U_f = \sqrt{\frac{\tau_{b1}}{\rho_w}} \qquad (9)$$

6. Peclet number;

$$P_e = \frac{6w_s}{KU_f} \qquad (10)$$

7. Coefficient β;

$$\beta = 1 + \frac{P_e}{1.25 + 4.75\left(p_{d1}^{2.5}\right)} \qquad (11)$$

8. Near bed concentration, kg/m^3;

$$c_{b1} = \beta \cdot c \qquad (12)$$

9. If $\tau_{b1} < \tau_{cr}$,

• Deposition rate according to Krone, $kg/m^2 \cdot s$;

$$S_{D1} = w_s c_{b1} p_{d1} \qquad (13)$$

• Deposition volume, m^3;

$$W_d = \frac{S_{d1} T_1 \chi_1 l}{\rho_{sc}} \qquad (14)$$

• Erosion volume, $W_e = 0$, m^3;

10. If $\tau_{b1} \geq \tau_{cr}$,

• Erosion rate in the first time step, m/s, [7, 70];

$$z_1 = C_1 (\tau_b - \tau_{cr})^{1.8} / 3600 * 1000 \qquad (15)$$

• Erosion volume in the first time interval, m^3;

$$W_e = z_1 \chi l T_1 \qquad (16)$$

• Deposition volume in the first time interval, $W_d = 0$ m^3;

11. Total sediment erosion-deposition difference, m^3;

$$W_{total1} = W_d - W_e \qquad (17)$$

where

F_i – fraction of fines by mass for each time step, dimensionless;

ρ_{sc} – density of fully saturated cohesive sediment for each time step, kg/m^3;

PI – plasticity index of cohesive sediment for each time step, dimensionless

w_s – settling velocity of cohesive sediment for each time step, m/s;

qu – unconfined compressive strength of cohesive sediment for each time step, N/m^2;

$S_g = \rho_{sc}/\rho_w$ – specific gravity of fully saturated cohesive sediment for each time step, dimensionless;

$w = e/S_g$ – water content for each time step, dimensionless ratio.

$K = 0.41$ – Von Karman constant;

$\alpha_d = 0.07$ – coefficient, unit conversion constant for design;

Calculations for other time intervals are also carried out in this order except already computed parameters for every time step.

4.2. Computing non-cohesive sediment transport with Brownlie and Ackers-White method

In Brownlie method calculations are carried out for each sediment size class with a table method. Representative particle diameter d_{50} is replaced with the average particle diameter of each size class d_i.

Sediment transport potential for each size class, [3, 233];

$$q_s = 727.6 c_f (F_g - F_{gcr})^{1.978} s^{0.6601} \left(\frac{R}{d_{50}}\right)^{-0.3301} \quad (18)$$

where

c_f – coefficient;

$c_f = 1$ for laboratory conditions, $c_f = 1.268$ for field conditions;

S – bed slope;

$s = \dfrac{\rho_S}{\rho_w}$ – relative gravity;

ρ_S – specific gravity of sediment, kg/m^3;

ρ_w – specific gravity of water, kg/m^3;

R – hydraulic radius, m;

v – cinematic viscosity, m^2/s;

1. Water flow travel time t_1, s;

$$t_1 = l/\vartheta_1 \quad (19)$$

where

l – canal length, m;

ϑ_1 – average flow velocity, m/s;

Sediment input volume of each size class;

$$W_{input} = \frac{P}{100} c_1 Q_1 T_1 \quad (20)$$

Sediment transport of each size class;

$$W_{output} = q_s T_1 \quad (21)$$

Continuity limiters for each size class, $Coef_i$, [4, 342];

- If $W_{input} \geq W_{output}$ deposition efficiency coefficient;

$$Coef_i = Coef_{deposition} = \frac{wt_1}{h} \quad (22)$$

- If $W_{input} < W_{output}$ erosion efficiency coefficient;

$$Coef_i = Coef_{erosion} = 1.368 - e^{-\left(\frac{30L}{h}\right)} \quad (23)$$

Sediment input-output volume difference of each size class;

$$W_{actual} = (W_{input} - W_{output}) * Coef_i \quad (24)$$

Total sediment erosion-deposition difference ,m^3;

$$W_{total} = \sum_1^i W_{actual} \quad (25)$$

Calculations with Ackers-White method are carried out for each sediment size class with a table method. Representative particle diameters d_{50} and d_{35} are replaced with the average particle diameter of each size class d_i. The rest of the calculations are the same with as those presented above in Brownlie method.

5. Morphological changes of the cross-section parameters

Morphological changes are implemented based on total sediment erosion-deposition difference of the previous time step. Sediment continuity equation, that is Exner equation, is used to tackle this problem [4, 337]:

$$(1 - \lambda_p) B \frac{\partial \eta}{\partial t} = -\frac{\partial Q_s}{\partial x} \quad (26)$$

where

Q_s – transported sediment load, m^3/s;

B – canal width, m;

η – canal elevation, m;

x – distance, m;

t – time, s;

λ_p – active layer porosity;

In this model, we distribute the eroded/deposited sediment volume equally throughout the canal length and the wetted perimeter.

Therefore, we computed morphological changes as follows:

1. Change at the canal bed with Exner equation, in m;

$$dh = \frac{W_{total}}{l\chi(1 - \lambda_p)} \quad (27)$$

where

l – canal length, m;

χ – wetted perimeter, m;

W_{total} – deposited or eroded sediment volume of previous time step, m^3;

2. Change in the cross section area, m^2;

$$A_{change} = W_{total}/l \quad (28)$$

3. New canal cross section area, m^2;

$$A_{new} = A - A_{change} \quad (29)$$

4. New canal depth, m^2;

$$h_{new} = h_1 - dh \quad (30)$$

5. Assuming constancy of side slope and bed slope, new canal bed width is determined;

$$b_{new} = \frac{A_{new} - m h_{new}^2}{h_{new}} \quad (31)$$

6. New wetted perimeter of canal, m;

$$\chi_{new} = b_{new} + 2 \cdot h_{new}\sqrt{1+m^2} \; ; \qquad (32)$$

7. New hydraulic radius of canal, m;

$$R_{new} = A_{new} / \chi_{new} \; ; \qquad (33)$$

6. Flow parameters for the next time interval

Flow depth h_2 of a next time step is computed with trial and error method considering changed cross section with following equations.

1. Cross section area, m^2;

$$A_2 = (b_{new} + m \cdot h_2) \cdot h_2 \qquad (34)$$

2. Wetted perimeter, m;

$$\chi_2 = b_{new} + 2 \cdot h_2\sqrt{1+m^2} \qquad (35)$$

3. Hydraulic radius, m;

$$R_2 = A_2 / \chi_2 \qquad (36)$$

4. Total equivalent height is computed with van Rijn method, m;

$$k_{s2} = k'_{s2} + k''_{s2} \qquad (37)$$

5. Chezy coefficient;

$$C_2 = 18\log\left(\frac{12R_2}{k_{s2}}\right) \qquad (38)$$

6. Following condition must be fulfilled:

$$Q = A_2 C_2 \sqrt{R_2 s} \; ; \qquad (39)$$

7. Then flow parameters are determined from the equations (34–39).

Conclusion

The above-described model is one of the attempts to develop new calculation algorithms, which enables to determine the bed slope of dynamic stable irrigation canal in the design process to solve the problem of deformation.

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ABOUT STIMULATION OF BIOLOGICAL ACTIVITY OF SEEDS MECHANISMS UNDER THE ELECTRIC FIELD

Abstract. This paper provides information about research results of energy, information and biochemical processes taking place in the seeds of agricultural crops under the influence of an external electric field in order to increase their biological activity and productivity of the plants. It is shown that the treatment dose should be validated taking into account reproduction, selection nature, genotype, moisture and physiological state of seeds for a specific environmental zoning.

Keywords: Seeds, electric field, exposure dose, mechanism, stimulation, bioactivity, enhancement, energy, information, biopotential, biochemistry, metabolism.

Introduction. Several years experiments with seeds of various crops shows that the electric field used for cleaning, sorting and etching, at the same time has also a stimulating effect [1; 2]. Extensive research shows that the sowing properties of seeds increases after their treatment under the electric field: they form more friendly and early shoots, and their plants give a vich cropand better quality [3]. This indicates the presence of the biological influence of the electric field, leading to changes of the agrobiological parameters of the plants. However, pre-sowing seed treatment under the electric field must be carried out in such modes, in which the embryo of the future plant, located in the seeds, received a stimulating effect of the electric field.

Academician Engelhardt emphasized, as " the basis of life consist of three streams: matter, energy and information. The flow of information is continuity linked with the flows of energy and matter. If life is impossible without the flow of information, then without nucleic acids it is impossible to move this flow" [4].

Taking into an aceount above mentioned, there is a need to study the electrophysical processes in the seeds, taking into account the energy, information and biochemical effects of external influence in order to justify the optimal parameters of the impact.

Research methods. The mechanisms of seed stimulation are considered on the basis of the theories of the electromagnetic field, physics of dielectrics, Biophysics and biochemistry, neurophysiology in relation to the stimulation of biological systems, as well as the results of experimental studies to improve the bioactivity of various seeds of agricultural crops.

Consideration of the biological bases of stimulation of seeds is carried out based on theoretical and experimental research N. Nazirov, P. A. Ibragimov, A. M. Kuzina, N. M. Berezina, N. F. Batygin, B. N. Kitlaev, Z. M. Hasanova, H. W. Ellis and others [4–12], devoted to various aspects of the problem and non-spesific response of seeds on the impact of different external irritants.

Research results and discussion. In the course of studies [1] on the sti-mulation of bioactivity of seeds of various crops, it was revealed that the effec-tiveness of biological effects depends on the parameters of electrical processing (field strength, exposure) and the properties of the object (dielectric penetration, humidity, etc.), as well as agroecological conditions of plant cultivation.

The initial and main factor determining the results of the impact is applied field intensity. This is due to the fact that all effects at the molecular-cellular level are the result of the interaction of the field in the seed with the charges of certain chemical-biological compounds that determine the life activity of the biological object.

Seeds of agricultural crops are organic matter, so their biological state, which means quantitative and qualitative acceleration and improvement of the passage of various stages of plant development in ontogenesis, can also be activated by using the impact of external energy factors that change the supply of internal potential energy.

According to Mitchell's theory, the intensity of biochemical processes depends on the value of the membrane biopotential [13], i.e. the membrane can serve as an energy storage. Based

on this, we can assume the following sequence of energy transformations. When an electric field is applied, a certain part of the energy accumulates on the membranes of cells and subcellular structures, due to the increase of their biopotentials. Then, as needed, the stored energy is spent on the transport of ions through the membrane for the implementation of vital oxidation-reduction processes. Thus, the energization of cell membranes by means of an electric field creates prerequisites for strengthening the processes of metabolism in the seed.

Under the influence of an effecting factor, in this case, the electric field, the seed is induced effect, continuing after the removal of the stimulus. If in the absence of irritation, the biosystem had a rest biopotential, then in response to external irritation, an action potential arises [14], which for a certain time can exceed the rest potential of the biosystem, after which the initial state is restored.

It should be noted that the magnitude of doses the effects of electric fields, triggering the onset of different phases of the reactions depends on the parameters of the electric field (tension, exposition, species), seed (moisture content, variety selection, reproduction, physiological state) and environmental (time, geography, climate). This requires a substantiation of pre-sowing seed activation regimes taking into account the specific conditions of their treatment and zoning.

Figure 1b shows the dependence of the energy of germination and laboratory germination of the cotton seeds from the duration (exposure) exposure electrostatic field intensity of 6 kV/cm in the time interval 0–60 s. When t > 40 with the energy of germination of seeds to grow because they receive a stimulating dose ($D_S < D < D_u$). In the period of time $40 \leq t \leq 50$ with its reduction of experimental seed to control seed, and at t > 50 it becomes less of vigour. This indicates the onset of seeds phase of oppression from the effects of electrostatic field. But after removal of the exposure, the experimental seeds return to their initial state, since their laboratory germination is greater than the germination of the control seeds, which corresponds to phase IV, when the electrostatic field effect does not yet reach the lethal dose (D_L).
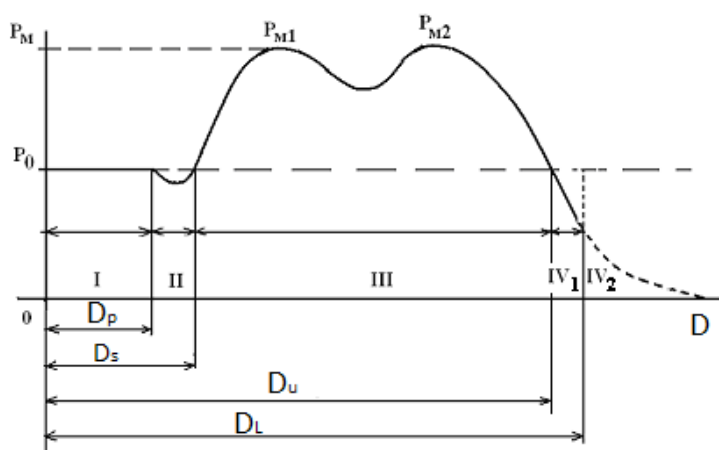
a)
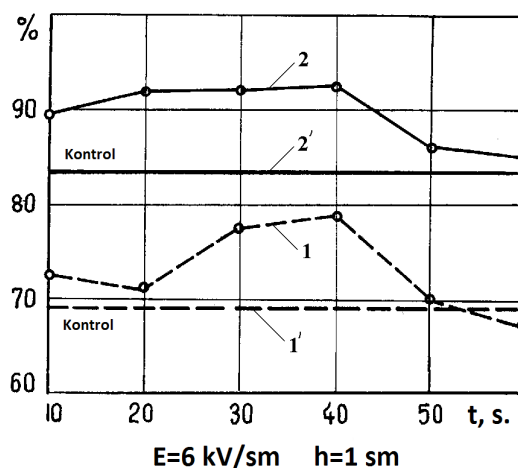
b)

Figure 1. Dose dependence of the seed reaction to the electric field: theoretical(a) and experimental (b, Tashkent-1, E=6 kV/sm): I – phase of stable nonequilibrium; 1'- 2' – control; 1–2 – experiment; II – preventive braking phase; 1, 1' – germination energy; 2-,2'-; III – phase of the stimulation; germination; IV – the phase of oppression

According to the existing information theory of Biosystems [15], infor-mation – a special functional relationship of the energy of the acting electric field with the energy of the seed, as a result of which the latter passes into a state of energy imbalance. The latter may arise as a result of a small signal effect of the external field, which is not yet able to cause biological changes, but can lead to the discharge of the seed of sufficient energy for the transformation of the energy absorbed by the seed of the external field. This effect of an external electric field is information. To carry the necessary information, the signal must also have a certain value. When the last value corresponding to the threshold dose of the electric field of the D_p is reached, as a result of the interaction of the external sig-nal with the potential of the seed, the internal braking mechanism is activated, which leads to the emergence of preventive protective functions.

To start the stimulation of the seed, the electric field dose should reach the D_S level, at which its information signal will cause an energy explosion in the family, changing the physiological equilibrium state of the latter. From this moment begins the transformation of external energy into internal free energy, which activates the internal biochemical processes of the seed.

In the case when the energy of the electric field and the free internal energy of a particular seed will correspond to each other in an informative respect quantitatively, a process

of stimulation occurs.This corresponds to the dose range of the electric field $D_S \leq D < D_u$ (figure 1). Further amplification of the information signal to the Control leads to the inclusion of catalysts – inhibitors that slow down the flow of biochemical processes, which corresponds to the beginning of the phase of seed suppression.

As a result of the external electric field influence, biochemistry processes begin, accom-panied by the appearance or enhancement of respiration, lipid and protein metabolism and ending with the formation of metabolites. The latter penetrate the nucleus and, acting on the information RNA, change the course of protein – enzyme synthesis, and it in turn changes the course of transformation in the cell as a whole. The properties of the synthesized proteins are determined by the specificity of the DNA program, and the inclusion of protein synthesis depends on the state of cytoplasmic metabolites and the level of signal action of the external electric field. Because "each new state of the cytoplasm as a reacting system is de-termined by three points: its previous state; external influence, which is dynamic and informational; purely information impact, coming from the nuclear apparatus" [16].

Thus, it follows from the above that the external electric field, which carries a certain irritating signal, can have a signifi-cant informational regulating effect on the flow of biochemical processes in cells and the seed as a whole, leading to changes in its biological activity.

From the analysis of earlier studies on the stimulation of bioactivity of seeds of grain, vegetable and industrial crops [11, 17–19], it follows that when an electric field is applied in bio-membranes, free radicals of white enzymes with an increased level of energy and biochemical activity are formed (figure 2). Especially this process is enhanced in the skin and germ of the kernel of the seed, which contains lignin and gossypol, capable of interacting with free radicals to form a variety of hydroperoxides, synthesized subsequently trigger the effectors (auxin, Generalova acid, etc.) [6; 8]. With the formation of the latter after exposure to the electric field is decondensation chromatin in physiological norms, thereby increasing gene activity of the cell nucleus and increased synthesis and accumulation of RNA.

Thus, the number of functioning genes increases as a result of the electric field. This leads to an increase in the rate of formation of individual tissues and organs of the embryo of the plant, which is one of the main reasons for the stimulating effect of the electric field. Since the genes opened by the electric field are closed again after a certain time, the stimulating effect is manifested only during a certain period after the electric treatment.
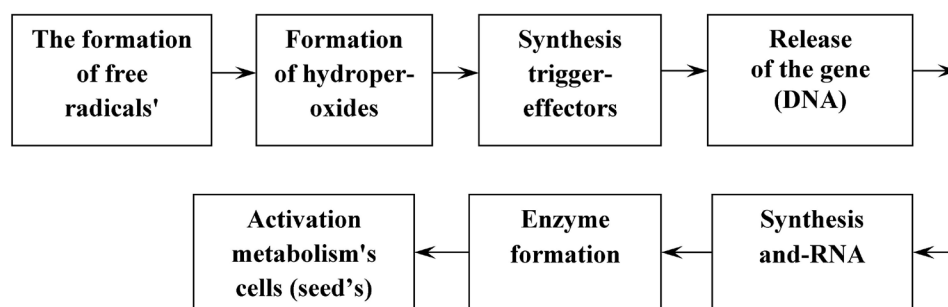
Figure 2. Diagram of the flow of biochemical processes, while promoting bioactivity of seeds in the electric field

This can explain the need for a certain time for keeping cotton seeds from the moment they are processed in the electric field to sowing, during which the biological activity of the seeds increases. So this period for cotton seeds is from 7 to 11–15 days, depending on the selection and processing modes [20]. The stimulation effect is then maintained for 40–100 days, after which it is smoothed, i.e. the stimulation of seed bioactivity is leveled due to reverse chromatin condensation. Moreover, the term of seed resting can be adjusted by changing the field strength and exposure. Larger doses correspond to a longer retention of the stimulation effect [21].

An important role in the organization of cell metabolism processes is played ion pumps located in the membranes and are protein moles designed for the transportation of ions, calcium, sodium, hydrogen, etc., which play an important role in the synthesis of substances at the molecular level. The transport of ions into the cell and in the opposite direction of sodium ions create the resting potential of the membrane. It is due to the potential, i.e. the electric field of the membrane, that the ions are transported: the electric field draws these ions into the cell. When the external field is applied, polarization and charging of the membrane bilayer occurs, which leads to an increase in the energy of the electric field and an increase in the flow of substances into the cell and the synthesis of protein enzymes, due to the opening and closing of the corresponding channels.

Studies on the seeds of wheat, barley, corn, peas, cotton and other crops [11, 22–24] found that as a result of the influence of the electric field increases the absorption of water by seeds, which contributes to a more rapid solution of the nutrients of the seed and the intensification of their transportation to the developing germ of the future plant.

The above-described physical, biochemical and morpho-genetic changes in cells of the seed after the imposition of an external field may lead to physiological change, expressed in the acceleration of the process of respiration, the germination of seeds and the improvement in the flow of growth, development and yield of plants in the future.

ions through the energized membranes due to the increase of their biopotentials, in the decondensation of the nuclear cells chro-matin under the action of trigger effectors, activating the synthesis of enzymes, DNA and RNA, which leads to increased metabolism and inflow of nutrient substances into the embryo of the future plant.

Summary

1. Stimulation of biological activity of seeds occurs as a result of complex (energy, information, genetic) action of the electric field, which is to increase ten times conductivity of

2. The external electric field, which carries a certain irritant signal, has a significant information regulating effect on the flow of biochemical processes in cells and the seed as a whole, leading to changes in its biological activity.

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REFINED METHODS FOR DETERMINATION OF FUEL CONSUMPTION IN MOTOR VEHICLES

Abstract. It is proposed to introduce improved methods for determining fuel consumption rate into the current method of fuel consumption rationing:
– Buses taking into account passenger load;
– Trucks when working in difficult traffic routes.
Keywords: Standard fuel consumption, transport fuel consumption, trucks and buses.

In the Republic of Uzbekistan, operating vehicles are about three million.

The cost of fuel and lubricants constitute 30–40% of the cost of transportation. One of the main ways to save fuel and energy resources is to establish and optimize their consumption standards for the actual conditions of operation of vehicles.

Automotive enterprises, organizations, entrepreneurs and others, regardless of the form of ownership, operating vehicles use standard fuel consumption that is given in the methodological recommendations "Fuel and lubricant consumption rates for road transport" [1].

In other countries that are part of the Commonwealth of Independent States, "The standards of fuel consumption and lubricants for road transport" were also developed [2].

The guidelines "Fuel consumption rates …" are updated periodically.

The regulatory documents on the determination of fuel consumption rates [1] provide the baseline – for cars and trucks and transports – for buses, the fuel consumption rate, and main factors affecting to fuel consumption are taken into account by standards and correction factors.

When rationing fuel consumption are distinguished:
– the basic value of the fuel consumption rate, which is determined for each model, brand or modification of the car as a generally accepted norm;
– normative value of fuel consumption, taking into account in addition to the basic value of fuel consumption, transport work and operating conditions of the vehicle.

For trucks, the base rate is set in liters per 100 km of the vehicle in full condition.

For onboard trucks, the normative value of fuel consumption is calculated by the formula:

$$Q_H = 0.01 \cdot (H_S \cdot S + H_W \cdot W) \cdot (1 + 0.01 \cdot D), \qquad (1)$$

where: Q_H – normative fuel consumption, l;

S – mileage of a vehicle or big trucks, km;

H_s – base rate of fuel consumption per vehicle mileage, l/100 km;

H_W – standard fuel consumption for transport work, l/100 t-km;

W – volume of transport work, t-km: $W = G_{gr} \cdot S_{gr}$ (G_{gr} – mass of cargo), t;

S_{gr} – mileage with cargo, km;

D – correction factor (total relative allowance or reduction) to the norm, %.

There are many models, brands and modifications of trucks. They work in difficult traffic routes. Special techniques have been developed for them [3] and they have been tested when performing contractual works [4].

Consider the definition of fuel consumption of trucks when working in complex traffic routes.

Example 1. The KrAZ-257 moving from a city with a population over 650 thousand heavy traffic conditions at 400 km, including 20 km in urban areas, 230 km by paved roads, and 150 km on sandy roads performed 2000 t km transport work.

$$D_\Sigma = \frac{S_1 \times (1 + 0.01 \times D_1) + S_2 \times (1 + 0.01 \times D_2) + S_3 \times (1 + 0.01 \times D_3)}{S_1 + S_2 + S_3} \qquad (2)$$

$$D_\Sigma = \frac{20 \times (1 + 0.01 \times 5) + 230 \times (1 + 0.01 \times 0) + 150 \times (1 + 0.01 \times 35)}{20 + 230 + 150} = 1.13375$$

Normalized fuel consumption for each condition and route is determined by the formula:

$$H_{ni} = H_s \times (1 + 0.01 \times D_i), \text{l/100 km} \qquad (3)$$

– in the city $H_{n1} = 38 \times (1 + 0.01 \times 5) = 39.9$, l/100 km;

– on paved roads $H_{n2} = 38 \times (1 + 0.01 \times 0) = 38$, л/100км;

– when working on sandy roads $H_{n3} = 38 \times (1 + 0.01 \times 35) = 51.3$, l/100 km;

– on a route

$$H_{n\Sigma} = \frac{S_1 \times H_{nsc1} + S_2 \times H_{nsc2} + S_3 \times H_{nsc3}}{S_1 + S_2 + S_3} =$$

$$= \frac{20 \times 39.9 + 230 \times 38 + 150 \times 51.3}{20 + 230 + 150} = 43.0825 \text{ l/100 km}$$

The fuel consumption rate (total consumption) for each condition and route is determined by the formula:

– in the city $Q_{H1} = 0.01 \times S_1 \times H_s \times (1 + 0.01 \times D_1) = 0.01 \times S_1 \times H_{n1}$ (4)

$$Q_{H1} = 0.01 \times 20 \times 39.9 = 8, \text{l}$$

– on paved roads $Q_{H2} = 0.01 \times S_2 \times H_s \times (1 + 0.01 \times D_2)$ (5)

$$Q_{H2} = 0.01 \times S_2 \times H_{n2} = 0.01 \times 230 \times 38 = 87.4, \text{l}$$

– when working on sandy roads

$$Q_{H3} = 0.01 \times S_3 \times H_s \times (1 + 0.01 \times D_3) = 0.01 \times S_3 \times H_{n3} \ (6)$$

$$Q_{H3} = 0.01 \times 150 \times 51.3 = 76.95, \text{l}$$

The fuel consumption rate (total consumption) the route is determined by 3 methods:

a) The total fuel consumption is composed of the fuel consumption for each section, determined by the base rate of fuel consumption (H_s).

Determine for each condition and route in general, normalized fuel consumption (Hn) and consumption rate (total consumption) (QH) of the car?

Source data:

– linear base rate of the KrAZ-257 truck

– $H_s = 38$ l/100 km [1];

– fuel consumption, taking into account performed transport work in $t \cdot$ km;

$$H_W = 1.3 / 100t \cdot \text{km};$$

– completed transport work – $W = 200t \cdot$ km;

– fuel consumption rate increases in the following conditions:

a) when working in a city with a population of 600 thousand to 1 million – 5% ($D_1 = 5$);

b) fuel consumption rate when working on paved roads does not change – ($D_2 = 0$);

c) when working on sandy roads – 35% ($D_3 = 35$).

The average specific value of the normative coefficient is determined by the formula:

$$Q_H = 0.01 \cdot \{(H_s \cdot S_1 \cdot (1 + 0.01 \cdot D_1) + \frac{S_1}{S_1 + S_2 + S_3} \cdot$$

$$\cdot H_W \cdot W \cdot D_\Sigma) + (H_s \cdot S_2 \cdot (1 + 0.01 \cdot D_2) + \qquad (7)$$

$$+ \frac{S_1}{S_1 + S_2 + S_3} \cdot H_W \cdot W \cdot D_\Sigma)\} \cdot K + Q_{nb}, \quad l$$

$$Q_H = 0.01 \cdot \{(38 \cdot 20 \cdot (1 + 0.01 \cdot 5) + \frac{20}{20 + 230 + 150} \cdot$$

$$\cdot 1.3 \cdot 2000 \cdot 1.13375) + (38 \cdot 230 \cdot (1 + 0.01 \cdot 0) +$$

$$+ \frac{230}{20 + 230 + 150} \cdot 1.3 \cdot 2000 \cdot 13375) + (38 \cdot 150 \cdot (1 + 0.01 \cdot 35) +$$

$$+ \frac{150}{20 + 230 + 150} \cdot 1.3 \cdot 2000 \cdot 1.13375)\} \cdot 1 + 0 = 201.8 \, l$$

b) The total fuel consumption is composed of the fuel consumption for each section, determined by the normalized fuel consumption (H_{ni}).

$$Q_H = 0.01 \cdot \{(S_1 \cdot H_{n1} + \frac{S_1}{S_1 + S_2 + S_3} \cdot H_W \cdot W \cdot D_\Sigma) +$$

$$+ (S_2 \cdot H_{n2} + \frac{S_1}{S_1 + S_2 + S_3} \cdot H_W \cdot W \cdot D_\Sigma) + \qquad (8)$$

$$+ (S_3 \cdot H_{n3} + \frac{S_1}{S_1 + S_2 + S_3} \cdot H_W \cdot W \cdot D_\Sigma)\} \cdot K + Q_{nb}, l$$

$$Q_H = 0.01 \cdot \{(20 \cdot 39.9 + \frac{20}{20 + 230 + 150} \cdot 1.3 \cdot 2000 \cdot 1.13375) +$$

$$+ (230 \cdot 38 + \frac{20}{20 + 230 + 150} \cdot 1.3 \cdot 2000 \cdot 1.13375) +$$

$$+ (150 \cdot 51.3 + \frac{150}{20 + 230 + 150} \cdot 1.3 \cdot 2000 \cdot 1.13375)\} 1.0 + 0 = 201.8 l$$

Table 1. Determination of fuel consumption rate (total consumption)

№	Model and state. the number of the car	manufactured year	Linear basis norm H_S, л/100км	Fuel consumption per 100 t km of transport work H_W, л/100км	Volume of transport work W, т·км	Passed road in all conditions S, км	Regulatory factors D,%				Normative fuel consumption by conditions Hn, л/100 км	Fuel consumption rate Q, л				
							In a city with a population of 600.000–1 million people D1	On paved roads D2	on sandy roads D3	average specific value of the normative factor, Dн		QH1	QH2	QH3	Qw	QH
1	Onboard car KrAZ – 257, 70093 DA	2010	38	1.3	2000	In the city S1=20	5			1.13375	39.9	8				201.8
						On roads with solid S2=230		0			38		87.4			
						on sandy roads S3=150			35		51.3			77		
						Route S=400					43.0875				29,4	172.4

c) The total fuel consumption is composed of the fuel consumption for each section; it is determined taking into account the total mileage (S) and the specific average value of the normalized fuel consumption ($H_{n\Sigma}$).

$$Q_H = 0.01 \cdot (H_{n\Sigma} \cdot S + H_W \cdot W \cdot D_\Sigma) \cdot K + Q_{nb}, \quad l \qquad (9)$$

$$Q_H = 00.1 \cdot (43.0825 \cdot 400 + 1.3 \cdot 2000 \cdot 1.13375) \cdot$$
$$\cdot 1.0 + 0 = 201.8 \; l$$

For trucks, the fuel consumption rate (total consumption) the route defined by 3 methods give the same results.

The first and third methods are preferred.

For buses, transport norm is set in liters per 100 km (1/100 km) of mileage when carrying out transport work of a bus, which takes into account the curb weight and the nominal load of passengers rationed for the purpose of the bus.

For buses, normative value of fuel consumption is calculated according to the formula [1]:

$$H_H = 0.01 \cdot H_S \cdot S \cdot (1 + 0.01 \cdot D) + H_{OT} \cdot T, l \qquad (10)$$

where: H_H – normative fuel consumption, l;

H_S – transport norm of fuel consumption per bus mileage, l/100 km (taking into account the loading of passengers rationed by class and purpose of the bus);

S – mileage of the bus, km;

H_{OT} – fuel consumption rate when using standard independent heaters for heater operation, l/hour;

T – operating time of the car with the heater on, hour;

D – correction factor(total relative increase or decrease) to the norm,%.

According to these standards it is not possible to accurately determine the transport fuel consumption rate at higher or lower values of the nominal load of passengers, i.e. when changing passenger traffic.

In the "Method of determining the basic norms of fuel consumption in road transport." P 03112134–0367–97 M.: NIIAT, Ministry of Transport of Russia used following terms and definitions [6]:

Calculation of fuel consumption when driving vehicles on typed routes is made at the following established control masses of buses:

– curb weight of the bus plus the mass of the additional load corresponding to half the nominal capacity of the bus.

– curb weight of a bus is defined as the mass of a fully filled (fuel, oil, coolant, etc.) and equipped (spare wheel, tool, etc.) vehicles, but without passengers, driver, other service personnel.

– estimated mass of one passenger and support staff (driver, controller, guide, etc.) is assumed to be 75 kg.

– nominal capacity of the bus is defined as the sum of the number of seats for seated passengers and the number of seats for standing passengers.

Transportation of passengers by buses is a complex process with changing passenger flows per flight, day, week, month and other.

The change in fuel consumption depending on the number of passengers above or below the regulatory load of passengers characterizes the additional or reduced transport work of the bus depending on the passenger traffic.

When loading passengers less than the nominal load of passengers, normative fuel consumption should be reduced, when loading passengers equal to the nominal load of passengers, the normative fuel consumption corresponds to the calculation with the transport rate of consumption, when loading passengers more than the nominal load of passengers, the normative fuel consumption should be increased [5; 6].

The proposed revised methodology for determining the normative fuel consumption for buses provide for the separation of the transport consumption rate for the basic (without passengers) fuel consumption rate and fuel consumption – $H_Б$ and fuel consumption for transport work during passenger transportation – H_W.

– Transport fuel consumption rate is determined by the formula:

$$H_S = H_B + H_W, \ l/100 \text{km} \qquad (11)$$

It is proposed to determine the normative fuel consumption by the following formulas:

– Basic (without passengers) fuel consumption rate of the bus is determined by the formula:

$$H_B = \left(H_s - \frac{G_P \cdot H_P \cdot P_{H.S}}{100} \right), l/100 \ km \qquad (12)$$

– The fuel consumption rate for transport work in transportation of any number of passengers is determined by the formula:

$$H_W = \frac{G_P \cdot H_P \cdot P_i}{1000}, l/100 \ km \qquad (13)$$

where: H_B – basic (without passengers) fuel consumption rate of the bus, l/100 km;

H_W – fuel consumption rate for transport work when transporting any number of passengers, l/100 km;

H_S – transport fuel consumption rate for bus mileage, l/100 km (taking into account the normalized class and purpose of the bus passengers load);

G_p – passenger weight $G_p = 75$ kg;

H_p – linear fuel consumption rate for additional mass of passengers in the cabin $H_p = 1.3 \ l/100 \ t.$ km for diesel engines;

$H_p = 2.0 \ l/100$ km for petrol engines;

$H_{н.s}$ – nominal bus loading;

P_i – number of passengers in the bus.

Example 1. Determine the baseline (without passengers) fuel consumption rate of the bus "MERCEDES-BENZ O-405", fuel consumption rate with the standard passenger load (Pi = 55), fuel consumption rate with the nominal passenger capacity (Pi = 110).

– transport fuel consumption rate $H_s = 33$ l/100 km;

– number of seated passengers P sitting = 31;

– number of standing passengers P facing = 79;

– correction factor for the norm,%. D = 0;

– fuel consumption rate for the heater, $H_{от} = 0$ l/ hour;

– car operating time on the line with the heater turned on, $T_{OT} = 0$ hour;

– passenger weight $G_p = 75$ kg;

– linear fuel consumption rate for additional mass of passengers in the cabin $H_p = 1.3$ l/100 t. km for diesel engines;

S – bus mileage, $S = 100$ km;

Basic (without passengers) fuel consumption rate of the bus is determined by the formula:

$$H_B = \left(H_s - \frac{G_P \cdot H_P \cdot P_{H.S}}{1000} \right) =$$
$$= \left(33 - \frac{75 \cdot 1.3 \cdot 55}{100} \right) = 33 - 5.4 = 27,64, l/100 \ km \qquad (12)$$

Normative fuel consumption at standard passenger load $(P_i = 55)$:

$$H_H = \left(0.01 \cdot H_B + \frac{G_P \cdot H_P \cdot P_{H.S}}{100} \right) \cdot S \cdot$$
$$\cdot (1 + 0.01 \cdot D) \cdot K + H_{OT} \cdot T_{OT}, \ l \qquad (13)$$

$P_i = 55$

$$H_H = 0.01 \cdot \left(H_B + \frac{G_P \cdot H_P \cdot P_i}{1000} \right) \cdot S \cdot$$
$$\cdot (1 + 0.01 \cdot D) \cdot K + H_{OT} \cdot T_{OT}, l$$

Normative fuel consumption at nominal passenger capacity $(P_i = 110)$:

$$H_H = 0.01 \cdot \left(H_B + \frac{G_P \cdot H_P \cdot P_i}{1000} \right) \cdot S \cdot$$
$$\cdot (1 + 0.01 \cdot D) \cdot K + H_{OT} \cdot T_{OT}, l \qquad (14)$$

with $P_i = 110$

$$H_H = 0.01 \cdot \left(27.64 + \frac{75 \cdot 1.3 \cdot 110}{1000} \right) \cdot 100 \cdot$$
$$\cdot (1 + 0.01 \cdot 0) \cdot 1 + 0 \cdot 0) + 38.36, \quad l$$

Application of this method of calculating the buses normative fuel consumption gave a good convergence of the results of computational and experimental studies "Determination of the temporary fuel consumption norms of the bus SAZ NP 37 01790 NDA of the Republican collection service of the State Unitary Enterprise Central Bank of Uzbekistan" [7] and "Determination of differentiated fuel consumption standards for buses "MERCEDES-BENZ C628.310 CONECTO LOW FLOOR" on two routes No. 89 and No. 24 in Tashkent city " [8].

General conclusions:

1. Proposed refined methods for determining the fuel consumption rates of trucks when working in complex traffic routes.

2. Existing method of determining the transport fuel consumption rate of bus does not exactly take into account the number of passengers in the bus.

3. Proposed improved method for determining fuel consumption of bus allows to determine the basic (without passengers) fuel consumption rate and transport work of the bus when transporting any number of passengers in the bus.

4. The basic (without passengers) fuel consumption rate can be determined before the start of bus operation.

5. The base fuel consumption rate makes it possible to evaluate the constructive bus efficiency by the ratio of curb and total mass.

6. Approbation of research work to clarify the methods of determining the fuel consumption of trucks and buses made in the bus parks "Toshshahartranshizmat" and freight transport enterprises in Tashkent city.

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COMBINATORY METHOD OF DEFINITION OF DISCRETE DECISIONS OF THE PROBLEM OF RATIONAL DISTRIBUTION OF VEHICLES ON RADIAL ROUTES

Abstract: In article three properties of the combinatorial method that allows determining discrete solutions of the problem of rational distribution of vehicles on radial routes are considered and justified. On the basis of the properties considered, the problem of effective distribution of vehicles for transportation of cotton on radial routes with application of a combinatory method of discrete programming is solved. One of decisions of a problem is received and the number the trips of each of considered five radial directions are defined.

By the proposed method it is possible to find and other decisions of a problem. As a result there will be a possibility of effective distribution carriages in a current of week, month and year.

Keywords: motor vehicles, discrete programming, cotton, radial routes, rational distribution, shipping, loading/ unloading mechanism, nodal point, cotton, working time, from the beginning forming, satisfy need, index number, property.

Analysis of the research work on the management of the process of transportation of goods by motor vehicles showed that, in essence, the problem under consideration uses the following modeling methods: linear programming, discrete programming, dynamic programming and stochastic linear programming.

If it is required to determine the objective function with constraint equations in the tasks of cargo transportation planning, then linear programming methods with widely used computational schemes and computer algorithms [1; 2; 3; 4] are used.

A separate method for solving optimization problems in transportation is dynamic programming, according to which, to find the optimal solution, the problem is divided into a series of steps (stages) and is solved sequentially from stage to stage [1; 5].

Some problems require solutions in the form of discrete values. These solutions require the use or development of methods for formulating and analyzing discrete solutions that meet all requirements. Such issues include the task of efficiently distributing vehicles along routes when transporting raw cotton.

Clap-raw transportation is carried out on radial routes (RR), i.e. cargoes are transported from one sender to several addressees or, on the contrary, from several senders to one addressee.

The scheme of a route which connects points of the sender and the addressee is the scheme of delivery and they can gather in uniform points or disperse from uniform points. Such schemes usually name assembly or distributive radial routes, and assembly (or distributive) point name nodal point (NP) [4; 6].

The satisfaction of requirement NP to transportation of cargoes is defined by parameters intensity of goods traffics which are provided vehicles, routes from a point of departure to reception point. RR, rendering transport services NP, consist of routes with various distances. The distance of a route of transportation of cargo and a type of cargo, on the one hand, defines number of vehicles which can effectively be used in these directions, and, on the other hand, defines number of flights which should be delivered the addressee or is taken out from the sender, depending on distribution of the limited quantity of vehicles. Vehicles, distributed in separate directions RR, cannot be big or small as we want. Because the quantity vehicles, allocated for routes, should not exceed possibility of points of sending (loading process) and acceptance (unloading process) cargo, and also their degree more an effective utilisation.

That is why the problem park distribution vehicles on RR demands the fresh wording and workings out of methods of

its decision on the basis of formation and the analysis of various combinations of variants of effective loading working on routes of final number vehicles within the working day.

Such a problem can be solved by means of discrete programming [7; 8]. The analysis of existing methods of discrete programming (a method of branches and borders, a method of casual search and combinatory methods) has shown that combinatory methods correspond essence of a considered problem. At the same time, for an effective utilisation of this method has arisen necessity of improvement of this method. Theoretical properties of a combinatory method are more low considered.

σ_j – the possible number of working loading (unloading) mechanisms in point of departure (acceptance) of cargo j-the route; γ – number of daily rides that can be performed as part of effective work with $\sigma_j = 1$; Z_l – number of trips to perform the daily volume of cargo transportation in NP RR; $Z_j \sigma_j$ – a set of possible number of rides on radial routes; $\sum_{j \in J} Z_{j\sigma_j} \cdot t_j$ – amount of time required to complete all rides.

Let's spend theoretical preconditions for application of a combinatory method of discrete decisions of a problem of rational distribution of vehicles on radial routes.

Property 1. For all admissible sets on i–the sum of values of indexes σ_j of a set or indexes $\psi_1^i \ldots \psi_e^i \ldots \psi_c^i$ – in number equally also is equal to a version of trailer Z_l/γ.

Justice of this property follows from a condition $\sum_{j \in J_l} Z_{j\sigma_j} = Z_l$, then $Z \sum_{j \in J_l} Z_{j\sigma_l} = \sum_{j \in J_l} \gamma \cdot \sigma_j = \gamma \sum_{j \in J_l} \sigma_j$, whence $\sum_{j \in J_l} \sigma_j = Z_l/\gamma$.

As Z_l it is identical to all admissible sets on i – the version of trailer and γ – number of daily rides that can be performed as part of effective work with $\sigma_j = 1$, that for all admissible sets of elements $Z_j \sigma_j$ value $\sum_{j \in J_l} \sigma_j$ is identical and equal Z_l/γ.

It is known, that number of an admissible set consists of set of indexes ψ_e^i, $(e \in \{1, 2, \ldots, e, \ldots, c\})$, where e – a serial number of element $Z_j \sigma_j$ in a set. Value of each index ψ_e^i in number is defined by value of corresponding index σ_j in an admissible set of elements $Z_j \sigma_j$. From here also follows, that $\sum_{j \in J_l} Z_{j\sigma_l} = \sum_{j \in J_l} \gamma \cdot \sigma_j = \gamma \sum_{j \in J_l} \sigma_j$, whence $\sum_{j \in J_l} \sigma_j = Z_l/\gamma$.

This property will be a basis at formation of every possible variants of admissible sets: their numbers are formed by assignment to indexes ψ_e^i $e \in E = \{1, 2, \ldots, e, \ldots c\}$, value from set $\sum = \{0, 1, \ldots, \sigma\}$ so that took place $\sum_{e=1}^{e} \psi_e^i = \frac{Z_l}{\gamma}$, i.e. distribution of values Z_l/γ on indexes ψ_e^i taking into account that value of each index belongs to set $\sum = \{0, 1, \ldots, \sigma\}$.

Consider the formation of the number of the first admissible set "from the beginning". Assign the first index (ψ_e^i) its maximum possible value, check $\psi_1^{l\max} = Z_l/\gamma$ and if

$\psi_1^{l\max} < Z_l/\gamma$, then we assign the maximum possible value to the 2nd index (ψ_2^i). Check again whether the ratio holds $\psi_1^{l\max} + \psi_2^{l\max} = Z_l/\gamma$ and if $(\psi_1^{l\max} + \psi_2^{l\max}) < Z_l/\gamma$, then go to the 3rd index and etc. Continues it until we will find out the such e-th index, for which the ratio holds $(\psi_1^{l\max} \ldots + \psi_e^{l\max}) > Z_l/\gamma$. If thus $\psi_1^{l\max} \ldots + \psi_2^{l\max} = Z_l/\gamma$, that number $\psi_1^{l\max} \ldots \psi_e^{l\max} \ldots \psi_{e+1}^{l\min} \ldots \psi_c^{l\min}$, where $\psi_{e+1}^{l\min} \ldots \psi_c^{l\min}$ take zero values, is the number of the first valid number "from the beginning". Otherwise, i.e. if $(\psi_1^{l\max} \ldots + \psi_e^{l\max}) > Z_l/\gamma$, index ψ_e^i must take on the value determined by the difference Z_l/γ and $\psi_e^{i\max} + \ldots + \psi_{e-1}^{i\ \max}$. The first admissible set "from the beginning" will look like thus: $\psi_1^{l\max} \ldots \psi_{e-1}^{l\max} \psi_e^l = \{Z_l/\gamma - (\psi_1^{l\max} + \ldots \ldots + \psi_e^{l\max})\} \psi_{e+1}^{l\min} \ldots \psi_c^{l\min}$. When forming the number of the first allowable dialing in order "from the end", the maximum possible values of the indices are assigned not starting from the first but from the last index. The rest of the process of formation does not differ from the above.

Determining the number of the first admissible set in the manner described above can be quite a long process, since before identifying the desired number gets a significant number of options.

Let's enter concept about a trial set and its number. The set is named trial "from the beginning" ("from the end") and designated – $H(Z_{j\sigma_j})_{samp}^{fbeg} \left(\sum_{e=1}^{c} \psi_e^i\right)_{samp}^{fbeg}$ (or $H(Z_{j\sigma_j})_{samp}^{fend}$), if the first (last) element in it takes the maximum possible, while the remaining elements take the minimum possible values.

In the general case, the definition of the number of the first admissible set "from the beginning" or "from the end" is represented as follows. The number of the test set "from the beginning" is formed $(\psi_1^{i\max} \psi_2^{i\min} \ldots \psi_c^{i\min})$ or "from the end" $(\psi_1^{i\min} \ldots \psi_{c-1}^{i\ \min} \psi_c^{i\max})$. For the trial dial number, the value is determined $\left(\sum_{e=1}^{c} \psi_e^i\right)_{samp}^{fbeg}$ or $\left(\sum_{e=1}^{c} \psi_e^i\right)_{samp}^{fend}$ and compared with Z_l/γ. There may be three cases:

1. $\left(\sum_{e=1}^{c} \psi_e^i\right)_{samp}^{fbeg} > Z_e/\gamma$ or $\left(\sum_{e=1}^{c} \psi_e^i\right)_{samp}^{fend} > Z_e/\gamma$. In this case, the following actions are taken:

- the difference is calculated $\Delta_1^i = \left(\sum_{e=1}^{c} \psi_e^i\right)_{samp}^{fbeg} - Z_e/\gamma$ and the first index of the number is determined $\psi_1^i = \psi_1^{i\max} - \Delta_1^i$. As a result, get the number of trial dialing $H(Z_{j\sigma_j})_{samp}^{fbeg}$: $\{\psi_1^i \psi_2^{i\min} \ldots \psi_c^{i\min}\}$;

- to determine the test dial number $H(Z_{j\sigma_j})_{samp}^{fend}$ calculated $\Delta_c^i = \sum_{e=1}^{e} \psi_e^i - \frac{Z_e}{\gamma}$ and $\psi_c^i = \psi_c^{i\max} - \Delta_c^i$. As a result, its number is set: $\{\psi_1^{i\min} \ldots \psi_{c-1}^{i\min} \psi_c^i\}$.

2. $\left(\sum_{e=1}^{c} \psi_e^i\right)_{samp}^{fbeg} < Z_e/\gamma$ or $\left(\sum_{e=1}^{c} \psi_e^i\right)_{samp}^{fend} < Z_e/\gamma_i$. In this case, the whole part of the relationship is taken

$$\Delta_k^i = \frac{Z_e / \gamma}{\left(\sum_{e=1}^{c} \psi_e^i\right)_{samp}^{fbeg}} \quad \text{or} \quad \Delta_k^i = \frac{Z_e / \gamma}{\left(\sum_{e=1}^{c} \psi_e^i\right)_{samp}^{fend}} \Delta_k^i,$$ and based on it is

determined by the index $\psi_{(1+\Delta_k^i)}^i = Z_e / \gamma - \Delta_k^i \left(\sum_{e=1}^{c} \psi_e^i\right)_{samp}^{fbeg}$ or

$\psi_{(c-\Delta_k^i)}^i = Z_e / \gamma - \Delta_k^i \left(\sum_{e=1}^{c} \psi_e^i\right)_{samp}^{fend}$. As a result, for $H\left(Z_{j\sigma_j}\right)_{samp}^{fbeg}$

get a number $\left\{\psi_1^{i\max}...\psi_{(1+\Delta_k^i-1)}^{i\max} \psi_{(1+\Delta_k^i)}^{i\min} \psi_{1+\Delta_{kr}^i+1}^{\min}...\psi_c^{i\min}\right\}$, and for

$H\left(Z_{j\sigma_j}\right)_{samp}^{fend}$ number $\left\{\psi_1^{i\min} ... \psi_{(1+\Delta_k^i-1)}^{i\min} \psi_{(c-\Delta_k^i)}^{i\max} \psi_{1+\Delta_{k+1}^i}^{i\max}...\psi_c^{i\max}\right\}$.

3. $\sum_{e=1}^{e} \psi_e^i = \frac{Z_e}{\gamma}$. In this case for a set $H\left(Z_{j\sigma_j}\right)_{samp}^{fbeg}$ number

will have the form: $\left\{\psi_1^{i\max}...\psi_2^{i\min}...\psi_c^{i\min}\right\}$, and for a set

$H\left(Z_{j\sigma_j}\right)_{samp}^{fend}$: $\left\{\psi_1^{i\min}...\psi_{(c-1)}^{i\min}...\psi_c^{i\max}\right\}$.

A union of sets is called as trial if, it consists the first admissible sets formed rather: 1) "from the beginning" or; 2) "from the end". In the first case we name its trial association "from the beginning" and value $(\sum_{j \in J} Z_{j\sigma_j} \cdot t_j)_{samp}$ for it it is designated $(\sum_{j \in J} Z_{j\sigma_j} \cdot t_j)_{samp}^{fbeg}$, and in the second – "from the end" – $(\sum_{j \in J} Z_{j\sigma_j} \cdot t_j)_{samp}^{fend}$. The following property of the trial set union is valid.

Property 2. Among the values of the sum $\sum_{j \in J} Z_{j\sigma_j} \cdot t_j$ for all possible combinations of permissible sets of value $(\sum_{j \in J} Z_{j\sigma_j} \cdot t_j)_{samp}^{fbeg}$ is the greatest and the value $(\sum_{j \in J} Z_{j\sigma_j} \cdot t_j)_{samp}^{fend}$ – the smallest. Let us prove the validity of this property. The elements $Z_j\sigma_j$ in a set are located in ascending order t_j that corresponds to a decrease order Z_l. In the first valid set "from the beginning," the elements $Z_j\sigma_j$, reaching at the beginning of the set, take their maximum possible values, they correspond to the highest values Z_l, because Z_l for the elements $Z_j\sigma_j$ in the set has a reducing character and therefore the value Z_l for the elements, reaching at the beginning, the greatest and for the subsequent ones – gradually decreases. As a result, for $(\sum_{j \in J} Z_{j\sigma_j} \cdot t_j)_{samp}^{fbeg}$ value $\sum_{j \in J} Z_{j\sigma_j} \cdot t_j$ is greatest of all its possible values corresponding every possible other admissible set. The trial set "from the beginning" consists of $(\sum_{j \in J} Z_{j\sigma_j} \cdot t_j)_{samp}^{fend}$ for all $i \in J$, hence the value $\sum_{j \in J} Z_{j\sigma_j} \cdot t_j$ will be the greatest of all. From property 2 the following consequence follows.

Consequence 1. If the test association satisfies conditions: 1) $(\sum_{j \in J} Z_{j\sigma_j} \cdot t_j)_{samp}^{fbeg} > (A_{\scriptscriptstyle Э}T_H)_{\max}$ or; 2) $(\sum_{j \in J} Z_{j\sigma_j} \cdot t_j)_{samp}^{fend} < (A_{\scriptscriptstyle Э}T_H)_{\min}$, then the task under the given conditions has no solution. Here, $A_{\scriptscriptstyle Э}$ – total number of vehicles used in transport, $T_{\scriptscriptstyle H}$ – the daily operating time of each vehicle. the total number of cars.

In view of property 2, the validity of consequence 1 is almost obvious. Really meaning $(\sum_{j \in J} Z_{j\sigma_j} \cdot t_j)_{samp}^{fbeg}$ is small of all

possible and if it is less than $(A_{\scriptscriptstyle Э}T_{\scriptscriptstyle H})_{min}$, then for any other association the ratio is fair $\sum_{j \in J} Z_{j\sigma_j} \cdot t_j < (A_{\scriptscriptstyle Э}T_{\scriptscriptstyle H})_{\min}$, i.e. the task has no solution.

Let's continue the problem decision as follows. After forming all the first valid sets, the value is calculated $(\sum_{j \in J} Z_{j\sigma_j} \cdot t_j)_{samp}^{fbeg}$ or $(\sum_{j \in J} Z_{j\sigma_j} \cdot t_j)_{samp}^{fend}$ and compared with the values $(A_{\scriptscriptstyle Э}T_{\scriptscriptstyle H})_{\min}$ and $(A_{\scriptscriptstyle Э}T_{\scriptscriptstyle H})_{\max}$. If at the same time the ratio provided by consequence 1, that concludes that the problem has the decision, and if not provided in it we come to a conclusion about necessity of moving "to the right" or "to the left" in sets of initial association.

The choice of directions of movement is made while taking into account the following property.

Property 3. In the movement in the number of the first allowable set "to the right", if possible, allows you to get the number of the set for which the value $\sum_{j \in J} Z_{j\sigma_j} \cdot t_j$ less and vice versa – "left" – more than the value of this sum in the first admissible set.

Let's prove this property. Assume that $\psi_1^i...\psi_d^i...\psi_{(c-\kappa)}^i...\psi_c^i$ – the number of the first valid set, formatted in the order "from the beginning": $Z_{j\sigma_{j(1)}}^l...Z_{j\sigma_{j(d)}}^l..Z_{j\sigma_{j(c-\kappa)}}^l...Z_{j\sigma_{j(c)}}^l$. The elements of this set of corresponding values t_j: $t_{j(1)}...t_{j(d)}...t_{j(c-\kappa)}...t_{j(c)}$. Known that $t_{j(1)} < t_{j(2)} < ... < t_{j(d)} < ... < t_{j(c-k)} < t_{j(c)}$. In this case, the first allowable set corresponds to the value of the sum $\sum_{j \in J} Z_{j\sigma_j} \cdot t_j$: $(\sum_{j \in J_l} Z_{j\sigma_j} t_j)_{1SN}^{fbeg} = Z_{j\sigma_{j(1)}}^l t_{j(1)} + ... + Z_{j\sigma_{j(d)}}^l t_{j(d)} + ... + Z_{j\sigma_{j(c-\kappa)}}^l t_{j(c-\kappa)} + ... + Z_{j\sigma_{j(c)}}^l \cdot t_{j(c)}$.

Suppose that in this set, moving to the right is possible (moving to the left is impossible here, which is proved by consequence 2, if moving to the right is also impossible, then the problem has no solution). We make an arbitrary unit move in the number of this set: let us assume that we move the unit from the d-th index to $(c-k)$-th. It is clear that $d < (c-k)$ and moving from the d-th index to $(c-k)$-th is moving "to the right". As a result of this move, we get the number: $\psi_1^i...(\psi_d^i - 1)...(\psi_{(c-\kappa)}^i + 1)...\psi_c^i$. This number corresponds to the set $Z_{j\sigma_{j(1)}}...(Z_{j\sigma_j \overline{(d)}}\gamma)...(Z_{j\sigma_j(c-\kappa)} + \gamma)...Z_{j\sigma_{j(c)}}$. It is clear that the movement of the unit in the number corresponds to the movement of the number γ in the set.

Amount value $\sum_{j} Z_{j\sigma_j} \cdot t_j$ for the result set is determined by:

$$(\sum_{j \in J_l} Z_{j\sigma_j}^l \cdot t_j)_{new} = Z_{j\sigma_{j(1)}}^l \cdot t_{j(1)} + ... + (Z_{j\sigma_{j(d)}}^l - \gamma) \cdot t_{j(d)} + ...$$

$$+ (Z_{j\sigma_{j(c-\kappa)}} + \gamma) \cdot t_{j(c-\kappa)} + ... + Z_{j\sigma_{j(c)}}^l \cdot t_{j(c)}.$$

Obviously, if the difference

$$A = \left[(\sum_{j \in J_l} Z_{j\sigma_j}^l \cdot t_j)_{new} - \sum_{j \in J_l} Z_{j\sigma_j}^l t_j)_{1SN}^{fbeg}\right] > 0$$ that

$(\sum_{j \in J_l} Z_{j\sigma_j}^l \cdot t_j)_{new} > (\sum_{j \in J_l} Z_{j\sigma_j}^l \cdot t_j)_{1SN}^{fbeg}$ which proves the validity of property 3.

For check of possibility of such case will define A:

$$A = Z^l_{j\sigma_j(1)}t_{j(1)} + ... + (Z^l_{j\sigma_j(d)} - \gamma) \cdot t_{j(d)} + ... + (Z^l_{j\sigma_j(c-\kappa)} + \gamma) \cdot t_{j(c-\kappa)} +$$

$$+ ... + Z^l_{j\sigma_j(c)} \cdot t_{j(c)} - Z^l_{j\sigma_j(1)} \cdot t_{j(1)} - ... - Z^l_{j\sigma_j(d)} \cdot t_{j(d)} - ... - Z^l_{j\sigma_j(c-\kappa)} \cdot$$

$$\cdot t_{j(c-\kappa)} - Z^l_{j\sigma_j(c)} \cdot t_{j(c)} = t_{j(d)}(Z^l_{j\sigma_j(d)} - \gamma - Z^l_{j\sigma_j(d)}) + t_{j(c-\kappa)}(Z^l_{j\sigma_j(c-\kappa)} +$$

$$+ \gamma - Z^l_{j\sigma_j(c-\kappa)}) = \gamma(t_{j(c-\kappa)} - t_{j(d)}).$$

Because $t_{j(c-k)} > t_{j(d)}$, then $A = \gamma \cdot (t_{j(c-k)} - t_{j(d)}) > 0$, as required.

It should be noted that the movement "right" must be carried out starting from the sets of $H(Z_{j\sigma_j})$, where the index i has the highest value with the decrement order, and moving "left" is the smallest with the increment order.

<div style="text-align:center">Table 1. Matrix possible the carriage $\left\|Z_{j\sigma_j}\right\|_{J\sum_j}$</div>

Quantity of loading mechanisms (σ_j) / Shippers (j)	Radial route numbers				
	1	2	3	4	5
0	0	0	0	0	0
1	10	10	10	10	10
2	20	20	20	20	20
3	30	30	30	30	30
4	40	40	40	40	40

Problem statement:

It is necessary to determine the combination and possible aggregations that are formed from the elements of the matrix $\left\|Z_{j\sigma_j}\right\|_{J\sum_j}$, representing a multitude of carriages running on radial routes so that a given number of carriages can be completed by destination $Z_l = 130$ with available car park ($A_\ni = 60$ units) within minimum $(A_\ni \cdot T_M)_{\min} = 600$ hours and maximum $(A_\ni \cdot T_M)_{\max} = 660$ hours of their congestion starting with minimum conditions ($T_{M\min} = 10$ hours) and maximum ($T_{M\min} = 11$ hours) time of performance of works.

The decision of the given problem can be found formation of all possible variants, allocation of variants "satisfying requirements", their check on degree of congestion and the performance analysis. However in this case it is required to consider 3125 variants and to check up to satisfaction to a condition of a problem of each variant. It is difficult enough work and demands performance of great volume of calculations. The following order of formation and the analysis of combinations the shipping therefore is recommended $Z_j\sigma_j$.

Possible set of elements $Z_j\sigma_j$ represents sequence of indexes $\psi^i_1 ... \psi^i_e ... \psi^i_c$, each of which takes the value of the index element σ_j from the aggregate.

In aggregate shipping $Z_j\sigma_j$, satisfying the requirements of Z_l each consumer by type of cargo l, indexes σ_j or the sum of the indexes of the series $\psi^i_1 ... \psi^i_e ... \psi^i_c$ are identical and equal Z_l / γ, and therefore $\sum_{j \in J_l} \sigma_j = Z_l / \gamma$; where γ – quantity

The effective distribution of vehicles by route considers the example of transportation and raw cotton.

Let the volume of homogeneous goods with an index l, $(l = 1)$ cotton of cleaning factory satisfying requirement makes $Z_{l=1} = 130$ carriage. Radial routes of transportation of cargoes are numbered as increase of full time of the turn (t_j) one vehicle on the route, $t_j\{2,3,4,5,6\}$.

Set of numbers carriage $(Z_j\sigma_j)$, that can be performed on each route (j) present in the form of an ordered matrix $\left\|Z_{j\sigma_j}\right\|_{J\sum_j}$ (Table 1).

of the articulated lorries, under condition of presence of one loading mechanism $\sigma_j = 1$.

Proceeding from the above mentioned, will form numbers of the first skilled set the carriage $Z^1_{j\sigma_j}$. For this initial few elements ψ^l_c assign possible maximum values $(\sigma_j = \sigma_j^{\max} = 4)$, other indexes – minimum values $(\sigma_j = \sigma_j^{\min} = 0)$. Then numbers of the first set $H(Z^1_{j\sigma_j})^{fend}_{samp}$ carriage $Z^1_{j\sigma_j}$ will be $4^14^14^10^10^1$.

For the generated numbers define the sum $\sum_{e \in E} \psi^l_e$:

$$\sum_{e=1}^5 \psi_e^{\ 1} = 4^1 + 4^1 + 4^1 + 0^1 + 0^1 = 12^1.$$

Calculates value of a parity (Z_l / γ): $\dfrac{Z_l}{\gamma} = \dfrac{130^1}{10} = 13^1$.

Value sum $\sum_{e=E} \psi_e^l$ compare with value $\dfrac{Z_l}{\gamma}$:

$$\frac{Z_l}{\gamma} = 13^1 \geq \sum_{e=1}^5 \psi_e^{\ 1} = 12^1.$$

That is the condition is available $\sum_{e=1}^c \psi_e^l < \dfrac{Z_l}{\gamma}$, thereby the totality numbers $H(Z_{j\sigma_j})^{fbeg}_{1SN}$ are determined by:

Δ^l_k – value of parameters for sets generated on-order "about the beginning", count a choice of the whole part of the following fraction $\dfrac{Z_l}{\gamma} : (\sum_{e=1}^c \psi_e^{\ l})^{fbeg}_{samp} = \left(\dfrac{13^1}{12^1}\right)_{6ym} = 1.$

Proceeding from value indexes are defined $\psi_{(1+\Delta^l_k)}$:

$$\psi^l_{(1+\Delta^l_k)} = Z_l / \gamma - \Delta_\kappa^{\ l} \cdot (\sum_{e=1}^c \psi_e^{\ l})^{fbeg}_{samp} : \psi^1_{3+1} = \psi_4^{\ 1} = 13^1 - 1 \cdot 12^1 = 1^1.$$

Thus, numbers of the first of sets "satisfying requirements" articulated lorries, written as – $4^1 4^1 4^1 1^1 0^1$ and set in a kind: $Z_{14}^{1} Z_{24}^{1} Z_{34}^{1} Z_{41}^{1} Z_{50}^{1}$.

Calculate the value of the sum $(\sum_{j \in J_1} Z_{j\sigma_j} \cdot t_j)_{samp}^{fbeg}$ for experienced associations of the first set of "satisfying needs" carriages:

$$A_{samp}^{fbeg} = \left(\sum_{j \in J} Z_{j\sigma_j} \cdot t_j\right)_{samp}^{fbeg} = \sum_{j \in J_1} Z_{j\sigma_j} \cdot t_j = Z_{14}^{1} {}^1 t_1 + Z_{24}^{1} {}^1 t_2 + Z_{34}^{1} {}^1 t_3 +$$

$$Z_{41}^{1} {}^1 t_4 + Z_{50}^{1} {}^1 t_5 = 40 \cdot 2 + 40 \cdot 3 + 40 \cdot 4 + 10 \cdot 5 + 0 \cdot 6 = 410.$$

If to compare this result with congestion of the car park in a current of day $(A_{\ni} T_H)_{min}$ and $(A_{\ni} T_H)_{max}$ whether it is possible to define satisfy the planned articulated lorries to following conditions:

$$(A_{\ni} T_H)_{min} \le (\sum_{j \in J} Z_{j\sigma_j} \cdot t_j)_{samp} \le (A_{\ni} \cdot T_H)_{max}.$$

From here it is visible, that skilled association does not satisfy to the put condition, i.e. $A_{samp}^{fbeg} = 410 < (A_{\ni} \cdot T_H)_{min} = 600$ hours.

If for the first associations $(\sum_{j \in J} Z_{j\sigma_j} \cdot t_j)_{atbeg} < (A_{\ni} \cdot T_H)_{min}$, then, in aggregate, calculate the value "satisfying needs" by moving "to the right":

$$3_{SN}^{right} = (A_{\ni} \cdot T_H)_{min} - A_{samp}^{fbeg} = 600 - 410 = 190 \text{ hours};$$

$$3_{SN}^{right} = (A_{\ni} \cdot T_H)_{max} - A_{samp}^{fbeg} = 660 - 410 = 250 \text{ hours}.$$

Here calculate the maximum value on which it is possible to move to the right in aggregate $H\left(Z_{j\sigma_j}^{1}\right)_{1SN}^{fbeg}$:

$$3_{max(right)}^{1SN} = (\sum_{j \in J_1} Z_{j\sigma_j}^{1} \cdot t_j)_{1SN}^{fbeg} - (\sum_{j \in J_1} Z_{j\sigma_j} \cdot t_j)_{1SN}^{fbed} =$$

$$= Z_{10}^{1} \cdot t_1 + Z_{24}^{1} \cdot t_2 + Z_{34}^{1} \cdot t_3 + Z_{41}^{1} \cdot t_4 + Z_{54}^{1} \cdot t_5 - Z_{14}^{1} \cdot t_1 -$$

$$- Z_{24}^{1} \cdot t_2 - Z_{34}^{1} \cdot t_3 - Z_{41}^{1} \cdot t_4 - Z_{50}^{1} \cdot t_5 = 0 \cdot 2 + 40 \cdot 3 + 40 \cdot 4 +$$

$$+ 10 \cdot 5 + 40 \cdot 6 - 40 \cdot 2 - 40 \cdot 3 - 40 \cdot 4 - 10 \cdot 5 - 0 \cdot 6 =$$

$$= 570 - 410 = 160 \text{ hours.}$$

Comparing value $3_{max(right)}^{1(1SN)} = 160$ ч с $3_{SN min}^{right} = 190$ hours and determined them $3_{max(right)}^{1(1SN)} = 160$ hours $< 3_{SN min}^{right} = 190$ hours.

Let's calculate the rest which is necessary for moving on the right part.

$$03_{SN min}^{right} = 3_{SN min}^{right} - \sum_{l=1}^{l-1} 3_{max(right)}^{1(SN)} = 190 - 160 = 30 \text{ hours};$$

$$03_{SN max}^{right} = 3_{SN max}^{right} - \sum_{l=1}^{l-1} 3_{max(right)}^{l(1SN)} = 250 - 160 = 90 \text{ hours.}$$

Thus, will designate $\psi_{d^m} = \psi_2$ departure index and $\psi_{(c-\kappa^m)} = \psi_4$ receiving index. Let the possible is known m-variant of moving of indexes. Identify opportunities for the index am sending and receiving:

$$\psi_{(c-\kappa^m)}^{otg} = \psi_{(c-\kappa^m)}^{max} - \psi_{(c-\kappa^m)} = 4 - 0 = 4;$$

$$\psi_{d^m}^{ots} = \psi_{d^m} = \psi_1 = 4.$$

Compare the parameters $\psi_{d^m}^{ots}$ and $\psi_{(c-\kappa^m)}^{otg}$ and define: $\psi_{(c-\kappa^m)}^{otg} = 4$ and $\psi_{d^m}^{ots} = 4$.

For a certain variant m will calculate value on which it is possible to move:

$$3_{\psi_{d^m}\psi_{(c-\kappa^m)}} = (t_{c-\kappa^m} - t_{d^m}) \cdot v \cdot \psi_{d^m}^{ots} = (t_4 - t_2) \cdot 10 \cdot \psi_2 =$$

$$= (5 - 3) \cdot 10 \cdot 4 = 80 \text{ hours.}$$

For a considered case, that $m = 1$, $\sum_{m=1} 3_{\psi_{d^m}\psi_{(c-\kappa^m)}} = 80$ hours.

This value is comparable to the parameters $O3_{SN min}^{right}$ and define: $\sum_{m=1} 3_{\psi_{d^m}\psi_{(c-\kappa^m)}} = 80 \text{ hours} > O3_{SN min}^{right} = 30$.

Check the condition $\psi_{(c-\kappa^m)}^{ots} > 1$, $\psi_3^{ots} = 4 > 1$. Conditions it is carried out.

Now define values $\Delta 3_{SN min}^{right(m)}$ and $\Delta 3_{SN min}^{right(m)}$:

$$\Delta 3_{SN min}^{right(m)} = O3_{SN min}^{right} - \sum_{m=1}^{m-1} 3_{\psi_{d^m}\psi_{(c-\kappa^m)}} = O3_{SN min}^{right} = 30 \text{ hours,}$$

$$\Delta 3_{SN max}^{right(m)} = O3_{SN max}^{right} - \sum_{m=1}^{m-1} 3_{\psi_{d^m}\psi_{(c-\kappa^m)}} = O3_{SN max}^{right} = 90 \text{ hours.}$$

Because at the above-stated calculations quantity of variants of displacement $m=1$, $\sum_{m=1}^{m-1} 3_{\psi_{d^m}\psi_{(c-\kappa^m)}} = 0$.

The minimum and maximum values of displacements $(n_{min}^{right(m)}, n_{max}^{right(m)})$, providing individual displacements to an interval $(\Delta 3_{SN min}^{right} \div \Delta 3_{SN max}^{right})$ can be determined by the expression:

$$n_{min}^{right(m)} = \frac{O3_{SN min}^{right}}{3_{\psi_{d^m}\psi_{(c-\kappa^m)}}^{1}} = \frac{30}{(t_4 - t_2) \cdot 10} = \frac{3}{5 - 3} = 1.5,$$

$$n_{max}^{right(m)} = \frac{O3_{SN max}^{right}}{3_{\psi_{d^m}\psi_{(c-\kappa^m)}}^{1}} = \frac{90}{10 \cdot (5 - 3)} = 4.5.$$

Now define quantity of individual movings. It is thus checked and define integer presence in an interval $n_{min}^{right(m)} - n_{max}^{right(m)}$. In a considered case there are three units of integers – 2, 3, 4.

Thus, from the possible maximum value of the digits of the aggregate articulated lorries – $0^1 4^1 4^1 1^1 4^1$, from the second index to the fourth will execute two displacements and will receive $0^1 2^1 4^1 3^1 4^1$ or in aggregate $Z_{10}^{1} Z_{22}^{1} Z_{34}^{1} Z_{43}^{1} Z_{54}^{1}$.

Let's check up congestion of the car park:

$$\sum_{j \in J_1} Z_{j\sigma_j} \cdot t_j = \sum_{j \in J_1} Z_{j\sigma_j}^{1} \cdot t_j = Z_{10}^{1} {}^1 t_1 + Z_{22}^{1} {}^1 t_2 + Z_{34}^{1} {}^1 t_3 + Z_{43}^{1} {}^1 t_4 + Z_{54}^{1} {}^1 t_5 =$$

$$= 0 \cdot 2 + 20 \cdot 3 + 40 \cdot 4 + 30 \cdot 5 + 40 \cdot 6 = 610 \text{ hours.}$$

The reached congestion makes 610 hours and it is between demanded values of 600 and 660 hours. This means that one of the solutions to the problem has the form $Z_{10}^{1} Z_{22}^{1} Z_{34}^{1} Z_{43}^{1} Z_{54}^{1}$, According to which in a current of day are carried out: on 2nd route 20 rider, 3rd route 40 rider, 4th route 30 rider and 5th route 40 rider. At the same time, the need of enterprises for raw materials is satisfied, the efficient use of loading mechanisms is ensured, and the cars are optimally distributed along routes.

By the proposed method it is possible to find and other decisions of a problem. As a result there will be a possibility of effective distribution carriages in a current of week, month and year.

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Section 11. Physics

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SPIN-DEPENDENT DIMENSIONAL QUANTIZATION IN A SEMICONDUCTOR HETEROSTRUCTURE

Abstract. A theory of spin-dependent dimensional quantization is contributed in a semiconductor heterostructure, where spin-orbit splitting is taken into account by introducing the Dresselhaus term into the effective Hamiltonian.

It is shown that the energy spectrum of electrons in the direction of size quantization consists of a set of non-equidistant discrete levels, depending on the wave vector directed along the interface of the heterostructure.

Keywords: energy spectrum, quantum well, wave function, dimensional quantization.

In connection with the growing interest in spin-dependent phenomena, the kinetics of spin-polarized electrons in semiconductors of various symmetries attracts great interest in order to create spin detectors. For the first time, the possibility of creating a spin filter based on tunneling through an asymmetric barrier in semiconductors is indicated in [1; 2], where the influence of spin on motion is taken into account by introducing the Rashba term [3] into the effective Hamiltonian of current carriers. The ability to obtain carrier polarization in a heterostructure, where asymmetry is created by doping, was analyzed in [4]. A theoretical model of a spin injector based on a symmetric barrier, where the Dresselhaus spin-orbit interaction was taken into account, was built in [5].

In this work, the size quantization of the energy spectrum of spin-polarized electrons in the quantum well of a piezoelectric semiconductor is theoretically considered. We assume that the structure is grown so that the normal to the interfaces of the structure is directed along one of the main crystallographic axes. For example, $Al_{1-x}Ga_xSb$ has a lattice of zinc blende type and it does not have a center of symmetry. Therefore, in the effective Hamiltonian of electrons, the terms are cubic in the wave vector. For definiteness, we assume that the axes Ox, Oy and Oz are directed along the crystallographic axes $[100]$, $[010]$ and $[001]$, respectively. Let $k_\perp (k_z)$ is the

wave vector of electrons is perpendicular (parallel) to the axis Oz along which tunneling can occur. In the absence of external influence, the state of the electrons can be described by the Hamiltonian:

$$\widehat{H}_l = -\frac{\hbar^2}{2m_l^{(*)}}\frac{\partial^2}{\partial x^2} + \frac{\hbar^2 k_\perp^2}{2m_l^{(*)}}\frac{\partial^2}{\partial x^2} + V_l(x) + \widehat{H}_l^{(D)}, \qquad (1)$$

Here $m_l^{(*)}$ is the effective electron mass, $V_l(x)$ is the potential, which depend on the layer number l of the structure, where the electron energy is measured from the bottom of the conduction band in the emitter [6].

In piezoelectric semiconductors of the type *GaAs* of spin-orbital interaction of an electron with a lattice field, a cubic in the wave vector term of the Dresselhaus term $\widehat{H}_D$ appears [7]:

$$\widehat{H}_l^{(D)} = \gamma_l \sum_{\alpha \neq \beta \neq \eta = x,y,z} \sigma_\alpha k_\alpha \left(k_\beta^2 - k_\eta^2\right), \qquad (2)$$

where γ_l is the Dresselhaus constant in the layer l of the heterostructure, $\sigma_\alpha (\alpha = x, y, z)$ is the Pauli matrix. For example, for $Al_{0.3}Ga_{0.7}Sb$, it takes the values $76\ meV \cdot nm^{-1}$ [8], for GaSb it takes $187\ meV \cdot nm^{-1}$ [5]. We will research the tunneling of electrons with kinetic energies (in the emitter and collector) substantially smaller than the depth of the well and the height of the barrier, which allows us to leave only terms linear in the wave vectors k_x, k_y and write the Dresselhaus term in (1) in the form:

$$\hat{H}_l^{(1D)} = \gamma_l \left(\sigma_y k_y - \sigma_z k_z \right) \frac{\partial^2}{\partial x^2}, \hat{H}_l^{(2D)} = \gamma_l \left(\sigma_z k_z - \sigma_x k_x \right) \frac{\partial^2}{\partial y^2},$$

$$\hat{H}_l^{(3D)} = \gamma_l \left(\sigma_x k_x - \sigma_y k_y \right) \frac{\partial^2}{\partial z^2}, \qquad (3)$$

Let an electric field be applied to the heterostructure. We will consider it sufficiently small, so that the distortion of the heterostructure caused by it is much less than the height of the barriers and the depth of the well. This allows us to consider it as a small perturbation and neglect the Rashba effect [7; 8], as will be shown later. So, the Hamiltonian for electrons in a layer with a number l, with which you can analyze dimensional quantization and tunneling, we write in the form:

$$\hat{H}_l^{(\zeta)} = -\frac{\hbar^2}{2m_l^*} \frac{\partial^2}{\partial x_\zeta^2} + \frac{\hbar^2 \left(\vec{k}_\perp^{(\zeta)} \right)^2}{2m_l^*} \frac{\partial^2}{\partial_\zeta^2} + V_l(x_\zeta) + \hat{H}_l^{(\zeta D)}, \qquad (4)$$

where $\zeta = 1,2,3$ correspond to the interfaces yz, xz and xy respectively, $\left(\vec{k}_\perp^{(1)} \right)^2 = k_z^2 + k_y^2, \left(\vec{k}_\perp^{(2)} \right)^2 = k_x^2 + k_z^2, \left(\vec{k}_\perp^{(3)} \right)^2 = k_x^2 + k_y^2,$ $x_1 = x, x_2 = y, x_3 = z$.

The wave function of an electron with a wave vector $k_\perp^{(\zeta)}$, following [7], will be sought in the form:

$$\psi_l^{(\zeta\pm)} = \chi_l^{(\pm)} u_l^{(\zeta\pm)}(x) e^{i\vec{r}_\perp \vec{k}_\perp^{(\zeta)}} \qquad (5)$$

and the spinor $\chi^{(\pm)}$ is chosen so that it diagonalizes the Dresselhaus Hamiltonian $\hat{H}_l^{(D1)}$ in (3):

$$\chi_l^{(\pm)} = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 \\ \mp e^{-i\varphi} \end{pmatrix} \qquad (6)$$

where φ is the polar angle of the vector components $\vec{k}_\perp^{(\zeta)}$ describing the electron motion in the interface plane of the structure.

Then the Dresselhaus Hamiltonian takes the form:

$$\hat{H}_l^{(\zeta D)} = -\gamma_l k_\perp^{(\zeta)} \sigma_{x_\zeta} \frac{\partial^2}{\partial x_\zeta^2} \qquad (7)$$

and the Schrödinger equation for the components of the wave function $u^{(\pm)}(z)$ has the form $\hat{H}_l^{(\zeta)} u_l^{(\zeta\pm)}(x_\zeta) = E_l^{(\zeta)} u_l^{(\zeta\pm)}(x_\zeta)$ or

$$\left[-\frac{\hbar^2}{2m_l^{(\zeta)}} \frac{\partial^2}{\partial x_\zeta^2} + V_l(x_\zeta) \right] u_l^{(\zeta\pm)}(x_\zeta) = E_l^{(\zeta)} u_l^{(\zeta\pm)}(x_\zeta), \qquad (8)$$

Here $m_l^{(\zeta)} = m_l^{(*)} \left(1 + \frac{2\gamma_l m_l^{(*)} k_\perp^{(\zeta)}}{\hbar^2} \right)^{-1}$ and it depends $k_\perp^{(\zeta)}$.

Next, we solve equations (8), where we assume that the potential in each layer is constant, i.e. $V_l(z) = V_l$. Then the solution of equation (8) well be sought in the form

$$u_l^{(\zeta\pm)}(x_\zeta) = A_l^{(\zeta\pm)} e^{i\kappa_l^{(\zeta)} x_\zeta} + B_l^{(\zeta\pm)} e^{-i\kappa_l^{(\zeta)} x_\zeta}, \qquad (9)$$

or

$$u_l^{(\zeta\pm)}(x_\zeta) = C_l^{(\zeta\pm)} \cos\left(\kappa_l^{(\zeta)} x_\zeta \right) + D_l^{(\zeta\pm)} \sin\left(\kappa_l^{(\zeta)} x_\zeta \right), \qquad (10)$$

where $\kappa_l^{(\zeta)} = \sqrt{\frac{2m_l^{(\zeta)}}{\hbar^2} \left(V_l - E_l^{(\zeta)} \right)}$, values $A_l^{(\zeta\pm)}, B_l^{(\zeta\pm)}$ or $C_l^{(\zeta\pm)}, D_l^{(\zeta\pm)}$ are determined from the boundary conditions of the problem. For example, from the condition $u_l^{(\zeta\pm)}(x_\zeta = 0) = 0$ we have $C_l^{(\zeta\pm)} = 0$, so

$$u_l^{(\zeta\pm)}(x_\zeta) = D_l^{(\zeta\pm)} \sin\left(\kappa_l^{(\zeta)} x_\zeta \right), \qquad (11)$$

from which when $u_l^{(\zeta\pm)}(x_\zeta = a) = 0$ we have $\kappa_l^{(\zeta)} x_\zeta = \pi n_l^{(\zeta)} a \left(n_l^{(\zeta)} = 1, 2, ... \right)$, from where

$$E_l^{(\zeta)} = V_l + \frac{\pi^2 \hbar^2}{2m_l^* a^2} \left(n_l^{(\zeta)} \right)^2 \left(1 + \frac{2\gamma_l m_l^{(*)} k_\perp^{(\zeta)}}{\hbar^2} \right). \qquad (12)$$

Thus, the energy spectrum of electrons in the direction of size quantization consists of a set of non-equidistant discrete levels, depending on the wave vector $k_\perp^{(\zeta)}$.

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Section 12. Philology

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COMPARATIVE TYPOLOGY OF KAZAKH AND MONGOLIAN LANGUAGES IN THE FIELD OF SYNTAX

Abstract. The article provides a brief overview of the basic studies of Kazakh-Mongolian languages, which are included in the group of Altai languages. The author points out the importance of comparative typological research in the syntax of the named languages, which is currently a gap not only in Turkic and Mongolian, but also in altaistic; gives generalized research results on this issue, which is focused on the level of simple Kazakh and Mongolian in the synchronous aspect. And we think that on the basis of typological studies it is possible to determine the future tasks of comparative studies of modern Altai languages.

Keywords: Kazakh language, Mongolian language, place of Kazakh language in Turkic studies, altaistics, syntactic typology, Turkic-Mongolian languages, descriptions of structural elements, type of communication.

Kazakh language is the state language of the Republic of Kazakhstan (since 1990 and this position is confirmed by the new Constitution of the Republic of Kazakhstan adopted on January 28, 1993) and together with Nogai and Karakalpak belongs to the Kipchak group and is considered the "youngest" language among all Turkic languages. Despite the fact that Kazakh language has such a "young" age, it has a great literary heritage and a rich literary language. The scientific works of Kazakh linguists are specific in the field of linguistics on a comparative study on the relationship between the Kazakh and Mongolian languages. Ironically, part of the ethnic Kazakhs who have been on the territory of the Mongolian People's Republic have lived in this country for many years. When Kazakhstan was part of the USSR, Mongolia as a socialist republic, had a good relationship with the Kazakh SSR in the field of science, technology and culture. All specialists of Kazakh language and literature studied in universities of the Kazakh SSR. Due to this, ethnic Kazakhs well preserved their identity and all the beauty of their native language and became bilingualists. Thus, it can be noted that this fact at a significant level encouraged Kazakh linguists to conduct research in this area. But the fundamentals of questions about the linguistic relations between Kazakh and Mongolian peoples were laid in the works of the first Kazakh scholar Sh. Ualikhanov, then – G. Musabaev, K. Akhanov, A Kaydari, Sh. Sarybaev, and their research was continued in the theses by Zh. Tuymebayev, G. Sagidolda, B. Napil. The views and works of a prominent Mongolian-Kazakh scholar B. Bazylkhan about the common-language common root elements in these languages in foreign altaistics received a well-deserved assessment. Therefore, we can rightly assume that Kazakh linguistics has considerable experience on this issue than other Turkic languages. Unfortunately, in Kazakh linguistics, the facts of the Mongolian language were mainly involved in order to establish the etymological basis of individual words, to mention toponymic parallels, phraseological units. The works of the Mongolian-Kazakh linguist B. Bazylkhan are dedicated to identifying single-root words and comparing the morphological categories of Kazakh and Mongolian words. In this case, it is impossible not to draw attention to the comments of Academician Sh. Sarybayev, that it is high time for Kazakh linguistics to work on problems of general Turkic studies or general linguistics [1, 208], this approach will make it possible to clarify to a certain extent the place of the Kazakh language in Turkic studies and even in altaistics. There is an opinion that "… altaistics has spent many decades – it has no prospects, since in the overwhelming majority of cases, the Mongolian forms proper act as proto forms, while the most ancient Turkic forms show greater similarity with the forms of modern Mongolian languages, rather than with ancient Mongolian. The same is true about the Manchu-

Tungus languages: Turkic forms are more similar to those languages whose phonetic structure has been greatly changed – Oroch, Ulchi, Nanai; similar changes are shown by the Even language, more than the other Tungus-Manchu languages, subjected to the Turkic (Yakut) influence" [2]. According to our review of research on Altai languages, we observe that as research materials in these languages, some are distributed in the form of random or natural and artificially limited parts of the language, such as phonetics, from the grammar only morphology. If both parts of the grammar (morphology and syntax) were sufficiently and comprehensively considered, then we could give information about the linguistic image of the historical past and about historical development, change, differentiation or integration and other phenomena. In other words, "private convergence still does not give anything; for every language fact is part of an inseparable whole. One particular case should not be compared with another special case; it is necessary to compare one language system with another" [3, 19]. The system of linguistic phenomenon is clearly expressed in grammar, it is a set of techniques by which words are changed and connected to build phrases in addition it is also the most stable side of the language [4, 26]. This would be possible, because each act of speaking in its composition, both small and large, is part of the statement, which contains a number of repetitive elements. In this case, not only speaking is the basis of the speech act and brings all sorts of repetitive language elements into the system. And a sentence is a systemic structure that provides an exchange of views, intercommunication, emotional and expressive effect, gives openness to the process of thinking, in a broad sense, the syntactic system of the language opens up great prospects for typological research. One of the main tasks of the syntactic typology is to identify the process of thought formation and its verbal expression in various languages, taking into account the research of its communicative, thought-conscious structures, which will be helpful in determining the structure of the basic syntactic model (phrase and outline structure of the sentence) in which information about the permanent content structure that has developed over the years in the space of various circumstances and events. In general, very significant problems relate to the main issues of the general syntactic typology. It is known that "all Turkic languages, … and all Altaic … have common typological features: … in the field of syntax, a specific word order in phrases and sentences, according to which all defining words are in position before defined, the complementary before complemented; lack of agreement in the number of defined and attribute, weak development of complex structures with subordinate clauses, which in most cases correspond to special participle and verbal participle phrases, etc." [5, 85]. And syntactic typological studies are mostly comparative and contrastive. This, apparently, is explained, on the one hand, by the volume of syntactic concentration, on the other hand, by the practical significance of clarifying linguistic similarities and differences. The syntactic level of the language, first of all, requires a description of its basic units and consideration of the most important functions, a comparison of the levels of a word combination, a sentence. Therefore, it is natural to describe the structural elements that will allow us to consider the "movement" of linguistic phenomena or the course of their mutual organization both from a formative and from a substantive position.

In our study, from the point of view of traditional grammar, the structure of the simple sentence of Kazakh and Mongolian languages was covered: methods and forms of syntactic relations, types of simple sentence, modality, introductory words and inserted constructions; members of the sentence and ways of their expression; homogeneous and detailed parts of the sentence of Kazakh language, their compliance with Mongolian language. At the same time, similar and distinctive features in the Kazakh and Mongolian languages identified in all literary styles of the language were defined. For example, that in the languages represented the main parts of the sentence have more differences than the secondary ones. This can be explained by the fact that the main parts form the structural basis and define the typical types of sentences, therefore, the main parts of the sentence undergo qualitative changes in the language.

Some syntax units, such as functional names, do not differ much in grammatical terms, but they have a difference: if in Kazakh language, functional names only in the isaphet combination perform a service function, then in Mongolian this pattern is not necessary, although they are also used after the genitive case.

Also there were found some syntactic facts that distinguish Kazakh language from Mongolian – non-traditional subject, i.e. subject expressed by the noun in indirect cases. For example, in Kazakh language in simple sentences of a complicated type, the subject can be expressed not only in the nominative, but also in the genitive, and in Mongolian – in simple, and in complex sentences it can be expressed in other cases. Analyzing the facts of these languages, we came to the conclusion that the non-traditional subject of the compared languages is, firstly, of a formal nature, in this case it is impossible to speak about ergativeness; secondly, such differences of these languages are the effects of their historical superstratss, in Kazakh – Arabic, in Mongolian – Tibetan.

In addition, there are a number of issues awaiting immediate resolution for both Turkic and Mongolian languages; we are talking about expanded parts of the sentence. Around this concept in Turkology and Mongolism for a long time there were discussions, disputes, partly meaningful, partly

terminological, and as a result, Türkologists had a common opinion, adopted the term as a unit of complicated type of simple sentence. However, in its grammatical form and syntactic function, the same equal unit in Mongolian language is understood as a component of a complex sentence. When analyzing the studied languages, it turned out that sometimes the expanded parts of the sentence in Turkic languages have an advantage over the members of the simple sentence, and in Mongolian – the component of a complex sentence sometimes loses its function as a part of the simple sentence. Therefore, this syntactic unit still needs detailed study in altaistics.

The results of our research can be summarized as follows:

1. It was found that the linguists of the studied languages adhere to different theoretical concepts, as a result of which "attitudinal differences" arise. For example, in Kazakh linguistics, the forms of the Participle I and Participle II are the ways of joining, and in Mongolian they are defined as a method of composing and subordinating connections in a sentence. In fact, their syntactic functions are the same.

2. On the basis of linguistic facts, these differences were revealed:

a) in Mongolian, the subject is not consistent with the predicate; therefore, the person in the sentence is determined by the context, appeal, and possessive endings; therefore, the relationship between the main parts of the sentence is called coordination.

b) in Mongolian language there is no such type of communication as "mutual subordination" characteristic of all Turkic languages, including Kazakh;

c) in Kazakh language analytical constructions dominate, and in Mongolian – synthetic; grammar functions of the *arkili, karai, boyinsha* of Kazakh language can be given as examples,

and in the Mongolian language they are transmitted by case endings of the case "uildeq", but some synthetic constructs are transmitted analytically, for example, the function of the "*deer*" of Mongolian language in Kazakh language perform dative-directional and local cases.

3. It should be noted that the question of a single epoch of these languages still remains open, but they still have the most ancient grammatical features. This is noted when considering such a category as the case: the grammatical-syntactic functions of the nominative, genitive, directional, local and original cases that are not subject to internal and external influence.

4. In order to deny or approve the Altai theory or give a more developed and scientifically based judgment and for a complete picture of Altai languages in general, it is necessary to study the syntax materials not only of Kazakh and Khalkha-Mongolian languages, but also of other Turkic and Mongolian languages.

In conclusion, we would like to note that the study of Altai languages from the point of view of comparative historical, comparative typological and areal linguistics should complement each other. According to our assumption, the study of Turkic-Mongolian (Altai) languages in the field of syntax should go in the following directions: determination of the scope and object of study of the syntactic typology of Turkic-Mongolian languages; development of basic criteria and identification of the syntactic typology of the named languages; delimitation or establishment of relations between syntactic typology and other typical types of linguistics, preparation of syntactic universal phenomena, etc. Solving a problem of this nature necessitates the expansion of language materials and the use of various research methods in order to create a more realistic typological picture of Altai languages "in one's home".

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AMPEROMETRIC TITRATION OF MERCURY (II) WITH MPHCMDEDTC – A NITROGEN-AND-SULFUR-CONTAINING REAGENT

Abstract. The article describes the determination of the dissociation constant of 4-methoxyphenylcarboxymethyldiethyldithiocarbamate (MPHCMDEDTC) ($pKa_1 = 2.84$). The reagent manifests depolarization properties on a graphite electrode in a wide range of acidity of background solutions. The linear dependence of the wave height on the concentration of the complexing agent is determined in the range from $2.5 \cdot 10^{-6}$ M – $5.0 \cdot 10^{-4}$ M. MPHCMDEDTC forms a soluble complex with mercury (II) with a 1:1 ratio on backgrounds of 0.1 M of CH_3COOH, CH_3COOK, KNO_3 and KCl potassium acetate, nitrate and lithium chloride. A rapid method has been developed for the determination of 0.25–90.0 μg/ml of mercury (II) in wastewater of non-ferrous metallurgy and petrochemical enterprises.

Keywords: 4-methoxyphenylcarboxymethyldiethyldithiocarbamate, solution, acetic acid, graphite electrode, electrolyte, reagent, concentration, complex, mercury (II), method, amperometric determination.

Introduction

Complexing agents are widely used in analytical chemistry. EDTA, also known as Trilon B (sodium ethylenediaminetetraacetate) is widely used as a titrant (including use in amperometric titration method) [1]. The use of EDTA as a titrant for the amperometric determination of mercury (II) is described in [2]. However, the lower limit of the determined contents in this case is very high – 4 μg/ml, also Cu(II), Ti(IV), Pb(II), Fe(III), Mo(VI) interfere with the determination of mercury.

In recent years, analytical chemists have been interested in complexing agents containing heteroatoms, including nitrogen and sulfur. Data on the use of nitrogen-and-sulfur-containing complexing agents in amperometric titration method are limited. Data are given for determining the composition of the complexes of a number of metals 1-morflino-4-methylhexin-2-ol-4 and ethylene glycol-bis (ethylthioacetic acid) [3; 4]. The use of dithiodiacetic acid for the amperometric determination of a number of metals, including mercury (II), by the current recovery of the reagent at the dropping mercury electrode [5] has also been described [5]. We found that the selectivity of the determination of mercury using the nitrogen-sulfur-containing complexing agent MPHMDEDTC

(4-methoxyphenylcarboxymethyldiethyldithiocarbamate) is higher than during the titration of EDTA. Therefore, the use of nitrogen-and-sulfur-containing compounds in the method of amperometric titration is of undoubted interest.

This paper is devoted to the study of the possibility of amperometric titration of mercury (II) with two indicator electrodes with solution of 4-methoxyphenylcarboxymethyl diethyldithiocarbamate (MPHCMDEDTC) in a wide range of aprotic bipolar solvents used in electrochemical studies, such as dimethyl sulfoxide (DMSO) and dimethylformamide (DMF), which show weak basic properties.

We tried to find the optimal conditions for the amperometric titration of mercury (II) with MPHCMDEDTC solutions in non-aqueous protolytic media on different acid-base properties of background electrolytes. The literature has no data on the amperometric titration of mercury (II) and ions of various metals with MPHCMDEDTC solutions, since it was synthesized relatively recently [6] and, apart from biological activity, their other properties have not yet been studied [7].

Materials and methods

The reference 0.002 M mercury (II) nitrate solution was prepared by dissolving a sample of $Hg(NO_3)_2 \cdot H_2O$ (CP) in DMSO or DMF and standardized by aqueous solution. Solutions of lower concentrations were obtained by diluting the reference solution immediately before their use. MPHCMDEDTC ($5 \cdot 10^{-2}$ M) solutions were prepared by accurately weighing the reagent. Mercury (II) solutions were prepared by dissolving a portion of CP mercury nitrate in distilled water, standardization was carried out on sodium chloride [8]. Working solutions of lower concentration were prepared by sequential dilution of the initial solution.

On the curve of potentiometric titration MPHCMDEDTC a potential jump is observed after addition of two moles of alkali. The acid dissociation constants pKa_1 and pKa_2 were calculated equal to 2.84 and 4.75, respectively.

0.1 M solutions of CH_3COOH, CH_3COOK, KNO_3 and KCl were used as backgrounds solutions.

Volt-ampere curves of MPHCMDEDTC in the anodic polarization region of the platinum microdisk electrode were recorded using the ППТ-1 (PPT-1) and ПУ-1 (PU-1) polarographs with recorders: ЛКД4–003 (LKD4–003) and ПДП4–002 (PDP4–002), using a three-electrode cell, design of which is described in [9] and amperometric titration with two indicator rotating platinum electrodes was performed on the previously described equipment. The titrant was dosed with a piston microburette to the accuracy of 0.0005 ml the final volume of the solution prepared for the titration was 10.0 ml.

Results and discussion

Electrochemical oxidation of MPHCMDEDTC has been studied in a wide acidity range of background solutions. Against the background of 0.1 M CH_3COOH and ammonium-acetate backgrounds of pH 3.35–5.50 MPHCMDEDTC gives one clear oxidation wave with a current limiting area in the potential range of 1.25–1.45 V that decreases with the increase of pH background electrolytes and disappears at pH ≥ 7.0. At the 0.01 M H_2SO_4 background no oxidation wave of MPHCMDEDTC was detected, however, oxidation takes place (anodic shift). At the limiting current potential on all backgrounds, the dependence of the current on the reagent concentration is linear. It is established that the limiting current is directly proportional to the concentration of the depolarizer in the range of $2.5 \cdot 10^{-4} - 5.0 \cdot 10^{-4}$M.

The complexation reaction of mercury (II) with MPHCMDEDTC, was studied using the method of amperometric titration on different acidity backgrounds at E = 1.25–1.45 V by the current of reagent oxidation. At pH > 6.5 fuzzy titration curves were obtained, the end point of the titration is difficult to determine, since under these conditions the height of the titrant oxidation wave decreased. Distinct titration curves with a pronounced kink were obtained on the backgrounds of 0.1 M CH_3COOH, CH_3COOK, KNO_3, KCl as well as using ammonium acetate mixtures with pH 3.35–5.50.

Data on the titration of reference mercury (II) solution with a reagent lead to a conclusion, that complex of molar ratio of mercury (II) and MPHCMDEDTC is formed at a ratio of 1:1 on titration backgrounds. The results of the titration of mercury (II) with the solution MPHCMDEDTC presented in table 1. The data show that the lower limit of the determined content of mercury (II) is 0.25 μg/ml.

Table 1.– The results of the determination of various amounts of mercury (II) with a solution of MPHCMDEDTC in acetic acid

Introduced Hg (II), μg	Found metal, μg (P = 0.95; $\bar{x} \pm \Delta X$)	n	S	S_r
25.48	25.43±	3	0.21	0.008
50.96	51.23±	3	0.11	0.002
101.9	101.4±	4	0.34	0.003
231.4	234.0±	4	0.26	0.001
462.7	462.8±	3	0.36	0.001

The possibility of selective determination of mercury (II) in the presence of a number of related elements has been studied. The results are presented in (table 2). It has been established that any amounts of Cd, Zn, Co, Ni, Al, Cu, Pb, Ca, Mg do not interfere with the amperometric determination of mercury (II).

Table 2.– The results of amperometric titration of mercury (II) with a solution of MPHCMDEDTC in acetic acid on the background of 0.25 M of potassium acetate in model mixtures

Analyzed mixture composition, µg	Found Hg, µg (P=0.95; $\overline{x} \pm \Delta X$)	n	S	S_r
Hg(25.07)+Cd(4.85)	25.42±	5	0.32	0.013
Hg(25.07)+Mg(20.55)	24.65±	4	0.28	0.011
Hg(50.14)+Cd(35.62)+Zn(10.58)	50.51±	4	0.45	0.009
Hg(50.14)+Mg(6.45)+Ni(28.50)	49.85±	5	0.53	0.011
Hg(75.21)+Cd(10.45)+Ca(15.63)+Al(144.57)	75.96±	5	0.45	0.006
Hg(75.21)+Zn(150.40)+Al(16.55)+Pb(2.75)	74.71±	5	0.67	0.009

At high chromium (III) concentration, the results of mercury (II) determination were lowered, which may be due to the formation of a complex of chromium (III) with MPHCMDEDTC and a change in the slope of the titration curve after the equivalence point [3]. Silver (I) content of up to a 50-fold excess does not affect the results of the mercury (II) determination. The determination of mercury (II) in the presence of manganese (II) is difficult because of the high and unstable initial current, which is the result of the oxidation of manganese (II) at a given potential. The possibility of amperometric determination of mercury (II) in the presence of a 10-fold excess of vanadium (V) and iron (III) has been established.

Methods of analysis: 0.2 g of mesityl oxide is added to an aliquot of the analyzed solution containing 5–75 µg of mercury (II), then the pH is adjusted to 4.5–5.0 with caustic potassium and hydrochloric acid, the solution is diluted to 50 ml and extracted mercury (ii) for 1 min with 10 ml of mesityl oxide. After separation of the phases, the extract is destroyed by heating with chromic anhydride or hydrogen peroxide, then collected in a 25 ml flask, and brought to the mark, an aliquot of the analyzed solution is taken (2–5 ml), create optimal conditions for conducting amperometric titration (2.0 ml 0, 25 M potassium acetate and the required amount of acetic acid) and titrate the mercury (II) with a solution MPHCMDEDTC.

The results of the titration of mercury (II) with a solution of MPHCMDEDTC in the extracts are given in (Table 3). As can be seen from the data in the tables, the developed methods for amperometric titration of mercury (II) with MPHCMDEDTC solution in various artificial mixtures of salts after its extraction separation are distinguished by relatively high accuracy and very good selectivity.

Table 3.– The results of the amperometric titration of mercury (II) with the MPHCMDEDTC solution directly in the extracts (extraction reagent – mesityl oxide; backgrounds – potassium acetate, nitrate and lithium chloride, ($\Delta E = 0.75$ B))

Analyzed mixture composition,%	Found Hg, µg (II),% (P=0.95; $\overline{x} = \Delta X$)	n	S	S_r
Hg(3.154)+Bi(5.60)+Sn(91.24)	3.162 ± 0.079	4	0.05	0.016
Hg(1.072)+Au(0.56)+Cd(98.36)	1.077 ± 0.063	4	0.04	0.037
Hg(5.275)+Ir(14.62)+Cu(80.10)	5.259 ± 0.025	5	0.02	0.004
Hg(0.294)+Bi(11.40)+Ir(0.36)+Zn(87.94)	0.304 ± 0.016	4	0.01	0.033
Hg(0.435)+Ni(56.31)+Sn(28.65)+Mg(14.60)	0.421 ± 0.032	4	0.02	0.047
Hg(1.150)+Cd(65.12)+Pt(0.53)+Bi(33.20)	1.140 ± 0.048	4	0.03	0.026
Hg(0.684)+Co(45.18)+Os(0.47)+Cd(48.34)	0.675 ± 0.025	5	0.02	0.030
Hg(1.027)+Zn(12.43)+Pb(50.66)+Ni(34.44)	1.017 ± 0.018	4	0.03	0.029
Hg(0.342)+Mn(31.12)+Cd(0.88)+Sn(0.65)	0.335 ± 0.025	5	0.02	0.060

As shown by the data in the tables, amperometric titration of the studied metals with a solution of MPHCMDEDTC results in fairly accurate and reproducible results. In all cases, the found contents correspond to the introduced quantities and do not exceed the limits of the confidence intervals, and the relative standard deviation does not exceed 0.06.

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AMPEROMETRIC TITRATION OF PALLADIUM (II) AND PLATINUM (IV) IONS IN INDIVIDUAL SOLUTIONS OF VINYLPYRIMIDINE

Abstract. The article describes the conditions for and the possibility of amperometric titration of palladium (II) and platinum (IV) ions in individual solutions of vinylpyrimidine (VP) in non-aqueous media (acetic acid, n-propanol, DMF, DMSO) and their mixtures with background electrolytes with different acid-base properties. The article proposes methods of amperometric titration of microgramic quantities of palladium (II) and platinum (IV) ions in individual solutions.

Keywords: palladium, platinum, vinylpyrimidine, solution, acetic acid, n-propanol, DMF, DMSO, background electrolytes, amperometry.

Amperometric titration of metal ions in non-aqueous and mixed media with various complexants allows expanding their analytical capabilities and simplifying the solution of many complex analytical problems. One of the important factors for this is the fact that the nature of the solvent heavily influences the strength of the resulting complex, moreover, it is not the same for different cations, which determines the selectivity and expressivity of the method. In addition, methods of non-aqueous complexometry successfully solve the problem of accurate and selective determination of metals in organic objects, as well as directly in the extracts obtained by concentration.

We tried to find optimal conditions for amperometric titration of a number of noble metals with solutions of vinylpyrimidine (VP) in non-aqueous protolytic media with different acid-base properties of background electrolytes.

Reagents and equipment. The original 0.002 M solutions of Na_2PdCl_4, K_2PtCl_6, as well as 0.01 M solution of VP were prepared by dissolving the reagents of appropriate weight in acetic acid (n-propanol, DMF and DMSO). The concentration of noble metals was determined amperimetrically by using a 0.01 M solution of potassium iodide [1]. Amperometric titration was carried out on a device with two rotating (1000 rpm) platinum wire electrodes on a common axis. The structure of electrodes, automatic piston microburettes and apparatus are described in detail in [2].

Amperometric titration was carried out on a device with two rotating (1000 rpm) platinum wire electrodes on a common axis. The structure of electrodes, automatic piston microburettes and apparatus are described in detail in [3].

According to voltamperometric behavior of VP and other products participating in electrochemical environments,

amperometric titration of noble metal ions should be carried out at a polarization voltage of 0.75–1.15 V, depending on the nature and concentration of the background electrolyte (acetates, nitrates, chlorides, alkaline metals and ammonium) [4]. The indicator current should occur beyond the equivalence point (e.p.) due to oxidation of the free reagent and reduction of the dissolved oxygen in the air.

Experimental data showed that in the studied media and backgrounds of 0.15–0.40 M solutions of noble metals ions with VP solutions titrated well and fast enough, and the shape of the curve coincides with the expected with only some constant current at the beginning of the titration followed by a sharp transition (curve) at the end point of titration (EPT).

Determination of palladium (II) and platinum (IV) ions in individual solutions. It was found that during the titration of the following noble metals ions, the corresponding molar ratio metal/reagent is: Pd/reagent 1/2 and Pt/reagent 1/4, the titrated solution gains reddish-brown color. During the transition from acetate to perchlorate backgrounds containing some amount of perchloric acid, the shape of the titration curve of noble metal ions deteriorates significantly, which ultimately leads to a decrease in reproducibility and correctness of results. This is explained by an increase in the acidity of the analyzed medium during the transition from acetates to perchlorates [5]. Some of the data obtained are shown in the table.

Table. Results of amperometric titration of various number of palladium (II) and platinum (IV) ions with solution of VP in DMSO on 0.20 M lithium perchlorate background

Introduced metal, μg	Found metal, μg (P = 0,95; x ± ΔX)	n	S	S_r
Pd 15.44	15.423 ± 0.16	3	0.061	0.004
Pt 30.88	30.854 ± 0.12	4	0.052	0.002
Pd 61.75	61.782 ± 0.18	3	0.033	0.001
Pt 123.50	123.494 ± 0.20	4	0.102	0.001
Pd 247.00	246.951 ± 0.41	4	0.213	0.001
Pt 493.10	493.793 ± 0.52	3	0.624	0.001

The results of the different concentrations of noble metal ions determination with a solution of VP in 10.0 ml of the test solution under optimal conditions indicate a good accuracy of the developed technique. The effect of additives to acetic acid, n-propanol, DMF, DMSO on the correctness and reproducibility of titration of noble metal ions was studied for such inert solvents as chloroform, carbon tetrachloride, benzene, toluene, hexane, methyl ethyl ketone, dioxane, etc., which are often used as extractants. Conditions, as in the titration of noble metal ions in their individual solutions, with the difference that the content of the protolytic solvent in the analyzed sample was regulated strictly according to the volume of the added inert solvent. Due to the decrease in the solubility of the background electrolyte under these conditions to values less than 0.2 M, under the influence of large additives of an inert solvent, the background concentration (with 40–50% by volume of inert solvent) must be continuously reduced

back to values of the order of 0.05 M. Adding any of these solvents in the amount of 10–20% of volume (depending on the solvent) has almost no influence on the shape of the titration curve, which becomes less steeply inclined to the axis of the volumes. For the same reason, when the content of the solvent is above 50–60% of volume, the reproducibility and accuracy of the definitions of the noble metal ions deteriorate.

The revealed nature of the influence of inert solvents on the type of titration curve is explained by the decreasing electrical conductivity of the titrated solution with a high content of inert solvent in the protolytic medium, resulting in a significant and continuously increasing ohmic drop in the analyzed solution with increasing indicator current.

Consequently, amperometric methods for the determination of palladium (II) and platinum (IV) ions with VP solution are distinguished by high selectivity and reproducibility with a relative standard deviation not exceeding 0.004.

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Section 15. Economics and management

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CONSTRUCTION BUSINESS AND IMPROVEMENT OF ENVIRONMENT IN GEORGIA

Abstract. In Georgia, construction business has a great potential of development. For this purpose it is important to attract and direct investments to the priority fields of economy in order to restore basic funds and create new capacities. In the both cases this function can be fulfilled only by construction business.

In the direction of seeking investments it is necessary for Georgia to become an attractive country for investing.

Keywords: construction, business, investment, investment environment, branch, risk, products, economy, stock exchange.

Georgia's investment attractiveness depends on various factors. It is quite difficult to define the influence of these factors. One of them is to do business easily, without barriers and obstacles. In the rating Georgia took the 9th place in 2014 instead of the 112th place in 2006. Georgia takes the 34th place according to the Index of Freedom, the 41st place based on Investor Protection Indicator, etc. It is true that these are not leading positions, though certain progress can be observed.

Construction business is one of the most prospective and profitable sphere of economy all over the world. The state of development of this sector shows the life-cycle stage of not only this branch but also the whole economy. Development of construction means development of economy, as well; collapse of construction, construction business implies beginning of economic stagnation [1].

In 2005, in Georgia, investment of GEL 9,032 million was carried out in fixed capital, this means that it was by 120.4% more than in 2008 and by 19.8% more than in 2014. The top-5 places in investments were distributed as follows:

- Transport and communication (16.9%);
- State management and operations with immovable property (16.4%);
- Agriculture (11.6%);
- Trading (11.5%);
- Industry (11.1%).

Construction has taken no place in this top-five unlikely to 2008. In 2008, it took the fourth place. In our opinion, the state policy of Georgia shall be built so that the first and second places were taken by branches of economy focused on export; these branches are agriculture and industry; construction shall be on the third place as construction is the branch which forms the fixed capital – buildings, structures, etc. – for them (and not only).

In the countries with transitional economy (including Georgia), all scientists unanimously admit that import of foreign investments is especially useful when investments are spent on adopting new technologies and developing export-oriented fields.

If capital construction is assessed only with this approach as a recipient branch of direct foreign investments, investments put in it are not useful for the country since its products are not oriented on export, but capital construction is the sphere which forms fixed capital for all branches of economy – oriented or not oriented on export. Thus, an investment spent on formation and renewal of the country's fixed capital, whether foreign or local, is regarded as useful investment by us. Order of spending an investment is another matter. Of course, if capital construction as a leaseholder forms, first of all, for the branches, sub- branches and separate enterprises fixed capital, this means erects buildings and structures, installs technical equipment, etc., which create export production, this will be the most appropriate investment. As it has been already noted nowadays such branches in Georgia are: agriculture, process industry, tourism and health resort business, hotels and restaurants, pharmaceutical industry. Buildings, structures and greenhouses are necessary for agriculture; erection of buildings and structure and installation of new technical equipment – for food industry; tourism needs construction of hotels and food facilities, etc. All these are created by construction companies on order of relevant branches.

Thus, spending investments on capital construction is not useless and non-priority for the country, but as we have mentioned above, these funds shall be directed according priorities, purposefully. It has not been done this way until today. Capital construction spent almost all investments on housing sector. Housing market has been saturated; the demand on flats has been mostly satisfied. The same picture is on the market of commercial areas. Now construction companies should focus on import substitution branches and the ones oriented on export. Formation and renewal of fixed capital in these branches needs large investments. With the purpose of attracting them from foreign countries, it is necessary to raise the country's investment attractiveness, this means to improve the investment environment.

Creation of a favourable investment environment is one of the most important issues of the state investment policy. The concept "an investment environment" implies all the factors which are taken into account by an investor before making investments and which, finally, affects such complex indicator as an investment risk [2]. It is very difficult to find the ways of improving the country's investment environment. Georgia tries its best to assure international society in the country's political and economic stability and investment attractiveness. As the result of the reforms made recently, Georgia has the image of one of the quickly developing countries on a world-wide scale. One of the factors of success is the fact that "economic reforms are made on a regular basis due to which Georgia establishes a place of leader in this sphere. The strategic geopolitical situation for accelerating the country's economic development gives it the opportunity of developing and using quite important resources. The favourable trade regime has been created. The effective tax reform has been carried out. The procedure of issuing licences and permits has been simplified; the environment free from corruption has been formed. Mechanisms of lawfulness in business have become operative" [3]. As the flow of direct foreign investments into Georgia has recently decreased, this means that the measures taken are not enough, there are hindering reasons and the country should work on their elimination.

The country's economic performance and growth depends on how it will be able to mobilize monetary funds in order to satisfy the demands of both the state itself and companies, and physical persons. For example, if the housing construction in the country had not had large investments, so many flats would not have been built and, what is most important, so many unemployed had not been hired in building. It is true that an investment activity of one branch cannot save the economy but it contributes to an economic growth. The same is for all countries and the same is for Georgia. Thus, all the country's economic subjects need availability to monetary funds and "if they manage these funds reasonably or invest them in production, this is the precondition of an economic growth" [4].

As Georgia's construction sector is production, more precisely, production of construction products, it can be stated with full responsibility that if the inward investments are directed to production and the reconstruction and renewal creation of fixed capital is ordered for agriculture, food (process) industry, tourism (we mean its infrastructure, as well), health resort business, pharmaceutical industry and other priority branches, this will be a great step towards the country's economic growth.

Thus, the country still needs foreign investments with large doses so it should be quite active in order to improve the investment environment in the country. As it is mentioned above, a lot has been done in this direction, but a lot is still to be done. Investors are still scared of frozen conflict zones (Abkhazia, Ossetia), uncontrolled territories, unmarketable stock exchange, unavailability to venture information, etc. in Georgia. In spite of a large number of the above listed problems, as the specialists write, "the main hindrance for investors in Georgia is the economic environment. Export diversification and attraction of direct foreign investments have close relation as an export sector oriented on more foreign markets is the most attractive for an investor. The county has a low index of freedom in relation with protection of property rights, according to which it lags behind the average world indicator" [5].

Low economic potential of Georgia is really a serious threat to the attraction of foreign investments. From this viewpoint Georgia, with its natural resource potential, which may become the basis for manufacturing production for export, is not a poor country. The climate and geological features of its territory conditions the variety of the exposure of natural minerals and the capacity of the country of being rich in resources. The mineral-resource fund of the country involves 950 quarries and exposures. 62.8% of the resource fund represents a large deposit, 30.9% represents the deposit of local importance, and 6.2% represents the exposure. It consists of thermal-energy resources, different deposits, chemical and non-chemical resources, construction material and underground mineral water resources. This is followed by forest resources, land resources and other resources[6]. Due to these resources and the location of Georgia it has a potential to be attractive for investors. At first, or during the time when Georgia became independent, and started its own path to the market economy, the situation was not similar. It was the time when various laws, such as the Law of Georgia on the Promotion and Facilitation of Investors were reviewed and a new law on Foreign Investments was drafted for the purposes of stimulating foreign investors. The field was completely liberalised. Almost each year the foreign investments were being increasingly attracted on this basis. But as it turned out the foreign companies were only interested in the purchase (or to take

them on the basis of a long-term lease) of our natural resources (deposits, land, forest area and other immovable property) and as soon as it was ruled to set some restrictions on the sale of such deposits, the foreign investment started to decrease. To our opinion, the restrictions on such property should be stringier.

The country is facing this challenge today. Georgia cannot develop its own economy without the help by the foreign investments, this is why we should reduce the barriers and facilitate the money attraction in the form of foreign investments, but we should also assure them to invest not only for their own benefit, but also for the benefit of Georgia. This shall be carried out not in the form of the sale of immovable property or other natural resource, but it shall be exercised in the form of the arrangement of an industry and manufacture on the basis of such resources – in the form of the development of agriculture on the land, and in the form of the extraction of raw material and its procession on the deposit quarry area, in the form of fish breeding and fishery on lakes and rivers, and in the form of the arrangement of tourism and resort economy and infrastructure in the forests and fields and meadows, etc. We should assure foreign investors that by investing in such field and by operating joint enterprises they will raise the export potential in Georgia, by which both the foreign investors and Georgia will gain. For the purposes of taking this policy we should highly stimulate them in these fields (for a certain period). In order to create such stimulating environments the Georgian investment legislation shall be revised. In the new legislation Georgia shall focus on the creation of joint enterprises. It is known that Japan, Taiwan and South Korea have never sold their natural resources, but they created their own industrial base by way of the formation of joint enterprises. The same path is followed by the former social countries of the Eastern Europe. In the Czech Republic almost 70% of export in the country is supplied by its enterprises, which are created by the participation of the foreign capital. About 30000 foreign companies are registered in Hungary, which totally or partially work for export and release more than 2/3 of the export product of the country [7]. These countries created appropriate environment for achieving this, which should be exemplary for us. The Czech Republic totally relieved newly created companies from profit tax for 10 years, in Hungary investments were relieved from local taxes for 10 years, Hungary relieved the import of industrial equipment from the payment of customs duties by 50–100%, etc [8]. We do not have such exemptions, and we should adopt them and shall inform potential investors thereon.

The Georgian Investment Agency shall take an active part in this activity. It should provide information to foreign investors, namely in which fields and sub-fields they may create joint enterprises using their own funds and technologies. The assessment of risks related to different fields is carried out on the basis of the analysis of created conditions. As a result of the

analysis, it is clear whether the investor takes risk in investing in the given field [9]. The joint companies will be founded on the basis of the local raw material and by employing local workforce, and the investment and technologies shall be foreign. The export potential of Georgia will be thus raised together with the level of usage of natural and labor resources, the progressive structure of the economy will be developed and the level of living of the population will be raised, etc.

To create healthy investment environment for business entities is a complex and long process. It started in the 90's in Georgia and has not been finished yet. In this field the government's initiative is to cancel profit tax from 1 January 2017, more specifically, the distributed (dividend, etc) profit will be taxed, which means that the profit envisaged for reinvestment shall not be taxed. The Government presumes that by taking such measures it will raise the reinvestment motivation. The economists carried out special calculations and it turned out that after taking such tax reform, the total reinvestment of nearly one billion GEL remaining in the private sector shall not significantly influence the growth of the total GDP" [10]. The mentioned requires in-depth surveys by the specialists.

Nowadays, in accordance with the 2013–2014 report on Global Competitiveness, Georgia engages the 98th place in the component of total national savings, and in the component of availability of finances of the local capital market it engages the 126th place [11]. It is of course not a good index.

To our mind the facilitation of internal savings shall be more emphasized, what we mean here is the state as well as private savings. For the purposes of the increase of state savings the Government of Georgia shall carry out a consistence policy of fiscal consolidation. By ensuring the reducing and stable deficit the State will be able to increase savings in the country. What concerns the private savings, its increase is hindered by the poverty of population. There is a social layer in Georgia which has excessive money but they do not address banks to deposit their money, because the interest rate for the deposit in too low in Georgia (10–12% per year). The deposition in banks for a longer period (for 10 years and more) shall be facilitated. Then the volume of investments in the country shall be increased and a long-term and stable base for the availability of financial resources will be created.

A good source of extending local investment base is the development of a stock exchange, which has not been developed in Georgia yet. In the case of the development of the stock exchange the companies would place their shares, the purchasers would appear, as a result of which the companies would not have to take credits from banks. Besides, the purchasers of shares would gain dividends from such companies, which would increase their savings. "Besides, it should be also taken into consideration that the issue and release of shares are related to other

types of expenses, such as: expenses related to advertizing, share emission, share distribution, etc [12]. "The paid dividends significantly influence the financial program of the enterprise, its budget and liquidity" [13]. From the legal viewpoint, the law of Georgia on Statistics enables the companies to reckon financial information as confidential and oblige somebody not to disclose it. We consider this is wrong and we think that the Georgian legislation framework will need to be reviewed in this field [14].

The restraining by the companies to participate in the trading process held at the stock exchange may be explained by the following reasons:

1. The deficit of information (ignorance) on making benefit from the stock exchange;

2. The complicated barriers which are set for the right to enter the stock exchange;

3. High cost of transactions compared to bank transactions;

4. A bad working experience of the similar stock market developed in the 90's in Georgia – such as the Caucasus Stock Exchange, the Tbilisi Stock Exchange.

Conclusion

As we have mentioned, according to the access to finances with the help of the local capital market, Georgia is nowadays on the 126th place. In the strategy of social and economic development of Georgia – "Georgia – 2020" – it is envisaged that it will move to the 75th place by 2020. In the given process, except for the commercial banks, a significant role shall be played by the stock exchange. This may happen only with the activeness and efforts of the Government of Georgia. With regard to the construction we would like to point out that the construction business is the realization of investments in the main capital. It constructs the building and structures and installs the equipment, and its operation is on what the state of all fields of economy depends and this is the means of providing main capital to the sub-field.

Hence, macro-economic regulation of internal or external investments, the state administration of the ways of receiving or "giving away" investments will turn Georgia into a country, which is safe and attractive for investments.

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INTERNAL CULTURAL ENVIRONMENT OF INTERNATIONAL COMPANY

Abstract. In the article, the international cultural environment of the international company is open. In the opinion of the author, it represents an important component of the business environment in which the firm's activities are implemented. In the article the author discusses the overall values of corporations that all their employees share. According to the author, these values create corporate culture. At the same time, the author discusses the second opinion that describes corporate culture as an instant awareness of the enterprise derived from the behavior of its members and, in turn, manages the formal and informal behavior models of individuals.

The author concludes that corporate culture is the system of values and norms that are characteristic of this organization.

Keywords: Corporate culture, national characteristics of management, business environment culture.

Assessing the content of "corporate culture" is quite difficult. Business environment culture – this is the situation in which all the companies already exist. In the formation of the internal cultural environment of business, first of all, with regard to the culture of its own, everyone has a realistic and consistent position.

As long as the leadership and staff of the organization have misconceptions about loyalty, it is impossible to correct corporative business culture and targeted teaching. In any event, the culture-oriented collective measures are needed, in which case it is clear that the conclusions of the basic leverage of their respective cultures are adequate; Their interaction is implemented and critically resolved on the strategic adequacy of the internal culture of the firm.

One of the foundations of the transnational company is that corporate culture can be seen as suspicious, because managers of different countries may have different ideas about the rules of conduct, or the values and production that are in the headquarters of the firms. Despite this, many companies are trying to disseminate their own corporate culture, thus providing more close contacts between heads of branches of different countries.

Managers' private movements from one country to another – expands their performances and increases their commitment to the system values and goals of the corporation; As a result, procedural issues will be simplified within the management pyramid to reduce the activity of the subsidiary firms and control of communications. The control over the selection of supervisory firms and their branches by the headquarters of the company may be so high as the headquarters of the corporate headquarters is considered as necessary. Finally, the level of corporate culture Isomába in front of its business entrepreneurs with corporate social responsibility (Table 1).

Table 1. – The types of social responsibility of the corporation before business participants – subjects

Business participants – subjects	Corporate Social Responsibility
1	2
Shareholders	The fair compensation of the capital placed under their risk
Buyers	Information on which the decision is made on purchase
Servants	Fair treatment without discrimination; Fair returns; Equivalent compensation of labor; Responsible attitude towards continuing employment contract; Career growth and learning ability
Trade unions and prof. associations	Openness of information; Lawfulness and openness of negotiations and complaints; Willingness to cooperate
Suppliers	Open and legitimate negotiations; Payment in due time; Provide information about plans that are in contact with them.

1	2
Local community union	Considering the environmental factor; Example of the Employer Employer; Creation and maintenance of jobs for economic equilibrium.
State	Develop laws and monitor their execution; Creation of business promotion conditions; Stimulating tax and fiscal policies.

From the standpoint of assessing the significance of the importance of corporate culture, we can make a conclusion about its decisive influence on business efficiency. The elements of corporate culture are:

- Marks (values, history, views);
- Components (jointly acquired experience);
- Results (organizational effectiveness of management).

Main problems of planning and management of producing organizations are usually associated with factors such as:

- Delay in execution of planned work;
- Different prioriities of the governors of various subdivisions in distribution of existing resources;
- Flexible interaction between clients;
- Bad business communication among the staff of the neighboring subdivisions.

These problems are more human-type than technical or financial-economic nature. One of the modern complex tools for solving these issues is the "Organizational Culture", which stipulates three different ways: Ethnographic approach – this is an idea of the organization's culture, which is carried out by studying its description and individual characteristics. The classic example of this approach is to study the influence of national characteristics on the style of management (Table 2).

Table 2. – National Factors of Organizational Culture

Country Parameter	US	Japan	Georgia "Yesterday"	Georgia "Today"
Organization employee "I"	Active "me" who has the hope of self	"I" as an active part of "we"	Depressed "I", which expects to protect the collective	The "I", the sharp transition from one state to the other
Formulating the goal	To achieve a specific goal set by the head	Achieve common goal	Task control level	Task control level
Management	Personality of the employee	Team management Prospective	Upira governance	Manage small collections
Time and key orientations	Short-term orientation on profits	Orientation on quality of life	Medium-term orientation on quantitative growth	Short-term orientation on quick removal of expenses
Respect to resources	Resource Making Saving	We reserve the resources of the resource, which at the same time loses sense of high technology	Focusing resources, high flow rate	Being interested in buying private companies
Focusing on business	Focus on efficiency	Focus on coordination	Emphasis on performance	Focus on maximization

Based on the data of the (table 2) we can conclude that the national factors of organizational culture of different countries are significantly varied according to different parameters. For example, in the United States, it is obviously oriented to the employee's personal qualities, but at the same time, within the task set by the management. In Japan more emphasis is placed on the employee as part of the unified system. Now Georgia is in the process of establishing its own organizational culture, which in itself is characterized by the synthesis of "Western" and "Oriental" behavioral Georgians.

In our opinion, when we see the impact of the environment on business, we can make the following conclusions:

1. The contacts between the different countries are becoming more widespread, contributing to the development of international manufacturing, transport, communications, information network, migration and the growth of personal income of the population. At the same time, global competition is growing

because transnational and multinational companies are increasingly competing with each other. The unchanging factors of the formation of business environment (spiritual, cultural, national and other) affect the pace of current changes;

2. All companies in the world resemble each other for the purpose of their activities, organizational forms and technologies used. But people are stubbornly persistent in their respective cultural traditions. In other words, some material factor in business becomes increasingly universal, and entrepreneurs can cooperate and solve problems, but people will never be able to become single, but remain unique, and will have local national character;

3. The country may be comprised of different community groups, some of whom will be more likely to find alien ana-logues than with other representatives of other groups in the country. Identification of such groups facilitates the conduct of international business;

4. Various variations in business civilization environment in state institutions or private firms generate specific dependence on labor;

5. It is often a great interest to study the methods of business that are used in countries with the greatest economic success as national socio-economic non-economic factors in different societies can predict their success or failure.

Based on the above, we conclude: as planning, as well as the daily practice of individual company activities, should be flexible, adaptable to changing circumstances in the country as well as in the world.

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WELL-KNOWN MARKS AND SPORTS IN VIEW OF THE WORLD INTELLECTUAL PROPERTY DAY 2019

Abstract. The World Intellectual Property Day represents an occasion to learn more and better demonstrate the importance of intellectual property rights in helping the economic development of a country and encouraging innovation and creativity. This day is celebrated every 26 April anywhere in the world through the participation and contribution of many IP offices, professionals, law offices, lawyers, professors and students. For that reason, this article aims to highlight the importance of IP rights in protecting the intellectual creations of humans, as well as the benefits and advantages that the registration of IP rights before the competent authority bring. As the World Intellectual Property Day 2019 has been chosen to be dedicated to the IP rights within the world of sport, the article will cover the main topics of the famous or well-known sport marks in the area of IP law. Such topics include very interesting information and commentaries as regards the famous sport marks in the world: the advantages of registration of a mark, the benefits of famous or well-known sport marks in ensuring a broad protection to their owners, the protection against the counterfeiting activity concerning the well-known sport marks, etc. IP rights and famous marks are closely related to each-other as the IP rights enable the protection of famous sport marks and guarantee the latter from the unfair trade and concurrence practices.

Keywords: IP rights, well-known/famous marks, trademark registration, sport marks.

Every 26 April, it is celebrated the World Intellectual Property Day to learn more and better understand the role of intellectual property (IP) rights in helping the economic development of a country and encouraging innovation and creativity. Such a date constitutes a great opportunity to get people interested in matters of IP and broadly involves many activities and people from different countries over the world. In 2000, WIPO's member states designated April 26 – the day on which the WIPO Convention came into force in 1970 – as World IP Day with the aim of increasing general understanding of IP.

Faster, stronger, higher! The new slogan that is chosen to celebrate the World Intellectual Property Day 2019 represents the real values of sport's competition which often lead athletes and ordinary people to achieve extraordinary success. This year, the focus of the World Intellectual Property Day will be directed to the very beautiful world of sport and how do the IP rights protect the development of sport! But, how do the IP rights encourage the development of sport and protect the global industry of sport as well?

We are aware that sports have become a multi-billion-dollar industry, which involves more and more people, athletes, sponsors, businesses, TVs and other communication media. Today, thanks to the development of technology and Internet, anyone can follow different sport activities from any place in the world. In this manner, you may follow and watch your favorite athlete or team directly from the armchair of your house. The industry of sport is growing year-on-year and a greater number of people are being involving, as well as many businesses are currently investing in development of sport or organization of sport activities.

Trademarks, designs, patents and copyright play all a great role in the global industry of sport by providing exclusive rights to their owners and enabling them an appropriate compensation for the exploitation of their intellectual works. In this commentary, the focus will be on famous trademarks and their precious value for the athletes, sponsors, businesses and organizers of sport events.

If we would be required to tell a name of a famous mark in the field of sport, everyone will certainly mention Adidas, Nike, Reebok, Puma, Espn, Nba, etc. But, why these marks

are considered to be famous marks in the world of sports and in general as well? What should we consider to be a famous mark? Famous marks or well-known marks is the term used for those registered or unregistered marks which have gained a very good reputation for their goods and/or services in the relevant sector of public. As a rule, a famous mark should fulfill some specific conditions in order to be considered as such:

1. *The degree of knowledge or recognition of the mark in the relevant sector of the public; 2. The duration, extent and geographical area of any use of the mark;*

3. *The duration, extent and geographical area of any promotion of the mark, including advertising or publicity and the presentation, at fairs or exhibitions, of the goods and/or services to which the mark applies;*

4. *The duration and geographical area of any registrations, and/or any applications for registration, of the mark, to the extent that they reflect use or recognition of the mark;*

5. *The record of successful enforcement of rights in the mark, in particular, the extent to which the mark was recognized as well known by competent authorities;*

6. *The value associated with the mark.*

The above-mentioned conditions are almost adopted by all the countries in the world. Moreover, the majority of countries have fully adopted and implemented the said provision concerning the famous/well-known marks into their domestic legislation. As provided by the Paris Convention for the Protection of Industrial Property (1883), *the countries of the Union undertake to refuse or to cancel the registration, and to prohibit the use, of a trademark which constitutes a reproduction, an imitation, or a translation, liable to create confusion, of a mark considered by the competent authority of the country of registration or use to be well known in that country as being already the mark of a person entitled to the benefits of this Convention and used for identical or similar goods.*

The Paris Convention for the Protection of Industrial Property constitutes an important legal instrument regarding the protection of famous or well-known marks. In addition to the above, the protection provided by such a convention for the well-known marks is also extended for similar signs which are used for dissimilar goods or services. Under certain conditions such as: the earlier reputation of the well-known mark in a country, the use or registration of the subsequent mark or sign without a reasonable cause and the acquirement of unfair advantage or damage of the distinctive nature/good name of the well-known mark, the well-known mark is protected even for those cases when the subsequent mark or sign is used/registered for dissimilar goods or services. Furthermore, the above-cited provisions shall be applied even in the cases when the essential part of the subsequent mark or sign constitutes a reproduction of any such well–known mark or an imitation liable to create confusion therewith.

Taking into account the provisions of the Paris Convention for the Protection of Industrial Property as a strong basis and international obligation for the protection of well-known marks, the WIPO adopted a specific document whereby the factors for consideration in determining a well-known character of a mark are provided. In this sense, we should underline the fact that the above-mentioned conditions are not pre-conditions for reaching the determination that a mark is well-known, but such conditions should be necessarily taken into account in order to define the well-known character of that mark. Under specific circumstances and in some cases, the above conditions should be all relevant. In other cases, only some of these conditions may be relevant.

As a conclusion, we may summarize that the famous or well-known marks enjoy in most countries protection against signs which are considered a reproduction, imitation or translation of that mark, independent of the fact that such a mark is registered or not. Further to the above-mentioned, as well as considering the above-cited conditions, many sport marks are considered to be well-known or famous in the whole world among both the relevant and general public. Sport marks represents valuable assets that can build trust and loyalty to a product.

As we already know, the main function of a mark is to identify the commercial origin of the concerned goods and/or services in order to enable to the relevant consumers to distinguish the goods and/or services of a mark from those belonging to a competitor or another subject. Nowadays, consumers represent a vital part of a brand as they always recognize and select the products or services of a particular business through the trademark. For instance, everyone is able to recognize the Adidas's three stripes mark, Nike's symbol or Puma's panther.

But, which are the benefits and advantages of these famous sport marks? What does they represent for the relevant consumers and public? And why is it so important to create and register your own trademark?

Following the example of famous sport marks mentioned above (e.g., Adidas, Nike and Puma), we may conclude and realize that such marks constitute a guarantee for the quality of their products. Consumers are always certain about the quality and value of the goods bearing these famous marks when deciding to purchase such a kind of goods. In the other hand, the international and national legislation provides a broader protection to these famous marks against anyone who tries to use, reproduce or imitate them for dissimilar goods or services which are not related to the world of sports (*please see above*).

In other words, no one can use the Adidas's three stripes mark or Nike's symbol for goods such as: chemicals, pharmaceutical products, paints, industrial oils, legal services, medical services, etc. For this reason, the broad protection of famous marks constitutes one of the most important advantages of

these kind of marks in relation to other marks having a normal distinctive character.

Trademarks play a role of huge importance in commerce and increasing income of the companies, especially in the case of famous marks belonging to famous and notable companies. Sport events create an important audience and appeal among the relevant and general public. The number of people attending or following different sport events is continuously increasing. Nowadays, many people from different part of the world follow their favorite sport teams, athletes or events via telecommunication means, TV sport broadcasting programs or Internet.

A famous trademark has a strong distinctive character, and as a such, it enables to its owner to increase prices, revenue and royalty of consumers. It is commonly known that most of the people prefer and choose to purchase a product bearing the sign/mark of Adidas or Nike instead of purchasing the same identical product with the same model and color bearing another "unknown" sign, irrespective of material of the product.

In such a manner, trademarks in general, and famous trademarks in particular, give the possibility and opportunity to their owners to benefit from various sponsorships, merchandising and licensing agreements. Further to the abovementioned, we may easily conclude that the trademark registration bears a huge importance for the owner as it enables him to directly benefit in various forms from its mark. For that reason, the original creation of the sign, as well as the strengthen of distinctive character of the mark and increase of the mark's value over time, bear a specific importance for the long way of becoming a famous mark.

In the world of sports, the benefits and advantages of famous sport marks are even more significant and bigger. For example, the most famous sport marks in the world sponsor and bear the costs for the organization of global and world sports events, such as: world cups, Olympic Games, world championships, national cups and championships, etc. The value and presence of these famous marks in these events constitute a guarantee for all the participants and general public.

At the same time, the marketing and investing policies of the owners of these marks have consequently increased the distinctive and well-known character of the mark, as well as the value and degree of recognition of the mark in the relevant sector of public and general public, which led these marks to become famous. Sponsoring and displaying trademarks in prominent places at sporting events help also to directly increase sales and link the company or products of the company to the sport event in particular, and world of sports in general.

Furthermore, the famous sport marks always sign mutual agreements with high financial values with sport teams and famous athletes/sport personalities in order to both benefit from the publicity and sales of various range of sport articles which are customized to that specific team or athlete. By following these policies, as well as based on the interest of people for sports, the well-known character of the mark has been further increased.

With respect to the organization of sport events and mutual agreements with sport teams and athletes, intellectual property rights create the legal framework to protect and ensure sponsors, businesses, athletes, organizers, manufactures and sport personalities from unauthorized use and infringement of their marks. The famous sport marks build a strong confidence among consumers regarding the authenticity and quality of goods. In the context of the authenticity of goods, it is very important for the owner of famous marks to register them before the WIPO or national IP offices.

Such an aspect is of a huge importance if we consider the fact that the most counterfeited products involve and affect the most famous marks in the world, and in particular, the famous sport marks due to their popularity. Under such circumstances, the owner of marks shall first nationally or internationally register their trademarks, and subsequently, it is strongly recommended to file a customs application before the customs authorities in order to let the latter seize the goods infringing the intellectual property rights. Based on this point of view, the registered trademark rights of the owner may be further protected and guaranteed in relation to various counterfeiting activities.

The registration of a trademark also provides a long-term protection and competitive benefits in the market. Businesses may protect their registered trademarks by having exclusive rights over the mark and preventing any third party to unauthorized use this mark. The ownership of a trademark also allows its owner to prevent the use of any sign which is confusingly similar with the registered mark. Thus, owning a trademark is an effective legal tool in combatting unfair competition and protecting the owner's investment.

A famous mark bearing a high distinctive character allows a business to build public goodwill and brand reputation in the goods and/or services it sells or provides. Trademarks are a part of everyday life that enables the consumers to decide whether to purchase the goods or services of a particular business instead of those produced or provided by another one.

In this sense, many sport teams and athletes have registered their names as a trademark in order to maximize their profits and revenues based on their fame and popularity. For that reason, they register and use their names as trademarks in order to indicate the commercial origin of the goods and identify them among the other similar sport goods. There is a number of infinitely examples as regards such a kind of trademark registrations, such as: CR7, Messi, Air Jordan, Los Angeles Galaxy, Chicago Bulls, NBA, etc.

Considering all the above-mentioned, and the increase popularity of sport, we can certainly say that the famous sport marks have now become a symbol of a lifestyle too!

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