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## REACTIVE CHANGES IN RATS' LIVER TISSUE CAUSED BY POTASSIUM HUMATE LOAD

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The article describes the structure of the rats' liver in the embryogenesis and ontogenesis on the back of additional intragastrical load of potassium humate solution. It is identified, that potassium humate can stand as a hepatoprotective agent in the fetal development, since it promotes accelerated formation of liver tubules. In the ontogenesis, potassium humate proves itself as an antioxidant through inhibiting of cellular apoptosis.

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**Keywords:** histomorphology, liver, hepatoprotective agents, rats, potassium humate

Complex therapy of the hepatobiliary system includes various groups of drugs, but hepatoprotectors hold a special role among them. They differ from each other in structure and mechanism of action, but all of them cause selective beneficial effect on the liver. Hepatoprotectors administration is focused on normalization of the hepatic metabolism and homeostasis in the liver, increase of hepatocytes resistance to pathogenic influences, stimulation of regenerative processes, recovery of the liver parenchyma, and normalization of its physiological functions. Despite the recent fundamental discoveries in the hepatology, many aspects of treatment and prevention of liver disease remain unexamined [4, 8].

For the most of the hepatoprotectors, the biochemical mechanism of immediate protective action is not absolutely clear yet, but it is known that their mechanism and pharmacodynamics are integral indicators that include membrane stabilizing, anti-toxic, anti-inflammatory, choleric, antiviral, antioxidant, immunomodulating, blood ammonium decreasing, and other effects [2, 4, 8, 11].

Recent economic developments in the Russian Federation and introduction of new biotechnologies contribute to the drugs with the highest effectiveness and the lowest price to the patient and health services [2, 4, 11, 12].

Potassium humate, a humic acid salt, obtained from brown coal at the base of LLC «Emulsion Technology», Samara, meets these requirements.

Humates are organic compounds of complex physical and chemical structure widely distributed in nature and characterized by wide spectrum of biological activities. They are environmental and safe to use [1, 13, 14].

Humates are characterized by non-stereochemical composition, irregular structure, heterogeneity of structural elements and polymolecularity. The structural units of humic acids salts are aromatic condensed systems with side

chains and heterocycles. The functional groups are carboxyl, carbonyl, phenolic, and alcoholic hydroxide, quinoid groups, methoxyls, amino- and amido groups, mono-, di-, and polysaccharides, peptides, up to twenty amino acids, vitamins, and minerals [1, 3, 5, 10].

Polymorphic structure leads to a variety of humic compounds positive effects, because if one molecule of the substance cannot participate in the chemical and physiological processes, then there will always be others suitable for such processes by size and properties [6, 7, 14].

Humates have multiple binding potential. Due to carboxyl, carbonyl, and aromatic fragments, these compounds can participate in ionic, donor-acceptor, and hydrophobic interactions. Thus, they are able to bind different classes of ecotoxicants forming complexes with metals and compounds with various classes of organics. Thus, they can be a kind of intermediaries softening toxins exposure on living organisms [1, 10, 11].

Despite the variability of the functional groups, all humic substances have a similar set of properties that allow them to act on the general mechanisms, the most important of which are: activation of nucleic and protein metabolism; intensification and normalization of cell's energy balance; transport of electrons in the mitochondria electron transport chain; activation of oxidative phosphorylation, sorption capacity [5, 6, 7, 10, 13].

It was experimentally found that the humates can effectively intensify metabolic processes in living organisms. *In vitro* experiments on rats' liver mitochondria have shown that their presence accelerates the oxidation-reduction processes, improves gas exchange, increases the rate of free radical oxidation, thus, leading to normalization of the homeostasis in «lipid peroxygenation-liver antioxidants» system [3, 5, 13, 14].

In relation to the above mentioned, the **object** of this study was to examine the reactive changes in rats' liver tissue caused by potas-

sium humate load as a potential hepatoprotective agent.

To achieve this goal, the following **objectives** had to be solved: to carry out histological analysis of the liver tissue during rats' embryogenesis and ontogeny on the back of additional intragastrical load of potassium humate solution.

The study involved 20 (14 – females, 6 – males) random bred albino rats weighing 190–210 g equally divided into a control (intact) and an experimental group.

The material for histochemical analysis of liver tissue were the embryos at 15<sup>th</sup> and 21<sup>st</sup> days of embryogenesis obtained from the rats of control and the experimental groups, as well as liver of the reproductive rats received an additional intragastrical load of potassium humate solution 30 days before the pregnancy and delivery at a dose of 10 mg/100 g per body weight, 1 ml. Solution was prepared in distilled water [5, 9, 11].

The intact rats of similar developmental age were used as a control.

4–4,5-month rats were used in order to obtain females with dated gestational age. Males were placed to the females in the evening taking into account their estrous cycle, and in the morning the vaginal smears were sampled. Since rats coupling is usually take place at 1–2 am, the date of sperm detection in the smear was established as the first day of pregnancy.

Upon completion of the experiment, the animals were decapitated after an overnight fast, and liver was extracted. Liver of the adult rats and the embryos was fixed in 10% buffered formalin, and then the histological material was processed using closed-loop apparatus for tissue processing Tissue-Tek® Vip 5 junior. After that the samples were swamped into the paraffin blocks and used for section cutting thickened of 6–7 µm. The sections of liver tissue were stained with hematoxylin and eosin.

In addition, an immunohistochemical study of the liver was performed using a set of monoclonal antibodies to the apoptosis inhibitor (Bcl-2) and proliferation antigen (Ki-67). The typing was performed with DACO antibodies.

Experimental studies were carried out in accordance with the «Guide for the Care and Use of Laboratory Animals».

The light microscope «Mikromed» with ×40, ×100, ×200 and ×400 magnification power was used for photographic survey of liver tissue samples.

Samples imaging was performed by the light microscope «Mikromed» and digital camera [9].

Investigation of the liver tissue reaction after administration of potassium humate showed that, in general, organogeny during ontogeny and embryogenesis is not affected. On the 15<sup>th</sup> day of embryogenesis, the tubular structure of the liver is forming (Fig. 1).

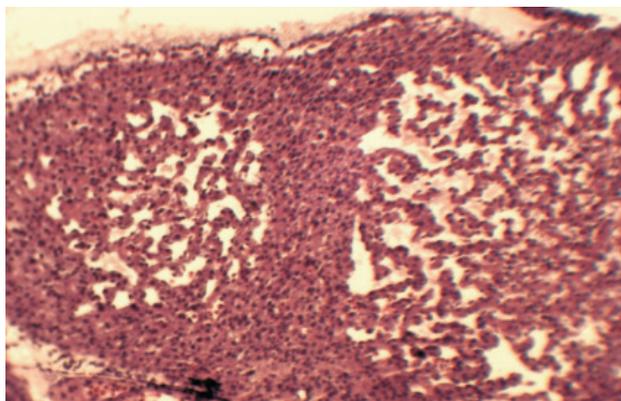


Fig. 1. Liver at 15<sup>th</sup> day of embryogenesis. Hematoxylin and eosin stain. ×100 magnification power

Lobulation of the liver is not developed, but hepatic tubules are better formed as compared to the liver of the control animals. In the formation of the hepatic tubules, more compact cells' clump can be found on the periphery in the subcapsular zone, and in the center the cells are loosely distributed due to enlarged sinusoidal spaces deep insight the organ (Fig. 2).

Sinusoidal capillaries have enlargements filled with differentiating erythrocytic cells,

but in general, erythropoiesis is poor; as compared to the embryos obtained from the intact rats, only small amount of blood islands and isolated erythroblasts can be observed.

In general, at the 15<sup>th</sup> day of embryogenesis liver development in rats administered with an additional load of potassium humate solution did not differ from the control group except for poorer erythropoiesis and rapid formation of liver tubules.

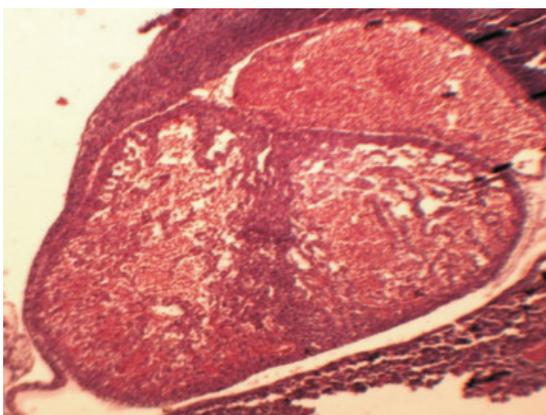


Fig. 2. The hepatic tubules with enlarged capillaries filled with differentiating erythrocytic cells (15<sup>th</sup> embryonic day). Hematoxylin and eosin stain. ×40 magnification power

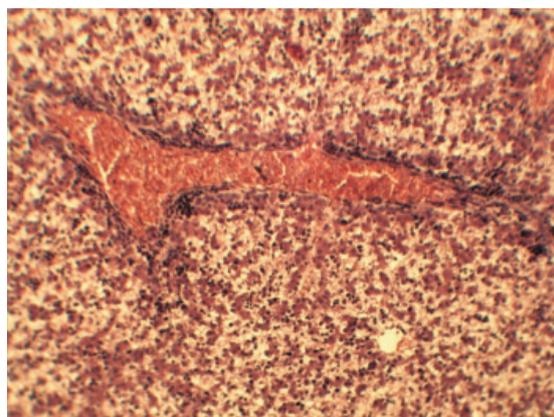


Fig. 4. Liver tissue of the experimental rats at 21<sup>st</sup> day of embryogenesis. The central vein. Hematoxylin and eosin stain. ×100 magnification power

By 21<sup>st</sup> day, tubular structure of the liver is completely formed (Fig. 3). Enlarged perisinusoidal spaces are filled with erythro- and lymphopoiesis areas, but lymphopoiesis is more expressed than erythropoiesis.

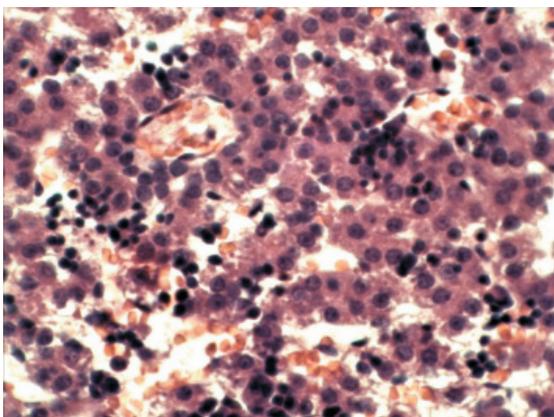


Fig. 3. Liver tissue of the experimental rats at 21<sup>st</sup> day of embryogenesis. Hematoxylin and eosin stain. ×200 magnification power

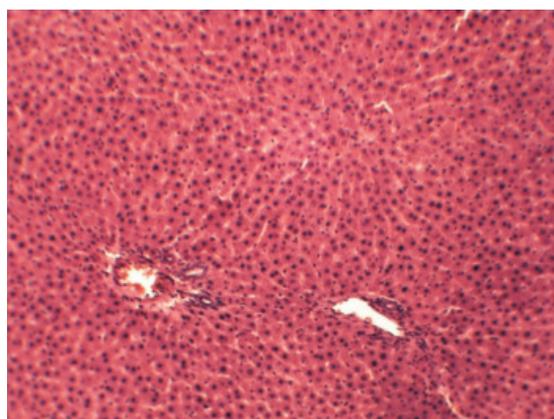


Fig. 5. Liver tissue of the experimental rats at 4<sup>th</sup> month of ontogeny. Hematoxylin and eosin stain. ×200 magnification power

The maximal concentration of hemopoietic cells is found closer to the central veins.

The hepatic lobules are small. The cells have «cobblestone» appearance, which is specific for hepatocytes without glycogen (Kraevsky cells). Portal tracts are poor developed (Fig. 4).

In ontogeny (at 4-month age), the liver of the experimental rats have formed marked tubular structure and apparent portal tracts (Fig. 5). Poor proliferation of connective tissue cells in portal tracts is also can be observed (Fig. 6).

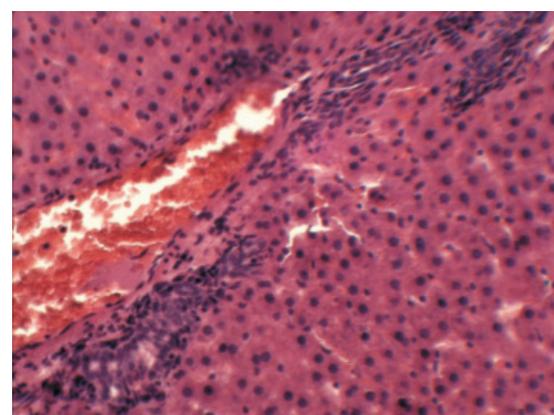


Fig. 6. Proliferation of connective tissue cells of portal tracts. Hematoxylin and eosin stain. ×400 magnification power

Single small centers of infiltration consist of monocytes, isolate granulate leucocytes, and dominant lymphocytes are seen in the liver tissue of the animal from the experimental group.

In 4-month rats from the experimental group, the structure of the liver also has some characteristics not found in liver tissue of the control animals.

In the liver of the experimental rats, there are some hepatocytes with small-hydropic degeneration.

Also among parenchyma cells there are binucleated and multinucleated cells, cells with pyknotic nuclei, and small necrosis foci (Fig. 7).

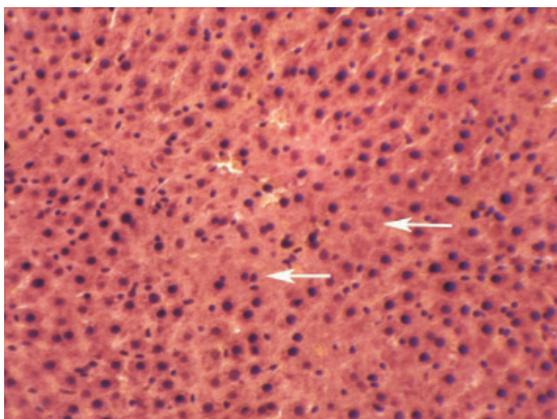


Fig. 7. Liver of the experimental rats at 4<sup>th</sup> month of ontogenesis. Hematoxylin and eosin stain.  $\times 60$  magnification power

The following data presented on figures 12–15 were obtained during immunohistochemical study of 4-month rats' liver with a set of monoclonal antibodies to the inhibitor of apoptosis (Bcl-2) and proliferation antigen (Ki-67).

Study of the receptors of apoptosis inhibitors revealed that antigen expression is observed in the centrolobular part of the liver lobule (Fig. 8, 9).

Proliferation in the isolated hepatocytes is shown at a periphery of the liver lobules (Fig. 10, 11).

Thus, the following conclusions can be made based on the study results:

1) long-term administration of potassium humate solution to the rats causes no pathological changes in fetal liver tissue and promotes accelerated formation of the liver tubules;

2) potassium humate inhibits liver erythropoiesis in the embryogenesis;

3) potassium humate causes no significant influence on proliferative activity of hepatocytes as shown by immunohistochemistry with monoclonal antibodies to proliferation antigen (Ki-67);

4) binucleated and multinucleated hepatocytes, especially in the central part of the liver lobules, should be considered as a sign of their enhanced functional activity, which may be due to inhibition of cells' apoptosis as shown by immunohistochemistry with monoclonal antibodies to the apoptosis inhibitor (Bcl-2).

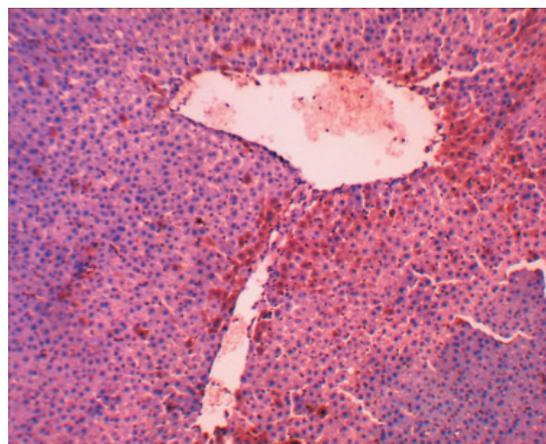


Fig. 8. Liver of the experimental rats at 4<sup>th</sup> month of ontogenesis. Immunohistochemical study of antibodies to apoptosis inhibitor Bcl-2.  $\times 100$  magnification power. Significant antigen expression is shown in the centrolobular part of the lobule

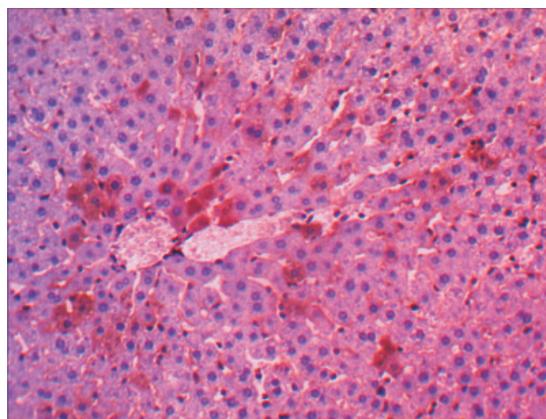


Fig. 9. Liver of the experimental rats at 4<sup>th</sup> month of ontogenesis. Immunohistochemical study of antibodies to apoptosis inhibitor Bcl-2.  $\times 200$  magnification power. Significant antigen expression is shown in the centrolobular part of the lobule

Thus, based on all above mentioned it can be concluded that potassium humate can stand as a hepatoprotective agent in the fetal development, since it promotes accelerated formation of liver tubules.

In the ontogenesis, potassium humate proves itself as an antioxidant through inhibiting of cellular apoptosis.

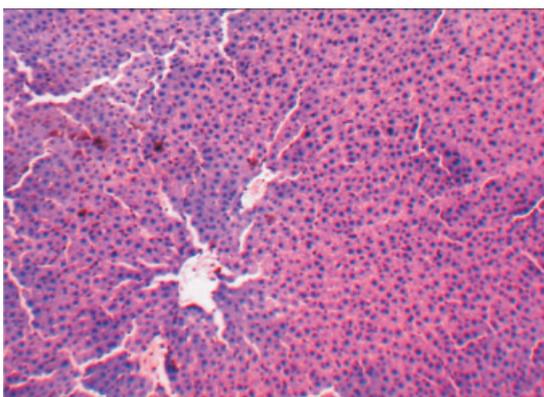


Fig. 10. Liver of the experimental rats at 4<sup>th</sup> month of ontogenesis. Immunohistochemical study of proliferation antigen Ki-67 expression. ×100 magnification power. Cells' proliferation is observed at the periphery of the liver lobules in the isolated cells

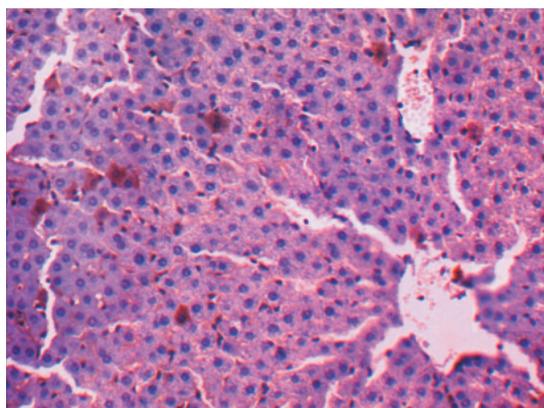


Fig. 11. Liver of the experimental rats at 4<sup>th</sup> month of ontogenesis. Immunohistochemical study of proliferation antigen Ki-67 expression. ×200 magnification power. Cells' proliferation is observed at the periphery of the liver lobules in the isolated cells

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## CHARACTERISTICS OF CHANGES IN PROTECTIVE MECHANISMS IN THE GASTRIC MUCOSAL TISSUE IN APPLYING ANTI-ULCER ANTIBACTERIAL THERAPY

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In an experimental model of gastric ulcers in rats it is found that antibacterial drugs have a multidirectional effect on the state of the gastric mucosal barrier. Metronidazole and furazolidone suppress, yet tetracycline, and amoxicillin have no effect on the synthesis of mucosal barrier. One of the reasons of this is the inhibitory effect of metronidazole and furazolidone on the enzyme activity of the MOS. Tetracycline, and amoxicillin have no effect on the enzyme activity of the MOS.

**Keywords:** gastric ulcers, gastric mucosal, furazolidone, metronidazole, amoxicillin, tetracycline

Peptic ulcer disease is a disease of multifactorial origin, however, now in its etio-pathogenesis of major importance is given for the infectious agent-*Helicobacter pylori* (*H.pylori*). Numerous clinical studies carried out in our country and abroad, have demonstrated the efficacy of *H.pylori* therapy in the treatment of peptic ulcer. However, at present, no one can dispute the fact that only a minority of patients infected with *H.pylori* become ill with a stomach ulcer, which supports the postulate of the comprehensiveness of the pathogenesis of peptic ulcer disease. Therefore, successful treatment can only be achieved by exposing to all the major factors of the pathogenesis at the same time. Unfortunately, up to now, all of the studies were devoted to the study of the effectiveness of the anti-ulcer therapy for eradication of *H.pylori*. In view of the above, the particular interest is shown to studying the effect of *H. pylori* products on condition of protective mechanisms in the gastroduodenal area.

**The purpose of the research.** To study the features of changes of some protective mechanisms in the mucosal tissue of the stomach in the application of anti-ulcer antibiotics.

### Materials and methods of research

The studies were conducted in seven groups of animals. There were 6 animals in each group. Model of experimental ulcers (EU) prepared by the method of V.A. Vertelkin in the modification of Losev I.A. et al. [1]. After modeling the animals were divided into the following groups: 1-gr. intact, 2-gr. animals with experimental ulcer, 3-gr. EU + H<sub>2</sub>O (without treatment), 4-gr. EU + metronidazole, 5-gr. EU + tetracycline, 6-gr. EU + furazolidone, 7-gr. EU + amoxicillin. The drugs which we used were administered orally in the form of aqueous suspension for 10 days at the following doses: metronidazole 50 mg/kg, tetracycline 10 mg/kg, furazolidone 100 mg/kg and 40 mg amoxicillin/kg.

State mucosal barrier was studied by determining the content of the carbohydrate fraction of insoluble glycoproteins (IGP) in the mucosal tissue of the stomach. The sialic acid content was determined by the method of Linevik L.I. [2] Fucose content was determined by the method of Rabinovich P.D. [3]. Monoxygenase system state (MOS) in the mucosal tissue of the stomach was assessed by the activity of NADPH-cytochrome-c-reductase and aminopyrine-N-demethylase [4, 5].

### Results of research and their discussion

Results of research on the effect of antibiotics on the content of fractions IGP in the mucosal tissue of the stomach in experimental ulcer are presented in Table 1.

**Table 1**

Effect of antibiotics on the content of the fractions IGP in the mucosal tissue of the stomach in experimental ulcer.

Animal group	Sialic acid, mcg/ml	Fucose, mg/ml
1. Intact	3,44 ± 0,17	5,66 ± 0,25
2. Experimental ulcer (EU)	1,52 ± 0,11*	1,89 ± 0,12*
3. EU + H <sub>2</sub> O	1,74 ± 0,18*	2,11 ± 0,19*
4. EU + Metronidazole	0,71 ± 0,07* <sup>@</sup>	0,92 ± 0,08* <sup>@</sup>
5. EU + Tetracycline	1,92 ± 0,12*	2,47 ± 0,17*
6. EU + Furazolidone	0,52 ± 0,05* <sup>@</sup>	0,78 ± 0,07* <sup>@</sup>
7. EU + Amoxicillin	1,90 ± 0,14*	2,32 ± 0,16*

Note: \*  $p < 0,05$  on the index of intact group;  
<sup>@</sup>  $P < 0,05$  on the index of group without treatment.

As seen from the shown results in experimental ulcer the content of the IGP significantly reduced as well as its fractions in the mucosal tissue of the stomach. In particular, a decrease was observed in sialic acid content for 2, 3 times, and fucose in 3 times. In the group without treatment, this alteration did not change.

It was observed that there was an adverse effect of metronidazole and furazolidone on gastric mucosal barrier. In the groups of ani-

mals treated with tetracycline, and amoxicillin, some tendency was observed to an increase in the synthesis of mucosal barrier, but the content of the fractions IGP in these groups did not differ significantly from that of the group with no treatment.

The results of the research carried on the effect of antibiotics at standard schemes of anti-ulcer therapy on the activity of enzymes MOS in the mucosal tissue in experimental gastric ulcer were demonstrated in Table 2.

Table 2

Effect of antibiotics standard schemes antiulcer therapy on the activity of enzymes of the monooxygenase system in the mucosal tissue of the stomach in experimental ulcer

Animal group	Amidopyrine-N-demethylase (nmol HCOH/min/mg)	NADPH-cytochrome c reductase (nmol/min/mg)
1. Intact	1,72 ± 0,098	17,48 ± 0,94
2. Experimental ulcer (EU)	0,88 ± 0,071*	7,30 ± 0,64*
3. EU + H <sub>2</sub> O	0,95 ± 0,068*	7,88 ± 0,45*
4. EU + Metronidazole	0,40 ± 0,033* <sup>@</sup>	4,21 ± 0,18* <sup>@</sup>
5. EU + Tetracycline	1,04 ± 0,088*	8,12 ± 0,39*
6. EU + Furazolidone	0,52 ± 0,048* <sup>@</sup>	4,40 ± 0,31* <sup>@</sup>
7. EU + Amoxicillin	0,89 ± 0,059* <sup>@</sup>	7,35 ± 0,34*

Note: \*  $p < 0,05$  on the index of intact group;  
<sup>@</sup>  $P < 0,05$  on the index of group without treatment.

As can be seen from the data in experimental ulcer, activity of aminopyrine-N-demethylase is reduced for almost twice and 2, 4 times the activity of NADPH-cytochrome-c-reductase. In the group without treatment, reduction of enzyme activity was the same. As for the efficacy of the data clearly shows that metronidazole and furazolidone have an inhibitory effect on the enzyme activity of the MOS, and tetracycline, and amoxicillin have no effect on their activity. In the group with metronidazole activity of aminopyrine-N-demethylase was decreased by 57,9%, while in the group with furazolidone by 45,3%. Reduced activity of NADPH-cytochrome-c-reductase in both groups was almost identical (46,4 and 44,2% respectively).

It has been found that among the factors of «protection» in the development of ulcer genesis the special role is played by protective mucus barrier, over 95% of which consists of the IGP. In the synthesis of the IGP of carbohydrate components and proteins MOS enzymes are involved. In turn, changes in the activity of MOS enzymes depend on other factors of aggression, such as reducing the synthesis of

NO, increasing the rate of lipid peroxidation and etc.

Our results in monotherapy and in combination therapy are consistent with the allegations and Belov IM [6], which says that triple and quadruple therapy schemes which include omeprazole, metronidazole and furazolidone have quite an active eradication and antisecretory action, however, they have a negative effect on the mechanism of cytoprotection. A similar view is shared by other authors [13].

Unfortunately, we have not found the literature regarding the effectiveness of the influence of amoxicillin, metronidazole and tetracycline under monotherapy for the protective mucus barrier of gastro duodenal area.

Our results on the effect of antibiotics on the state of the enzymes MOS faithfully confirm the special role of this system in the synthesis of mucosal barrier and suggests that one of the reasons for the negative effect of metronidazole and furazolidone on the synthesis of gastric mucosal barrier is their inhibitory effect on the enzymes of the MOS.

We set up that amoxicillin and tetracycline do not affect the activity of enzymes MOS, which is consistent with the data by Yakubov A.V. [21].

### Conclusions

1. Antibacterial drugs have a multidirectional effect on the state of the gastric mucosal barrier. Metronidazole and furazolidone suppress, yet tetracycline, and amoxicillin have no effect on the synthesis of mucosal barrier.

2. One of the reasons of this is the inhibitory effect of metronidazole and furazolidone on the enzyme activity of the MOS. Tetracycline, and amoxicillin have no effect on the enzyme activity of the MOS.

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## BLOOD VOLUME MONITORING IN DIALYSIS-REQUIRED ACUTE KIDNEY INJURY AFTER CARDIAC SURGERY: A PILOT STUDY

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Intradialysis hypotension is a serious complication for patients with an acute kidney injury (AKI). Recurrent hypotension can complicate achievement of target values of ultrafiltration (UF) and cause ischemic damage of organs [1]. One of the main causes of intradialysis hypotension is an aggressive UF that emerges due to a disbalance between speed of liquid removal from the vascular bed and refilling speed [1]. However, there are still no efficient instrumental methods of control and establishing UF safety nowadays.

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**Keywords: kidney, cardiac surgery, intradialysis hypotension, ultrafiltration**

Modules of Blood Volume Monitoring (BVM) have been facilitated during recent years. BVM modules are integrated into stationary dialysis apparatus and allow one to control Relative Blood Volume (RBV) in the extracorporeal cutout during the process of hemodialysis (HD). RBV level does not provide an image of intravascular liquid volume, it only reflects its alteration from the initial level that is taken as 100%. Alterations in RBV are estimated with ultrasound sensors, according to changes in values of hemoglobin and hematocrit in blood. UF speed can be regulated in manual or automated regime. Automatic regulation of UF speed operates according to the principle of biologic feedback depending on vascular bed refill rate. Besides, a parameter that limits UF speed is RBV decrease down to a manually-set «critical» level [2].

Nowadays BVM modules are available in a line of dialysis apparatus, however, there is no sufficient data on how they should be used in order to optimize dialysis. Studies mostly refer to patients with chronic kidney deficiency (CKD), and opinions on perspectives of BVM are inconsistent. Data on RBV informativity in predicting intradialysis hypotension is also ambiguous [2, 3, 4]. Special features of using BVM in treating cardiosurgical patients with AKI are not studied. Besides, legislations of Starling and capillary drain from interstice are disturbed significantly among patients with heart-vascular deficiency, and establishing a safe UF remains urgent for this category of patients [5]. The objective of this research is to define safe limits of decreasing RBV under UF and estimate a possibility to implement BVM among patients with AKI after cardiac surgeries.

### Materials and methods of research

Pilot research has been carried out, it included 26 patients in age from 31 to 79 years who experienced cardiac surgery. Research design is prospective intervention. Criterion of introducing into the research is dialysis-dependent AKI among patients with hyperhydration.

Hemotransfusion during dialysis served as an exclusion criterion as it can corrupt indexes of BVM.

Evaluation of patient's severity equaled  $22,4 \pm 4,5$  point according to the scale APACHE II. Mechanic ventilation of lungs has been implemented in 7 cases (27%), 8 patients (31%) required inotropic support. AKI of stage 2–3 has been diagnosed among all patients according to classification of AKIN. Oliguria have been established among 18 patients, in other cases initial hyperhydration and significant volumes of infusion therapy required water balance correction.

49 sessions of dialysis in SLED (Sustained Low Efficiency Dialysis) regime of 322 hours total length. Dialysis apparatus 5008, equipped with BVM modules (Fresenius, Germany) have been facilitated. Blood flow speed equaled 140–180 ml/min, dialysis flow equaled  $12,8 \pm 4,6$  l/hr. Managing UF speed during SLED was carried out manually. Negative balance of liquid considered infusion therapy, UF volume, and diuresis. During SLED we have been registering hourly alterations of RBV and estimated their relation with episodes of hemodynamic complications (hypotensions and rhythm disturbances). Decrease in average arterial pressure (AAP) below 70 mm of quicksilver or decrease in AAP by 20% of its initial index have been set as criterions of hypotension. Criterions of rhythm disturbance were stable increase in heart rate (HR) above 110 beats per minute, or its increase by 20% of initial tachyarrhythmia.

Statistic analysis of the received results has been carried out via program MedCalc 12.4.0 (MedCalc Software, Belgium). Inclinations have been considered statistically-significant under  $p < 0,05$ .

### Results of research and their discussion

The prescribed negative balance of liquid in the studied group of patients formed  $1430 \pm 660$  ml/session that equaled to UF speed from 50 to 400 ml/hour (Table 1). 16 episodes of hemodynamic complications have been registered during SLED sessions. 6 cases were episodes of hypotension, and the rest 10 cases were tachycardia. In these cases we decreased UF speed with a simultaneous increase in SLED session duration that allowed us to achieve target values of water balance. Only two cases required additional increase in dose of inotropic support, and one – infusion of salty solutions. Overall increase in ses-

sion length for these patients equaled  $2 \pm 0,7$  (from 1 to 4) hours, and decrease in UF speed equaled  $84 \pm 30$  (from 50 to 150) ml/hr of the plan. UF speed that has been associated with

hemodynamic complications has been higher than UF speed during SLED sessions with no complications ( $285 \pm 58$  vs  $173 \pm 71$  ml/hr;  $p < 0,01$ ).

Table 1

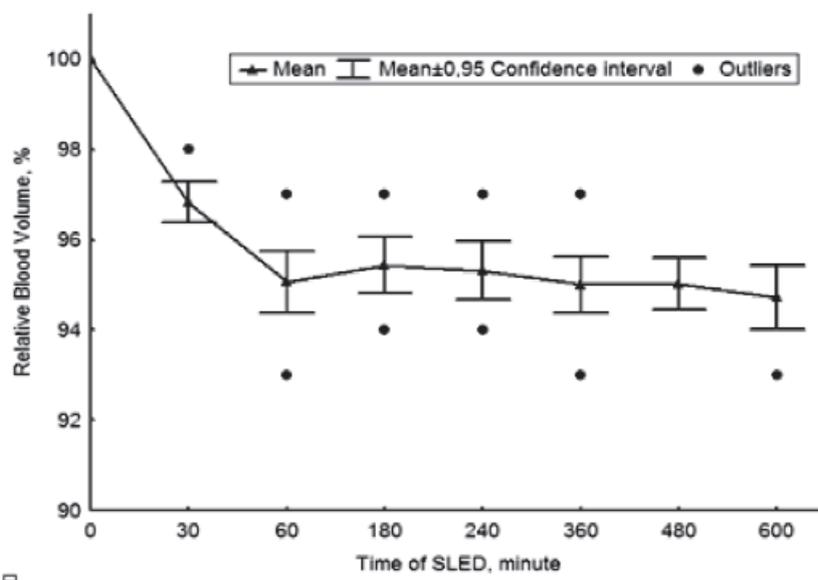
Indexes of water balance during SLED

Parameters	SLED session, (n)	UF volume, ml/session	Pre-scribed session length, hr	Actual session length, hr	Planned UF speed, ml/hr	Actual UF speed, ml/hr	UF speed, associated with complications, ml/hr	UF speed with no complications, ml/hr
Results	49	$1430 \pm 660$	$6,7 \pm 1,1$	$7,4 \pm 1,5$	$210 \pm 85$	$187 \pm 66$	$285 \pm 58$	$173 \pm 71$

The results are represented as average and standard inclination. UF is ultrafiltration.

We have estimated alterations of RBV during sessions of SLED (Figure). The most significant absolute decrease in RBV has been observed during the first hour of therapy. Probably, speed of liquid removal from vascular bed exceeded speed of its refill from

interstice during this period. During later hours of SLED alterations of RBV obtained a linear nature without expressed oscillations ( $p > 0,05$ ). It can testify for the balance between UF speed and refilling. A moderate backward correlation has been revealed between hourly speed and the level of RBV ( $r = -0,39$ ;  $p < 0,001$ ).



Dynamics of alteration in RBV level during to sessions of hemodialysis. The analysis of secondary alterations in RBV was carried out with Fridman criterion; RBV–Relative Blood Volume

Though general volume of body water decreases under UF, hypotension can be avoid if intravascular volume of liquid is preserved. While using BVM, alterations in volume of intravascular liquid are estimated indirectly according to alterations in RBV. RBV level that has been associated with hemodynamic instability in the studied group of patients, was registered in range from 96 to 90% with a average of  $93 \pm 1,4\%$ .

In order to define a safe level of RBV decrease, we have carried out ROC-analysis (Receiver Operator Characteristic). «Optimal cut-off value» with an utmost sum of sensitivity and specificity corresponded to RBV level of 94% (Table 2). In other words, decrease in RBV below 94% has been associated with an increasing risk of development of hemodynamic complications.

**Table 2**  
ROC-analysis results

Parameters	Results
Optimal cut-off value	94 %
Sensitivity	94 %
Specificity	72 %
Diagnostic efficiency	83 %
Area Under Curve	0,87
0,95 confidential interval	0,83–0,906

Generally, BVM can be useful if patients are dehydrated. It is supposed that its implementation allows one to prevent sharp or continuous linear decrease in RBV that were predicted as hemodynamic complications earlier [2; 6]. However, safe limits of RBV decrease and the very method of its implementation is a subject of conflicts. Some authors have defined individual utmost RBV level for each patient during 3–5 sessions of HD, and then, generalized value has been used for future sessions [3; 7]. Another variant implies orientation not only towards a specific RBV level, but a nature of its decrease (linear, exponential, etc.) [6]. However, these methods are relatively complicated for everyday facilitation.

We have estimated possibilities of using the calculated RBV level as a universal «critical» limit for the totality of patients, treated with SLED. As you can see in Table 2, this parameter has a high sensitivity for preventing hemodynamic complication. Besides, the calculated RBV has a moderate specificity. It means that in a number of cases predicted episodes of complications will be false-positive under a decrease in RBV in range of 94–90 %, and it will require an anticipatory decrease in UF speed. However, considering the severity of intradialysis hypotension consequences, even such less-aggressive tactics of UF can prove reasonable for the severe category of patients.

For the majority of studies hypotension serves as a complication criterion that defines a necessity to decrease UF speed. In our opinion, it is also reasonable to use tachycardia as such criterion as well. A stable increase in HR under UF is a clinic expression of intravascular hypovolemia and often precedes sudden hypotension [2]. A low rate of the very hypotension in our research, when an increase in inotropic support or intravenous infusion of solutions was necessary, testifies for advantages of this approach. It allowed us not to interrupt SLED sessions and achieve target values of UF.

Thus, the suggested unified «critical» limit of RBV (94%) is a simple and convenient criterion for application, and its high sensitivity allows one to minimize complications risk for a similar group of patients. The efficiency and safety of this method of using BVM requires confirmation within a comparative random research. We plan to devote the next stage of this study to solving this problem.

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*Materials of Conferences***EFFECTS OF HYDROGEN  
SULFIDE PRODUCTION  
ON MENSTRUAL FUNCTION**

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Environmental factors may have an adverse impact on women's health. Many scientists, such as, A.K. Ailamazyan [1, 2, 3], N.G. Kosheleva et al [5], O.V. Sivochalova et al [7, 8] proved the negative impact of production factors and aggressive factors of the environment in cities with developed chemical industry on the reproductive system of women, proved their role in the growth of gynecological diseases, including menstrual dysfunction.

In 1986 in Astrakhan region there was opened the largest in Europe gas processing complex. Astrakhan gas is characterized by the composition of the aggressiveness and high toxicity. As a result of emergency situations the emissions of harmful substances have occurred in the atmosphere to high and extremely high concentrations.

In Astrakhan gas processing complex employs about two thousands women. They are affected by harmful substances almost during the whole shift (up to 85%) of working hours. So the possibility of chronic exposure of toxic substance is very high.

A.I. Dobrinskaya studied pregnant women from the Astrakhan gas processing complex. She noted the high level of extragenital pathology and placental insufficiency. So, the neuro-endocrine and reproductive systems are developed in the hypoxia conditions. As a result of uterine lesions during adolescence there appear menstrual disorders, including juvenile uterine bleeding. In future these patients suffer both reproductive disorders and infertility [4].

In the Astrakhan State Medical Academy professor A.A. Nikolaev et al conducted research of inhibin A levels as an indicator of ovarian reserve in women working at Astrakhan gas processing complex. It was revealed that after 2,5 years of work the levels of inhibin A are reduced, that indicates a decrease in ovarian reserve. It leads to menstrual irregularities, such as anovulatory uterine bleeding, amenorrhea and infertility as a result [6].

Oxidative stress caused by Astrakhan hydrogen sulfide [9] has a negative effect on woman endocrine system and causes an imbalance of regulation ovulation factor.

It must be admitted that the effects of hydrogen sulfide production in Astrakhan region affects not only the employees, but also the people living in the vicinity.

So, women with high risk of exposure to hydrogen sulfide products must be followed up by gynecologist and have regular rehabilitation courses.

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**INTERRELATIONS BETWEEN  
HEART RATE VARIABILITY  
AND CYTOKINE SPECTRUM  
PARAMETERS IN INFANTS  
WITH CONGENITAL  
CYTOMEGALOVIRUS INFECTION**

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The work was initiated to study cytokine profile and to analyze heart rate variability in 35 infants with congenital cytomegalovirus infection and in 25 non-infected infants aged  $1,81 \pm 0,13$  years. Direct correlations were found between heart rate variability and cytokine profile in cytomegalovirus

fants indicating heterogeneity of ergotropic and tropotrophic effect on productions of cytokines. Direct high correlation between functional activity of autonomic regulation sympathetic loop and anti-inflammatory cytokines in peripheral blood of control group infants was established.

Role of autonomic nervous system (ANS) in the regulation of immunity systems is confirmed by the fact that the immune system formation as a whole functional unit in postnatal infants occurs with the direct participation of hypothalamic structures. Ante- and perinatal unfavorable factors leading to imbalance between ANS compartments contribute to the delay of immune system postnatal maturation. Taking into account cytomegalovirus (CMV) tropism to the nervous tissue, it is possible to suggest that intrauterine infection with CMV could affect functional condition of ANS underlying mechanisms. In its turn it will be reflected by condition of immunity. Today heart rate variability (HRV) determination is thought the most informative noninvasive method for quantitative assessment of autonomic regulation of heart rate and a human organism as a whole [1–10]. As applied to the subject of discussion, systemic and multicomponent processes of effect of intrauterine CMV infection on formation of vegetoimmune mechanisms of adaptation of infants are still unexplored. **The work was initiated** to detect statistically significant interrelations between ANS parameters and cytokine spectrum in children with congenital CMV infection.

**Materials and methods.** Some results of all-up examination of 60 infants (mean age  $1.81 \pm 0.13$ ) born to mothers with chronic latent TORCH infections. 35 patients with persistent congenital CMV infection were included into group P-1, P-0 group consisting of 25 non-infected infants. The groups were comparable as per age, sex and delivery parity. The newborns were follow-up at the Institute of Gynecology and Obstetrics, Uzbekistan Academy of Sciences from the birth. To determine infection level in the newborns 1–2 days postpartum as well as the virus persistence in those aged 6, 12 and 18 months samples of blood, urine and epipharyngeal scraping for virus genome were investigated by means of PCR method [11, 12]. Immunoenzymatic assay (IEA) was used to measure specific IgM, G by means of a test system («Vector-Best» Closed Joint-Stock Company, Novosibirsk, Russian Federation). To differentiate intrauterine infection and process activity avidity index was used (IEA – anti-G-avidity, «Diagnostic systems»: Scientific-Production Association, Nizny Novgorod, Russian Federation). [13]. At birth neither clinical signs of intrauterine infection nor pathologic course of early adaptation could be registered in the newborn examinees to perform planned vaccination and to discharge them from the maternity house. On

20–25 days of life clinical picture of intrauterine infection was observed in 8 infants (22,6%), manifesting in hepatomegalia, icteric viral hepatitis syndrome and pneumonia in P-1 group and necessitating their hospitalization at the newborns' pathology department. It should be noted that IgGs of low avidity were registered in the infants. Thus, assessment of clinical data of the infected infants showed presence of residual and subclinical infection forms in 25,7 and 74,3 %, respectively, residual one being associated with high degree of stigmatization and anomalies in development of osteocartilaginous tissue and urogenital system [3]. For subsequent 3 years the infants were followed-up at Tashkent Pediatric Consulting-Diagnostic Center. Immunological and cardiorythmographic investigations were conducted in the absence of concomitant infectious or severe somatic pathology in the examinees. Immunoenzymatic assay (IEA) was used to determine content of cytokines (IL-1 $\beta$ , IL-8, IL-2, IL-10, IFN- $\alpha$ ) in pg/ml by means of commercial kits («Vector-Best» Closed Joint-Stock Company, Novosibirsk, Russian Federation). Measurement of optical density at wavelength 450 nm was performed by means of photometer for microplates («Multiscan») at the Institute of Immunology, Uzbekistan Academy of Sciences. Blood samples were taken in the morning 10 minutes after cardiorythmography (CRG). CRG was performed by means of «Rate» (Republic of Uzbekistan) software-hardware complex. RR-intervals were registered for 5 minutes within 0.001s in the morning in resting infants [1]. Absolute values of spectral density were obtained by Fourier method (complete transformation of single series by «Hamming» code variant). CV(%) – coefficient of RR – intervals variability, Amo – amplitude of modal value of RR interval set, SDDN – Standard Deviation of Normal-to-Normal RR intervals, RMSSD – the square Root of the Mean of the Sum of the Squares of Differences between adjacent RR intervals, ABI – autonomic balance index, ARI – autonomic rate index, IRPA – index of regulation process activity, TI – tension index, HF – HRV spectral density in high-frequency range, HF –(1–30) subranges – 0,150–0,300 Hz, LF (21 subranges) – HRV spectral density in low-frequency range, 0,150–0,040 Hz, VLF (5 subranges) – HRV spectral density in very low frequencies, 0,040–0,015 Hz, ULF (3 subranges) – HRV spectral in ultra low frequencies, < 0,051 Hz were the parameters to consider[1]. Processing of the results and their graphic presentation was performed on PC «Pentium 4» with MS Excel-XP and «Statistica» programs [14]. Correlation analysis was performed by Kendall's method (r), relative risk (RR) being calculated by Kelmanson's [15].

**Results and discussion.** Results of all-up analysis of infants' early post-natal state of health showed significant differences in objective sta-

tus of infants with congenital CMV infection and their non-infected mates. As to structure of general morbidity, in 1-year infants respiratory diseases, such as, pneumonias (RR = 6,1), recurring bronchitis more frequently with obstructive component (RR = 3,4), allergodermias (RR = 2,7), neurological abnormalities (RR = 3,7), such as, hyperactive child syndrome, dyskinesias and vegetovisceral dysfunctions, as well as gastroenterological disturbances (RR = 3,6) were found to prevail. Motor development retardation in 1-year infants manifested as delay in mastering motor skills, the infants could keep the head straight only by 2,5–3 months ( $p < 0,05$ ), turn from back to side and to belly by 5,5–6 months, sit on one's own by 9–9,6 months and started walking later than usual ( $p < 0,05$ ). Physical development retardation (mainly owing to body mass deficiency) was observed less frequently in both groups. Gastro-intestinal disorders, not infrequent at the age, manifesting as constipation in turn with diarrhea ( $p < 0,05$ ), regurgitation ( $p < 0,01$ ), intestinal microbiocenosis abnormalities ( $p < 0,05$ ) were mainly functional and occurred in P-1 group more frequently. Atopic dermatitis (RR = 2,6) and functional gastro-intestinal disorders (RR = 2,0) evidently prevailed in P-1 infants in the 2<sup>nd</sup> year of life. In infants of the age frequent (more than 6 times a year) episodes of acute respiratory infections (RR = 4,3) and dysmetabolic nephropathies in combination with urinary tracts infection (RR = 3,4) in comparison with the control took place. Incidence of asthenoneurotic and vegetovisceral dysfunctions with speech development retardation remained rather high (RR = 2,9). Only 57 (42,9%) of 133 paired correlations for the control group (P-0) turned out confident. For the P-1 group there were 88 (66,2%) confident correlations. In infants infected with CMV direct correlation between HF and IL-1 $\beta$ , IFN- $\alpha$ , IL-10, between AMo, ABI, ARI, IRPA, TI and IL-2 was showed indicating heterogeneity of ergotropic and tropotrophic effects on the production of cytokines. Upon production of IL-2, IL-8 and IL-10 in P-1 group maximum tendency to reduction in effect of autonomic regulation (AR) sympathetic loop was observed, for IL-1 effect of only autonomic loop. Infants of the control group showed diametrical dynamics, that is predominance of vasomotor center (LF) and suprasedimentary level of regulation.

Upon production of IL-1 in P-1 infants presence of intermediate direct correlation with HF, effect of AR parasympathetic loop can be observed, while in P-0 infants this power is distributed on LF, spectrum of low frequency waves only. This distribution of powers is confirmed by IL-1 concentration in the peripheral blood, confident increase of its production being registered in P-1 group as compared with the control ( $p < 0,001$ ). IL-1 is an immunotransmitter, producing direct ef-

fect on the central nervous system (CNS) structures, on hypothalamo-hypophyseal-adrenal axis, in particular. In high concentrations IL-1 favors necrosis and nerve cell apoptosis. Clear logical correlation between perinatal injury of CNS in the CMV infected infants ( $p < 0.001$ ) and IL-1 content was established. This can be considered as a sign of the brain ischemic injury upon persisting CMV infection and inadequate response of AR central loop. Differentiating effect of sympathoadrenal mechanism can be seen upon production of IFN- $\alpha$ . In P-1 group close direct relations with high-frequency waves (HF) (5,3%) add, their complete absence in the control group evident. IFN- $\alpha$  production naturally increases in the group by 4,2% as compared with the control to confirm unsoundness of antiviral activity.

Predominant effect of high-frequency spectrum (HF) on IL-8 with positive vector in P-1 group was established. Similar synchronicity could be seen in IL-8 concentration as compared with the control ( $p < 0,01$ ). Increased IL-8 level is associated with chronic inflammatory process upon CMV infection and correlates with functional gastro-intestinal disorders ( $p < 0,01$ ). Close multidirectional correlations in respect to IL-2 and IL-10 were observed in the examined groups too. Peculiarities of interrelations between AR parasympathetic loop and IL-2, IL-10 are of special interest. For IL-2 positive vectorial effect in P-0 group gives place to the contrary one in P-1 group. For IL-10 antagonistic effect of AR humoral loop with predominance of central link can be seen in the control group, humoral link in the infected infants activating production of interleukin. IL-10 is the key link in pathogenesis of allergodermias (AD). By its immune suppressive activity IL-10 favors formation of chronic allergic inflammation. Confident dependence between IL-10 content and AD recurrences in infants ( $p < 0,05$ ) was found. Thus, cytokine spectrum of infants infected with CMV persisting form is regulated by the parasympathetic effect.

**Conclusion.** In infants with persistent congenital CMV infection diagnostically significant confident differences in correlation density between HRV and cytokine profile have been established. The natural dependences are found to characterize degree of imbalance in the system of regulation of cytokine reactions with predominance of autonomic loop regulation. Synchronic alterations in concentrations of peripheral blood cytokines confirmed prognostic value of HRV parameters. As the result, new approaches to development of methods of anticytokine therapy and prevention of persistent CMV infection in infants are possible.

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## CHANGE OF LIVE WEIGHT AND ITS GROWTH IN HEIFERS OF YAROSLAVL BREED IN NATURAL AND CLIMATIC CONDITIONS OF THE NORTH CAUCASUS

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Researches of the changes of the live weight and average daily gain in heifers of Yaroslavl breed in the new for animals natural climatic conditions of the North Caucasus were conducted. The rate of the development of animals to a great extent is determined by the breed characteristics, conditions of their feeding and housing. The authors found out that the relative growth of rate reaches a maximum when an animal is 12 month old and it declines with age. Nevertheless the process of development of animal, the sequence and duration of the periods determined by heredity, also depend on external conditions, the change of which can speed up or slow down their passage.

**Keywords:** breed, genotype, growth, development, live weight, gain

The choice of breeds and genotypes of cattle for a specific natural and economic zone is essential to effective livestock production. This problem should be solved on the basis of the fullest possible use of biological resources of animals in certain climatic and geographical conditions [2].

Nowadays a large number of cattle of Yaroslavl breed, not adapted to local climatic conditions, was brought to the south of Russia. They gave the offspring, which is planned to ranch and get livestock product [1, 3, 4].

The environment has an impact on health and viability of the farm animals, especially in the early postnatal ontogenesis. During this period key health indicators, the main functions of further economic use and possibility of a long-term industrial use are placed into young animals [5, 7, 8, 9].

Due to intense solar insolation, sharp continental climate and other natural and climatic factors of Stavropol physiological characteristics of animals are modified, new adaptive mechanisms needed for optimal life in these

conditions are produced [6,10]. One of the objective indicators that let to get the most accurate description of the biological characteristics of different breeds is the evaluation of the growth and development of the Yaroslavl breed heifers. It was conducted by comparing the offspring of brought animals with a similar group of red steppe peers, which are well adapted to the conditions of Stavropol region and are widely spread in the North Caucasus region.

The study of the growth and development of the young animals is of great interest to determine the regularities of milk and meat productivity formation, and live weight and average daily gain are important indicators of the overall of the animals development.

We have studied the change in the live weight and average daily gain of test animals from the birth to 18 months (Table 1). Researches have shown that the live weight of calves at birth was similar with the red steppe one and with the Yaroslavl breed heifers, and it comprised 31,1 and 31,2 kg (Figure).

**Table 1**

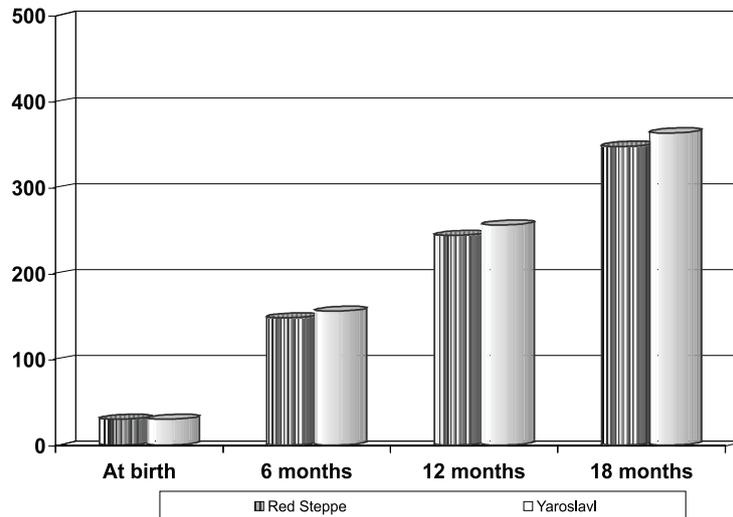
Dynamics of the live weight and average daily gain of red steppe and Yaroslavl heifers,  $M \pm m$

Age, month	Breed	
	Red Steppe	Yaroslavl
	Live weight, kg	
At birth	31,1 ± 0,93	31,2 ± 0,70
6	149,1 ± 3,82	156,9 ± 2,96
12	244,9 ± 5,48	257,1 ± 4,71
18	348,6 ± 6,03	364,3 ± 5,01
	Average daily gain, g	
0–6	648 ± 31,1	690 ± 30,1
6–12	523 ± 33,4	547 ± 28,5
12–18	569 ± 20,5	595 ± 18,4
0–18	579 ± 31,0	611 ± 27,4

At the age of 6 months Yaroslavl animals were superior to the red steppe by 7,8 kg or 5,2%. By 12 months the difference in the live weight between experimental groups of heifers was 12,2 kg, or 5.0%.

At the age of 18 months the average live weight of the red steppe heifer was 348,6 kg

and the Yaroslavl breed animals – 364,3 kg, the difference was 15,7 kg or 4,5%. In all periods of the growth the difference in live weight between the experimental groups of heifers was reliable at  $P > 0,95$ . For the half year of the life the live weight gain of the control animals was 317,5 kg, and experienced ones – 331,1 kg.



Dynamics of the live weight of heifers red steppe and Yaroslavl breeds, kg

During this period the average daily gain of red steppe heifers was 579 grams, and of Yaroslavl ones – 611 grams. And for 6 months of the life it was correspondently 648 and 690 grams, for 6–12 months – 523 and 547 grams, for 12–18 months – 569 and 595 grams.

The absolute rates of growth of animals, primarily to the increase of its mass, are of great practical importance as they make it possible to compare actual data with planned production tasks for a certain period, and thus control their fulfillment. However in absolute terms we can't say for sure about the intensity of growth processes in the body.

The relative growth of rate is determined multiply or in percentage terms to the initial or average value over the period. It testifies about the intensity of body growth for a specific time period.

The relative growth of rate over the period, expressed as fold increase in the initial rate, called the growth coefficient. This indicator is important to assess economic and biological characteristics of the animals and to judge the intensity of assimilation in the body.

For a more detailed judgment on the growth rate of heifers we have provided data showing the multiplicity of the weight gain of animals (Table 2).

**Table 2**

The coefficients of increase in the live weight of heifers in the experimental groups

Age, month	Breed	
	Red Steppe	Yaroslavl
6	4,79	5,03
12	7,87	8,24
18	11,20	11,68

The resulting coefficients indicate that the weight of Yaroslavl animals increased more rapidly than the red steppe.

The peculiarities of heifer's development may be judged more accurately by the magnitude of the relative rate of the growth (Table 3).

**Table 3**

The relative growth of rate of the experimental young animals, %

Breed	Periods of the growth, months		
	0–6	6–12	12–18
Red steppe	37,9	64,0	2,0
Yaroslavl	40,3	64,0	42,0

Under optimal conditions of the feeding and housing relative the growth of the rate of animals decreases with age, this trend is observed in our experiments.

In the postembryonic period, in comparison with the embryonic, the intensity of the growth of animals has slowed dramatically. The mass of the body of cattle in the embryonic period is doubled 26 times, and in the postembryonic one – only 4 times.

Thus, the intensity of the animal development, to a greater extent, is determined by the breed characteristics and their conditions of feeding and housing. It was found that the relative growth rate reaches a maximum in 12 months and declines with age in animals of both groups. We have not been identified any significant differences on this indicator. Nevertheless the process of body development, the sequence and duration of the periods determined by heredity also depend on external conditions, the change of which can speed up or slow down their passage.

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## SYNTHESIS OF OPTIMAL CONTROL OF THE OBTAINING ETHANOLAMINE PROCESS THE METHOD OF MATHEMATICAL PROGRAMMING ON THE BASIS OF REGRESSION MODELS OF THE OBJECT

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Was set and formalized the task of linear mathematical programming for optimization of the composition of the reaction mixture. The algorithm of optimization of the object. We found optimal conditions for the implementation of the production process for generating a mixture with a maximum content of the IEA in the field of admissible solutions.

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**Keywords: ethanolamine, synthesis, regression models**

A product of production in ethanolamine synthesis joint is a reaction mixture of three components: monoethanolamine (MEA), diethanolamine (DEA), and triethanolamine (TEA) that later is exposed to division into separate components through rectification and evaporation that is linked to significant energetic costs. In fact, a part of DEA in the reaction mixture does not depend on parameters of synthesis process in the studied area of their alterations and is supported at the level of average value of a selection. Parts of MEA and TEA are controlled factors and are adequately defined by the process parameters according to basic control channels.

Target products are realized in terms of market, and their realization volume is defined by a demand for separate types of products.

Depending on a demand, an objective arise – receive a reaction mixture with a maximum content of the required component in order to decrease costs at the division stage, particularly:

– receive a reaction mixture with a maximum content of MEA;

– receive a reaction mixture with a maximum content of TEA.

Therefore, optimization criterion is a content of the required component in the reaction mixture: part of MEA in the reaction mixture ( $Y_1$ ) – for the first problem, and part of TEA (%) in the reaction mixture ( $Y_3$ ) for the second problem. The prepared regression models describe dependences of the composition of the reaction mixture on the initial data and parameters of the production process condition:

$$\begin{aligned} Y_1 &= 67,74 - 5,196 \cdot X_1 - 0,108 \cdot X_3; \\ Y_2 &= 100 - Y_1 - Y_3; \\ Y_3 &= 8,471 + 5,796 \cdot X_1 + 0,088 \cdot X_3 - 0,394 \cdot X_2, \end{aligned} \quad (1)$$

where  $Y_1$  is a part of MEA in the reaction mixture at its discharge from the synthesis joint (%),  $Y_2$  is a part of TEA (%) in the reaction mixture,  $X_1$  is a consumption of ethylene oxide (m/hr),  $X_2$  is a consumption of  $\text{NH}_3$  ( $\text{m}^3/\text{hr}$ ),  $X_3$  is a temperature in the upper part of the synthesis reactor ( $^{\circ}\text{C}$ ).

We should consider that regression model is real only within the studied range of alteration of equation parameter  $X_1$ ,  $X_2$ , and  $X_3$  that can often limit the search for optimal solutions. Besides, we have established a highly-predictable and statistically-adequate relation between  $Y_1$  and  $Y_3$  (Fig. 1).

Here we can see a problem of search for an optimal solution with limitations. In this case optimization problem is solved via methods of mathematical programming, in other words, methods of solving problems of finding a function extremum at a number of final vec-

tor space that is be defined by limitations, such as equalities and (or) inequalities.

The problem of mathematical programming can be generally presented as:

$$\begin{cases} Z = f(X) \rightarrow \min; \\ F_i(X) \geq 0, \quad i = 1, 2, \dots, k; \\ H_j(X) = 0, \quad j = k + 1, \quad k + 2, \dots, m; \\ X = (x_1, x_2, \dots, x_n). \end{cases} \quad (2)$$

Where  $Z$  is the optimization criterion (target function), where  $Z$  – optimization criterion (objective function),  $F_i(X)$  and  $H_j(X)$  are limitations,  $X$  is a vector of n-dimensional vector space of the equation parameters.

It is a standard form of putting down a problem of mathematic equation.

The number of solutions of limitation system in this case can be called acceptable mul-

tiplicity of solutions. Solving an optimization problem at a number of acceptable solutions is the multiplicity of optimal solutions.

Setting a problem in case when we need to achieve a maximum part of MEA in the reac-

tion mixture at its discharge from the synthesis angle, looks as:

$$Z = Y_1(X) \rightarrow \max.$$

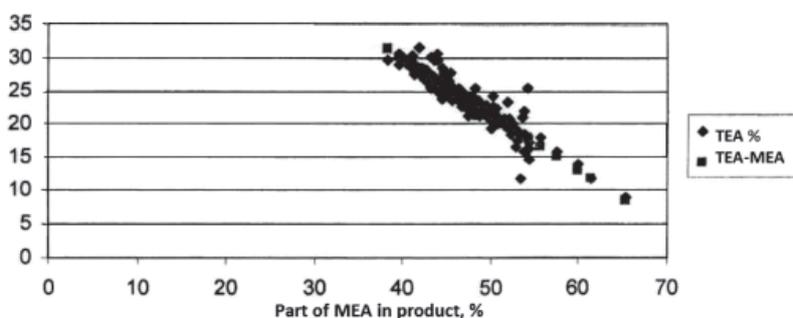


Fig. 1. Relations between parts of TEA and MEA in the product before the division. Equation of regression:  $Y_3 = 63,847 - 0,8512 \cdot Y_1$ ; Coefficient of determination  $D = 0,8476$ ; Fisher criterion  $F = 934,14$

Limited by the following equalities:

$$Y_1 = 67,74 - 5,196 \cdot X_1 - 0,108 \cdot X_3;$$

$$Y_2 = 100 - Y_1 - Y_3;$$

$$Y_3 = 8,471 + 5,796 \cdot X_1 + 0,088 \cdot X_3 - 0,394 \cdot X_2;$$

$$Y_3 = 63,84 - 0,08512 \cdot Y_1.$$

Limited by the following inequalities:

$$0,5 \leq X_1 \leq 3,0;$$

$$6,0 \leq X_2 \leq 18,0;$$

$$50,0 \leq X_3 \leq 80,0.$$

Inequality limitations set an area, in which regression model of the process of receiving

ethanolamine is adequate, and are defined by an initial statistic selection.

In a similar way we can form the second problem – search for an optimal conditions of achieving maximum part of TEA in reaction mixture before the division:

$$Z = Y_3(X) \rightarrow \max.$$

Limited by the following equalities:

$$Y_1 = 67,74 - 5,196 \cdot X_1 - 0,108 \cdot X_3;$$

$$Y_2 = 100 - Y_1 - Y_3;$$

$$Y_3 = 8,471 + 5,796 \cdot X_1 + 0,088 \cdot X_3 - 0,394 \cdot X_2;$$

$$Y_3 = 63,84 - 0,08512 \cdot Y_1.$$

Limited by the following inequalities:

$$0,5 \leq X_1 \leq 3,0;$$

$$6,0 \leq X_2 \leq 18,0;$$

$$50,0 \leq X_3 \leq 80,0.$$

Both problems are characterized by setting a target function and limitations by linear alge-

braic functions, in other words, these problems refer to the class of problems of linear programming. For linear problems, optimal results are usually achieved at the border of the acceptable solutions. The range of acceptable solutions is defined by solving the system of limitations, in other words, it is limited by planes in the area  $(X_1, X_2, X_3)$ :

$$2,284 + 1,378 \cdot X_1 - 0,00323 \cdot X_3 - 0,394 \cdot X_2 = 0.$$

And planes:

$$\begin{aligned} X_1 &= 0,5; & X_1 &= 3,0 \text{ with a normal axis } OX_1; \\ X_2 &= 6,0; & X_2 &= 18,0 \text{ with a normal axis } OX_2; \\ X_3 &= 30,0; & X_3 &= 80,0 \text{ with a normal axis } OX_3. \end{aligned}$$

Both problems share the same range of acceptable solutions, but their optimal solutions will differ, as there are different target functions.

Target function for the problem of optimizing the part of MEA in reaction mixture at its discharge from the synthesis joint is:

$$Y_1 = 67,74 - 5,196 \cdot X_1 - 0,108 \cdot X_3 \rightarrow \max.$$

We can see that the maximum value of  $Y_1$  will be achieved under the smallest of all possi-

$$2,284 + 1,378 \cdot X_1 - 0,00323 \cdot X_3 - 0,394 \cdot X_2 = 0.$$

Particularly – at its crossing with planes  $X_1 = 0,5$  and the minimum value  $X_3 = 30,0$

The optimum is reached at the point: supply of OX ( $X_1$ ) equal  $0,5 \text{ m}^3/\text{hr}$ , supply of ammonia ( $X_2$ ) equal  $7,3 \text{ m}^3/\text{hr}$ , and temperature of synthesis reactor ( $X_3$ ) =  $30^\circ\text{C}$ . The predicted composition of the reaction mixture in this

$$Y_3 = 8,471 + 5,796 \cdot X_1 + 0,088 \cdot X_3 - 0,394 \cdot X_2 \rightarrow \max.$$

$Y_3$  obtains its biggest value at the line of crossing of planes that limit the range of accepted solutions from the side of the

$$2,284 + 1,378 \cdot X_1 - 0,00323 \cdot X_3 - 0,394 \cdot X_2 = 0.$$

Specifically, at its crossing with planes  $X_1 = 3,0$  and  $X_3 = 80,0$ .

The extremum takes place at the point: supply of OX ( $X_1$ ) equal  $3,0 \text{ m}^3/\text{hr}$ , supply of ammonia ( $X_2$ ) equal  $15,6 \text{ m}^3/\text{hr}$ , and temperature of synthesis reactor ( $X_3$ ) =  $80^\circ\text{C}$ . The predicted composition of the reaction mixture in this case: part of MEA ( $Y_1$ ) equal  $43,59\%$ , part of DEA ( $Y_2$ ) equal  $29,7\%$ , and part of TEA ( $Y_3$ ) equal  $26,8\%$ .

Other variant of extremum problems are possible within this process, for example: finding an equation that provides for receiving the minimal part of MEA (or TEA) in the reaction mixture at its discharge from the synthesis joint.

$$2,284 + 1,378 \cdot X_1 - 0,00323 \cdot X_3 - 0,394 \cdot X_2 = 0$$

and other limiting planes. Calculations show that such point coincides with a point that provides for a maximum value of  $Y_3$  – part of TEA in the reaction mixture.

$$Z = Y_3 = 8,471 + 5,796 \cdot X_1 + 0,088 \cdot X_3 - 0,394 \cdot X_2 \rightarrow \min.$$

ble values of  $X_1$  (optimal EO) and  $X_3$  (temperature at the top of the synthesis reactor). Within the range of acceptable solutions the smallest values of  $X_1 = 0,5$  and the smallest value of  $X_3 = 30,0$ . These limits are set by the conditions of technological process at the available equipment and are defined by the initial statistic selection. The value of factor  $X_2$  (supply of  $\text{NH}_3$ ) should be found from the condition that an optimal point is located on a limitation plane

case: part of MEA ( $Y_1$ ) equal  $61,9\%$ , part of DEA ( $Y_2$ ) equal  $27,0\%$ , and part of TEA ( $Y_3$ ) equal  $11,1\%$ .

For the problem of optimizing a part of TEA ( $Y_3$ ) in reaction mixture before the division, the target function (optimization criterion) is:

biggest values of  $X_1 = 3,0$  and  $X_3 = 80,0$  at the point that lies on the limiting plane

If it is necessary to find conditions of receiving a reaction mixture with the minimum part of MEA, the target function (optimization criterion) looks as

$$Z = Y_1 = 67,4 - 5,196 \cdot X_1 - 0,108 \cdot X_3 \rightarrow \min.$$

And the system of limitation remains the same. It is obvious that within the range of the accepted solutions, the minimum value of  $Y_1$  will take place under the biggest border values of EO supply ( $X_1 = 3,0 \text{ m}^3/\text{hr}$ ) and the temperature at the top of the synthesis reactor ( $X_3 = 80^\circ\text{C}$ ), and supply of ammonia is defined by the point of crossing between the plane

While searching condition of receiving the reaction mixture with the minimum content of TEA, our target function is:

With a set range of acceptable solutions. Supply of ammonia ( $X_2$ ) should be found as a point of crossing between limiting planes  $X_1 = 0,5$ ;  $X_3 = 30,0$ , and

$$2,284 + 1,378 \cdot X_1 - 0,00323 \cdot X_3 - 0,394 \cdot X_2 = 0$$

Such point will coincide to the one that provides for the maximum content of MEA in the reaction mixture.

Extreme points are found in any definition of this problem on borders of the range of accepted solutions. We have found local extrem-

ums, and, in order to find global extremums, one should scan the whole surface of the accepted range of existing solutions. In case of necessity, this procedure must be realized within the process of optimal control over the object.

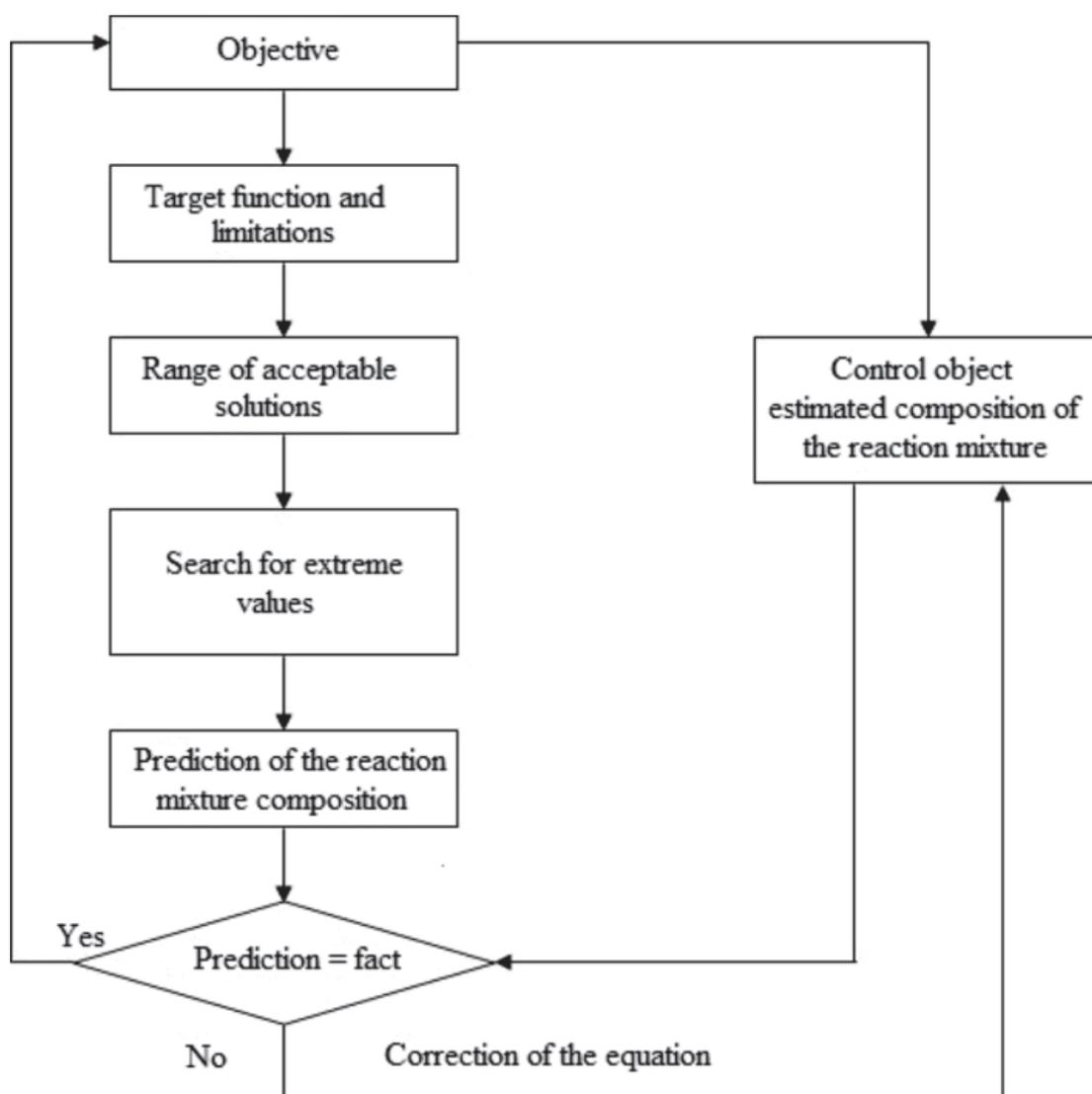


Fig. 2. Algorithm of an optimal control over the process of receiving ethanolamine

Limitations in forms of inequalities in this definition of the problem are defined by the composition of the initial statistic selection, according to which, the regression model of the control object has been received. The model is adequate within the studied area, but gives

an increasing number of prediction errors as it remotes from the center of the studied area. In order to search for optimal regimes of control within a wider range of alteration in parameters of production, it is necessary to develop a determined mathematic model of the object.

## FORMATION OF ETHNO-CULTURAL COMPETENCE OF STUDENTS IS BY MEANS OF ETHNO-CULTURAL EDUCATION

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At the modern stage of Russian development life demands from education implementation of the social order of society and ethnoses occupying it to transfer to younger generation the richness of language and culture of their native people, tradition and spiritual and moral values, experience of life of the people, to enrich it with culture of the people of cohabitation and to attach to values of world culture.

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**Keywords:** ethno-cultural education, ociety, ethnoses, language, culture

There is a difficult and inconsistent process of mixing, interpenetration and an interlacing of cultures in the majority of modern poly-cultural regions that puts forward before teachers a problem of realization in society of the ethno-cultural education providing formation of ethno-cultural competence of students, formation knowledge at young generation and experience of cooperation with people of different nationalities, cultures and religions. To teach people to live together is one of the most important tasks of modern school, and it can be solved on the basis of the concept of ethno-cultural education.

Today ethno-cultural competence of youth is formed in the extremely adverse conditions. In multiethnic space of Russia ethno-cultural traditions, folklore works, language leave a life. Problems of knowledge and conception of ethno-culture face to each people. It is necessary to hold historical memory of all people with an account of cultural and historical features of these or those territories in multinational Russia.

The analysis of psychology-pedagogical and educational and methodical literature shows that the concept «ethno-cultural education» arises in the most various contexts and is understood differently by various researchers.

The ethnos is one of factor of socialization. There wasn't conventional understanding of the nature, character and an ethnos structure. Some researchers take as a basis «objective data» is language, the territory, religion, a way of life, etc., others is behavior, the third is feeling of belonging to other group, the fourth is information communications. According to theoretical views of the Russian geographer and historian L.N. Gumilev, the ethnos is «the groups which arise, work, interact among themselves, and at last, die» [1].

S.I. Ojegov's dictionary [2] treats the first part of a compound word «ethno-cultural» («ethnos») as «historically developed steady group of people is a tribe, a nationality, the nation». The second part of this term corresponds to broader and ambiguous concept «culture» (from Latin cultura is cultivation, education,

development, honoring) which firstly appeared in an antiquity and it means «purposeful impact of the person on the nature and also education and training of the person».

Culture is difficult, interdisciplinary all-methodological concept, its characteristic, satisfying specialists of various branches of knowledge, is extremely difficult. There is no culture definition which could be considered exhaustive of the same mind. There are more than 500 definitions of culture that testifies about real complexity of the phenomenon nowadays, its inclusiveness in numerous social contexts, its universality ...

Ethno-culture consists of two words «ethnos» that means «people», and culture (lat mean). It sets of the material and cultural wealth created by human society and characterizing a certain level of development of society.

We offer the following definition of the term «ethnoculture». The ethno-culture is a constellation of traditional values, the relations and the behavioral features embodied in material and spiritual activity of ethnos, developed in the past, developing in a historical sociodynamics and constantly enriching with ethnic specifics culture in various forms of activity self-realization of people.

Ethno-cultural range of problems is difficult and multicomponent, many of its concepts are insufficiently developed in spite of the fact that at the beginning of the XXI century the sciences studying ethnic problems, actively develop. Complexity of its structure and internal communications causes emergence of a field of interdisciplinary researches and discussions in modern comprehension of ethno-culture.

It is impossible to carry out ethno-cultural education without illumination of theoretical and practical questions. The main problem of ethno-cultural education is the formation of ethno-cultural competence.

The term «ethno-cultural competence» have appeared in science recently.

So in the «Education of Ethnotolerance of the Teenager in a Family» dictionary [3] the following definition is given: «Ethno-cultural competence is extent of manifestation by the

identity of knowledge, skills and the abilities allowing to estimate specifics and conditions of interaction, relationship with representatives of other ethnic communities, to find adequate forms of cooperation with them for the purpose of maintenance of the atmosphere of a consent and mutual trust». V.A. Kortashev and V.Yu. Shtykareva's definitions in this dictionary are aimed to cross-cultural interaction, the sense of the term comes nearer to the contents interethnic (multiethnic, cross-cultural) competence, in their interpretation determination of ethno-cultural competence has a sociological foreshortening.

There is the T. Poshtareva's article which devoted the problems of formation at children of «ethno-cultural competence» in the «Pedagogy» magazine in which Poshtareva gives the following definition to this term: «Ethno-cultural competence is the property of the personality which is expressing available to set of objective representations and knowledge of this or that culture, being realized through abilities, skills and the models of behavior promoting effective interethnic mutual understanding and interaction» [4].

We offer the following determination of ethno-cultural competence. Ethno-cultural competence is the integrated property of the personality which is expressing in summation of representations, knowledge about native, and also about nonnative ethno-cultures, their place in world culture, taking experience by ethno-cultural values that is shown in abilities, skills, behavior models in the mono-ethnic and multiethnic environment. Essential difference of this definition is the culturological and ethnopedagogical approaches, an attention point on competence of area of native ethnoculture and on activity experience of mastering by ethno-cultural values on the basis of what the civilized ethno-cultural consciousness deprived of nationalism and ethnocentrism, but possessing healthy feeling of self-esteem in harmony with feeling of ethno-tolerance is formed.

Working in the field of ethno-cultural education and formation of ethno-cultural competence of students revealed characteristic problems in pedagogical process. One of them is the absence of uniform understanding of the general terms scientists of dynamically developing interdisciplinary sciences. There is a

need of clearing of terms framework even concerning the most common and root concepts.

The important problem which has the great importance in the course of formation of ethno-cultural competence is search of techniques and difficult for theoretical consideration.

One of the effective conditions of formation of ethno-cultural competence was also the ethnopedagogization of the educational process conducting to mastering by studying values of national and world culture. She assumes to use in educational process ways and methods of national pedagogy (folklore, traditions, customs, holidays, art, game, etc.), the accounting of national and psychological features of children and specifics of family education of various ethnoses.

Thus, we assume that one of effective conditions of a solution of the problem of formation of ethno-cultural competence of students is the ethnopedagogization of teaching and educational process. Education with a support on national traditions of the people, its culture, national and ethnic ceremonialism, customs acts as a condition of realization of multiethnic education.

Formation of ethno-cultural competence is inseparably linked with education of ethnic tolerance as it is the mechanism of achievement of interethnic mutual understanding and interaction. Ethnic tolerance and ethno-cultural competence represent two-uniform essence. On the one hand the ethno-cultural competence based on knowledge of ethno-cultures and experience in area of the interethnic relations and aimed at mutual understanding. On the other hand the ethnic tolerance based on recognition and acceptance of ethno-cultural diversity, gives the chance to understand other people, to expand a framework of ethnic experience and knowledge.

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## PECULIARITIES OF EDUCATION IN FOLK PEDAGOGY

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The article examines the theoretical aspects of education in folk pedagogy. The main purpose of the publication is to reveal the scientific approaches to the education of spiritual and moral values, traditions, norms of conduct of the Altai people. The work highlights the major socially significant approaches to educating of younger generation on the basis of ethno-cultural traditions. The article is relevant, has scientific and practical novelty.

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**Keywords:** education, traditions, traditional culture of the Altaians

In the Soviet period, G.S. Vinogradov was the first to appeal to the problems of folk pedagogy, who gave a description of the nature of this phenomenon as an integral part of the pedagogical culture of the people, who asserted the right of the term and concept of «folk pedagogics» to exist [1].

G.S. Vinogradov believed that the set of people's views, means taken by the people to influence the younger generation with the aim of learning and upbringing should be called folk pedagogy [1].

The continuity of generations is of great importance in folk pedagogy. The most significant and the most effective feature of folk pedagogy is its relation with life.

Outstanding teachers of the past paid a lot of attention to the study of educational principles of the nation and its pedagogical experience. Teachers-classics believed that folk pedagogics enriches the science of education, serves as its support and foundation.

Y.A. Komensky put forward and developed the idea of «a mother's school» on the basis of generalization of the experience of home education in labour families, the idea was aimed at raising all families to the level of the best families, where education was wiser [2]. The great pedagogue also took into account people's experience in the justification of the principle of nature conformity. Some didactic rules are given by him in the form of folk sayings, and in some cases, folk sayings are some elements of didactic regulations. His first work – «Treasure of the Czech language» was released as a separate edition, the collection of proverbs and sayings of the Czech people, «the Wisdom of the old Czechs» was a part of this work. An outstanding Swiss teacher J.H. Pestalozzi appealed to the ideas of upbringing and education of people. The work of other teachers and bright representatives of the classical world pedagogical thought such as R. Owen, A. Diesterweg testified that the truth of their ideas was checked in folk pedagogy [2].

Figures of the Russian enlightenment treated people's education experience with great respect. A significant contribution to the development of the idea of nation in the upbringing was made by an outstanding Russian enlightener M.V. Lomonosov, who was the creator of Russian grammar and the first Russian University, a brilliant scientist, who also made discoveries in many sciences, namely in the science of education. His commandment says that history gives the young minds of the old [3].

Having analyzed the pedagogical heritage of different peoples, K.D. Ushinsky came to the conclusion that there was no general system of education for all ethnic groups. Each nation has its own system of education. Experience of other nations in the education is a precious heritage for all, exactly in the same sense in which the experience of world history belongs to all nations [4].

According to K.D. Ushinsky, education, created by the people and based on the national basis, has the educational force, which does not exist in the best systems based on abstract ideas. He deeply believed in the principle of «people without a nation is a body without a soul» and explained the idea of nation basing on this principle. Knowing folk customs, ceremonies, traditions, K.D. Ushinsky concluded that «the wisdom of the ancestors is a mirror for posterity, he supported national education, for it was a vivid example of the process of national development [4].

According to K.D. Ushinsky, to achieve success it is necessary to rely on the system created by the people, which takes into account natural inclinations of man, originality of the national character, formed under the influence of the environment and circumstances [4]. Knowledge of oral national arts and the national parenting experience reflected in it, helps to understand the specific character of people's historical development, customs and traditions, family foundations, in conditions of which personality of each child was brought up and developed.

Folk pedagogy reveals peculiarities of the national character, people's face, thoughts and aspirations, moral ideals are especially evident in fairy tales, legends, stories, sayings and proverbs [1].

Preservation and revival of national cultural traditions can be done only on the basis of their mutual enrichment and appeal to the roots of traditional folk cultures.

For centuries people's spiritual values, traditions, norms of conduct played a crucial role in educating and upbringing of younger generations, formation of moral, ethical, labour and social qualities [6]. The role of education increases greatly. Education, according to its function, is a sociocultural technology which provides stability of the society and its development. Processing and understanding of spiritual culture and ethnical norms of behavior of the past will help to build the educational process in the modern school.

Search for the content, forms and methods led to the necessity of studying the traditional culture of Altai people, its history, religion, and that led to the consideration of philosophical, pedagogical and ethnic knowledge.

We consider the historical experience of the ethnos, its history, culture, education on the basis of works of scientists of Siberia and Altai mountains. This approach will provide prospects for the study of folk pedagogy and its use in educational process of modern Altai national school [11].

Judging by one of the ancient human camps traditional culture of the Altaians is one of the oldest cultures, (1,5 million to 150 thousand years). This period of time accumulated rich historical and cultural heritage.

The most popular in the Russian Federation are the materials of archeological excavations of burial mounds of Scythian time (Pazyryk culture). This includes the ethnographic unit of heritage, which begins with the natural objects associated with worldview sphere. The cult of ancestral mountains is of great importance, including the highest mountain in Siberia Kyzyl-Bazhi (Uch-Sumer) – Belukha which is very significant for all Altaians. There are also sacred places, in other words passes, healing springs (arzhans) etc. Besides, they are objects of material culture and religious customs, traditions, devotions and rich folklore.

The first scientific research of Altaian culture, including issues concerning education of Altai children belong to the pre-revolutionary scientists. Such great scientists as G.F. Miller, P.S. Pallas, and I. Georgi participated in Russian academic expeditions of the second half

of the eighteenth century and obtained interesting information about customs and traditions of the Altai people, they were trying to «open» the Altai national character and recreate an integral image of a mental type of an altaian in the context of historical and cultural reality.

Scientific data concerning issues of upbringing of Altai children belong to the middle of XIX century.

V.I. Verbitsky introduced the division of the Altaians into Northern Altaians and Southern Altaians on the basis of their language, culture and life. The division found support among the experts who paid attention not only to the difference in the economic way of life, but the features of their anthropological type and language [7].

V.I. Verbitsky was one of the first to explore the Altai epos in the nineteenth century. In his article «Heroes in the tales of Altai» he emphasized that «being rich in fantasy and idle time Altai people like to live in a fairy world» [7]. He appreciated the significance of all small genres of folklore for brevity, accuracy, they highlighted folk wisdom. Proverbs collected by him are mainly devoted to the man, his character, moral qualities, labour, kindness and evil, friendship and consent, hospitality, respect for the oldest.

Immersing into the life of Altai people, V.I. Verbitsky touched «grounds» of human existence, found the same values as in the civilized world: the thirst for freedom, respect for the individual, links to relatives.

Altai constantly attracts attention of scientists, travelers and ethnographers. Scientific works of the XIX and beginning of XX centuries are of special ethnographic and historical interest in the study of traditional culture of the Altaians. Writings by V.V. Radlov, S. Shvetsova, N.M. Bolshevikov describe magnificent qualities and traits of the Altaians, which deserve to be moved into modern life.

The study of Altai folk literature began from the middle of the XIX century. The beginning of this research was initiated in 1866 in St. Petersburg by V.V. Radlov's publication «Samples of folk literature of Turkic tribes in southern Siberia and the Junggar steppe» in all dialects of the Altai Turkic language, the publication was accompanied by a volume translated in German.

It should be noted that up to the present time this scientific work was republished neither in Russia nor in the USSR. Although in other countries, e.g. USA and Germany the work was republished on the occasion of centenary of the book and equipped with the necessary critical apparatus.

V.V. Radlov's works reveal sincere attitude to the Altaians. Extracts of his memoirs are the examples of this attitude: «no Turkic people of Northern Asia gives such a good feeling as the Altaians do!» [9]. Hospitality had a focus on the unity of people, friendship, respect, reverence, because a guest for the Altaians was always solemn and untouchable. He was met and allowed to enter the house, fed and always had conditions for recreation.

Children took an active part in entertaining guests, that developed responsibility, attentiveness, responsiveness to parents and guests. The one who does not respect the guest, does not enjoy respect of others. This tradition with deep ancient roots shows a beneficial effect on the upbringing of children.

V.V. Radlov thought it was necessary to live for a long time with the people to know them better, appreciate all their qualities. In his work «From Siberia (the diary pages)» he noted an important detail in the nature of the Altaians, it was mutual aid and assistance. On this occasion, he wrote: «Give Kalmyk what you want, and he instantly shares it with everyone who is in a yurt. But if anyone needs a piece of bread or sugar, he will split it into as small number of pieces as would be enough for everybody» [8].

The Altaians are noted for mutual assistance and reciprocity, and also honesty and directness. «No other nation has the same honesty and frankness as the Altaians have» [8].

This characteristic features of the traditional Altaian culture shows that the spiritual culture is still on a high level. V.V. Radlov tried to convince missionaries that baptized Altaians should preserve their distinctive character instead of Foundation of Russian schools, because only baptized Altaians could influence unbaptized relatives.

G.N. Potanin began his collection work after V.V. Radlov. He collected and studied Kazakh, Mongolian, Altai tales, legends which were partially published in the book «Essays about the North-West Mongolia». G.N. Potanin devoted many years to the studies of spiritual and material culture of the Asian East, the study lit by the light of the broad idea [8].

Scientist G.N. Potanin showed a vivid interest in folk art of the Altaians. He publishes well-known Altai legends «Caraty kaan», «Iren'-Shain-Chichirge «Demichi-Eren», the famous epos «Altai-Buuchay» and others. It is represented in oral stories, cosmogonic myths and legends about the universe, stars, animals, birds, myths about the origin of the names of mountains, rivers, lakes, valleys.

S.P. Shvetsov's works about Altaians are of great importance, he was the head of the

statistical, economic expedition, organized in 1897 by the administration of Altai mining district. In «the usual legal views of the Altaians (the Kalmyks) and the Kirghiz. Marital and family relations», materials related to the Altaians who preserved the traditional way of life was summarized. Much attention is paid to the customary law related to marriage and wedding: the right of girls for dowry, the role of relatives in solving the issue of marriage and the reasons of occurrence of the custom of avoidance. Woman in the family was a labor force to care for a large number of livestock. S.P. Shvetsov describes «a look at a woman as a work force, necessary in the household, and as a creature, which can give birth to a child and raise a child» [10].

The development of ethnographic science in Russia aroused an interest to customs and ceremonies, public and family life of different peoples. In this sense, the end of XIX century passed the baton to the developing modern ethnography. One of the substantive work of that time is the collection of epic tales prepared by N.YA. Nikiforov. Notes on the family life of the Altaians readers can meet in A.V. Andrianov's works. He is one of the first to pay attention to the independence of Altai women in making decision concerning some household affairs [11].

Homely atmosphere in which a child is growing up is very important. It is typical for an Altai family relations typical to avoid conflicts and to be tolerant towards each other. A.V. Anokhin points out the cause of such relations: «every husband feels and realizes on whose shoulders rests all material well-being at home, so every Altaian treats his wife with excellent attention and always answers with affection or complete silence when wife is in a bad mood. Rudeness between husband and wife is a rare thing in Altai families, probably because men always prevent any misunderstanding between husband and wife» [9]. Such nature of relations, in our opinion, is projected onto the attitude to children. Parents oppose all kinds of aggression, physical and verbal, which damage good relations between people. The Altai Proverbs teach in the following way: «When a stone is thrown at you, you throe butter in return» [12].

Folk culture, transmitted to the child in the family, gave him spiritual integration in the local society, the proper mentality, static socio-ethnically fixed identity. Family laid the basic pattern of behaviour which was then carried on the relations outside the family. The dominant principle of this model is the education for respect for elders, inclusion of

the children to the world of social relations, work, understanding of traditional life, with its customs and traditions, the whole picture of the world goes through family contacts. Interest in family, its educational role is due to the fact that it has a major impact on the consciousness, and the formation of personal qualities from birth until the moment when a man becomes a full part of the society.

Thus, the problems related to the education of the younger generation, never lost and will never lose its relevance. Altai folk pedagogics deserves close attention, in-depth study for the creative use of the modern practice of education.

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*Materials of Conferences***PROBLEMS OF INNOVATION  
DEVELOPMENT OF THE RUSSIAN  
FAR-EAST**

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The current tendencies in the global economy are important orienting point for formation of the regional policy in Russia. And in doing so consideration of the area factor for development of every region is an important condition of adequacy of the current changes to economic environment and to promotion of the effective territory development.

From these positions the organization in the Far East of innovation from the raw-material model, existing in the region for many years, to the model based on hi-tech industries is one the most important conditions for development of cooperation with the Asia-Pacific countries and precondition of effective use of the resources concentrated in Asia-Pacific Region for solution of internal economic tasks.

Nowadays the Far East of Russia belongs to the regions having extremely low impact on the development of modern technological processes and innovative structures. This lag is characterized by a number of factors.

First of all, innovative activity of the enterprises, industrial organizations and service sphere, existing in the Far East, is extremely weak. It was the lowest one in the country and accounted for 6–7,1% in 2001–2004 (for comparison – the average Russian level of innovative activity in this period accounted for 8,5–9,6%).

Second, the Far-East projects don't attract the interest of investments funds as well. According to the estimation of the Russian Private Equity and Venture Capital Association, out of the total sum of direct and venture investments, done by the specialized funds in Russia, in 2005 the Far-East Federal District received 1,1%, in 2006 – 0,8%. In terms of money these investments accounted for only several million dollars.

It is significant that this happens in the context of rapid growth of innovation-oriented investments in the economic vis-à-vis of Russia in the North-Eastern Asia. They were developing their innovative potential in this period by the accelerated pace. So the total venture capital investments in China (including Hong Kong), Japan and Republic of Korea in 2005 accounted for about 85 billion US dollars.

The existing vital differences in the innovative processes' arrangement in the Far-East of Russia and in the countries of the North-Eastern Asia result in

the catastrophic decline of the non-primary products' export from the region. If in the beginning of the 1990s the share of machines, equipment and transport means, exported from the Far-East, was more than 34%, then in 2006–2007 it didn't exceed 3%.

Much anxiety is caused not only by the current innovative processes in the region, but by their development in the foreseeable future. At the present time the requirements of the innovative activity development are to a small extent met in the program documents, governing prospective development of the Russian Far-East. Having backbone character for economic system of the region, the Federal Special-Purpose Program «Economic and Social Development of the Far-East and Trans-Baikal Area» has a clearly-marked infrastructural character. Allocation of the investments, envisaged by the document, shows that the system shifts in the structure of production in the region are not expected. For example, 58% of the investments will be directed to the development of the transport complex (there are also plans for reconstruction of 22 airports and 13 seaports, construction and improvement of 6,5 thousand kilometers of roads), 23,3% – for development of power-supply, 8% – for housing and public utilities, 6,7% – for social sphere. Development of innovative production is in fact not envisaged by the program. Sure, one can explain such setting of priorities by provision of necessary conditions for the next modernization of production system, but for this period of time the lag behind the neighboring countries will increase and, considering today's rates of innovations implementation in Asia-Pacific economies, will probably become irreversible.

It is obvious that the required a fundamental changes in the government's attitude to the hi-tech production formation, including information-communicational technologies, in the Far-East of Russia. Nowadays it is necessary to accelerate the processes of development and implementation of the programs, targeted to modernization of the regional economy. This approach is first of all conditioned by the full, legal and constructive consideration on the changes taking place in the economic systems of the Asia-Pacific. Underestimation of the current shifts can cause a negative impact on the Russia's integration in the global markets, exploration of advantages of international specialization of labor for solution of tasks of prospective social and economic development.

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### THEORETICAL BASIS FOR THE FORMATION OF STUDENTS' PROFESSIONAL AND VALUE AIMS

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Last several decades there is a decline of the specialists' professionalism in Russia. Mostly it is connected with political, social and economic changes in the society where the reconsideration of the basic values accepted previously by social consciousness took place. The analysis of the modern work practice shows that the big amount of cases of the incompetence are observed in different spheres because of the lack of an essential attention to formation of necessary professional value aims.

According to D.N. Uznadzeaimis determined as a whole dynamic state of the subject, the state of readiness to perceive future events and to make actions that are caused by subject's need and appropriate objective situation. So, «readiness» is understood as a base of selective subject's activity, an ability to integrate quickly and effectively into the situations [1]. According to A.G. Asmolov, who is a representative of the activity approach, aimis «subject's readiness and propensity that occurs in the process of the anticipation of some definite object and provides a stable and purposeful nature of the activity in relation to the object» [2].

The notion of value is important for understanding the concept of professional and value aims. In most studies value is identified with the importance, it is regarded as an object or phenomenon that is significant for people, and it has useful properties, i.e. it is associated with the ability to satisfy people's needs. Value is represented as an ideal, aspiration, purpose, meaning, it implies cognitive, spiritual and practical subject's relation to the object, to the evaluation of the object compared with the ideal [3]. It is determined by the aims which prescribe human behavior and include norms, standards and models, the thing on which the subject orients in its cognitive and practical activity. And in this case it determines the direction of person's activity, expresses the orientation on social self-actualization of the man.

Taking into the consideration these notions, we can understand the professional value aim as a whole dynamic state of the subject of the professional activity determined by his readiness for realization of his professional activity with the orientation on significant characteristics of the activity which define its effectiveness, an ideal, standards and models in professional behavior.

Student's formation of the professional value aim, in the process of his learning, based on the notion of its component structure. We have proved the four components structure of the professional value aim: cognitive component-the human's idea about the meaning of the professional value aims; motivational component – his motivation to the realization of professional value aims in the professional activity; emotional component-his positive attitude to the professional

value aims; functional component – the presence of professional capacities allowing to regulate the professional behavior based on the value base.

The allocation of the functional component as a fundamental in the professional value aim was based on the idea about the competence as: a «switched on» self-realized capacity to the practical activity, to the solving of the problems which is based on acquired knowledge, abilities, skills of the student, his learning and life experience, values and interests, which he has developed as a result of the cognitive activity and educational practice (A.V. Barannikov); integrate quality of the person, which includes the constellation of cumulative knowledge, abilities and experience allowing it to integrate into some certain sphere in the role of successful subject of the certain activity (N.V. Kuzmina, V.M. Shepel).

At the same time the competences are considered as: normative demand to the educational preparation, the realization of which must guarantee his competence in certain activity. Taking into account the functional character of the competence its 'nucleus' is ability (A.V. Barannikov, V.A. Ermolenko, A.F. Zeer, I.A. Zimnya, A.M. Novikov).

The modeling of the system of the competences, which are learnt by students, connected with the basis of the abilities that guarantee their readiness to the professional activity with the orientation on the input professional value aims. The connection of the professional value aims with the competences is based on the functional approach realized according to the psycho-pedagogical ideas: about the «washing out» principle of the consciousness circle which implies that the consciousness has to be developed in the activity (A.N. Leontiev); about the activity, that determines the development of the motivations and human's values, determining the common aim of the vital activity; about the motivation as a source of the activity that has a function of motivation and gumming; about the values that not only operate the actions, but serve as aims themselves or play the role of the meanings of the human life (I. Kant); about the kinds of the activities that influence on the rules of the human's mental development, i.e. his consciousness; about the personal sense as one of the characteristics of the consciousness and its value in the development of motivation to the activity (A.N. Leontiev); about the sense as an expressive attitude of the activity motive to the direct action aim and changing of the action sense with changing of its motive (L.M. Fridman).

Hence determining, in its constellation, the aims of the learning the professional value aims specify the component staff of the competences (which are presented as abilities), providing their formation.

On the base of the systematic, functional, competence approaches we offered the technology of creation of the pedagogical assurance of the students' professional value aims formation which includes the following stages: analytical – the exposure of the professional activity structure; purposeful – basis in the context of each kind of activity of the professional value aims as the aims of learning; simulated – the modeling of the professional competences, the constellation of which determines the readiness of the

specialist for the realization of the professional activity with the orientation on determined professional value aims; projecting–projection according to these competences of the content, methods and forms of teaching, determination of the principles of teaching organization; organizational – determination according to the principals of teaching organization of the content of the teacher’s activity at different stages of the teaching process; reflectively-evaluative-evaluation of the effectiveness of the pedagogical assurance creation with the aid of tracing of the students’ professional value aims readiness on the base of certain criteria and indices; correctional –correction of the pedagogical assurance.

The basis of professional value aims is realized according to independent kinds of professional activity. At the same time different ideas of its system can be used: some scientists place emphasis on the selection of certain kinds of behavior and people’s experience (I.A. Surina), the other think the emphasis of the environment on them is priority (V.M. Ivanova), and some others believe that values are determined not just in the inductive generalization experience process, but by means of the initial comprehension of idealized objects used as means of their construction, then comes their experienced checkup and transformation into a real value (U.S. Vildanov, H.S. Vildanov, F.S. Faizullin).

The system of competences which responses to the based professional value aims determines the demands to the results of specialists’ preparation and serves as a base for projecting of the education content and teaching methods, definitions of the principles of educational organization.

On the one hand it is based on the position of the competence approach which consists in that the constellation of competences determines the content of education (A.V.Barannikov). On the other hand during the selection of teaching methods we take into the consideration I.V.Zimnya and A.A. Verbitskii’s points of view, that all the competences are social: according to the way of formation in cooperation of teachers and students; according to the content because they show the essence of cooperative practical people’s activity; according to the way of functioning in society. It demands projecting, organization and realization mainly the cooperative subjects’ activity of the educational process, in which in one stream of activeness the adjusted teaching and pedagogical aims are reached. According to the principles of teaching organization the content of teacher’s activity is built at the different stages of education: projective, technical and reflective.

As long as the result of teaching is readiness of certain professional value aims which a student has to have, the evaluation of the effectiveness of created pedagogical assurance is made on the base of dynamics determined basically on corresponding to the components of professional value aim: cognitive-shows the fullness of ideas about the specificity of professional activity and the role of professional value aims in it; emotional-evaluates the students’ attitude to the professional value aims; motivational-shows the activity orientation of personality, charac-

terizes the stability of motive system to the realization of professional value aims in its professional activity;functional – evaluates the level of students’ competences which response to the certain professional value aims in the situations of professional teaching and designed professional activity.

As a result we determine three levels of criteria realization according to the character of their manifestation in the situations of professional teaching and professional activity:

1. Low level which is characterized by: low student’s competence about the professional value aims as a state of readiness for effective professional activity, inability to explain their influence on the success of different kinds of professional activity (cognitive criterion); his neutral attitude to the professional value aims (emotional criterion);unstable motivation system of implementation of the professional activity according to the professional value aims (motivational criterion); his rare demonstration of the competences corresponding to the professional value aims in the teaching and professional situations of professional teaching and activity (functional criterion).

2. Middle level which is characterized by: partial student’s competence about the professional value aims as a state of readiness for effective professional activity, an ability to explain the influence of some professional value aims on the success of different kinds of professional activity (cognitive criterion); positive student’s attitude to some professional value aims (emotional criterion); partially stable motivation system of implementation of the professional activity according to the professional value aims (motivational criterion); his partial demonstration of the competences corresponding to the professional value aims in the teaching and professional situations of professional teaching and activity (functional criterion).

3. High level which is characterized by: the full student’s competence about the professional value aims as a state of readiness for effective professional activity, an ability to explain the influence of professional value aims on the success of different kinds of professional activity (cognitive criterion); positive student’s attitude to the well-founded professional value aims (emotional criterion); stable motivation system of implementation of the professional activity according to the professional value aims (motivational criterion); his stable demonstration of the competences corresponding to the professional value aims in the teaching and professional situations of professional teaching and activity (functional criterion).

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## Materials of Conferences

## FREQUENCY ELECTRIC DRIVE

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In the described electric drive three-phase motor of alternative current  $M$  (Fig. 1) that can be anisochronous or synchronous, feeds from an auton-

omous inverter that is plugged into the main through a matching transformer  $T$  (depending on parameters of electric drive, plugging into the main through current-limiting reactors is possible).

Bridge thyristor rectifier  $VD_1$ , identical thyristor inverter  $WD_4$ , and an artificial commutation condenser facility  $C_c$  is included into the composition of the autonomous inverter.

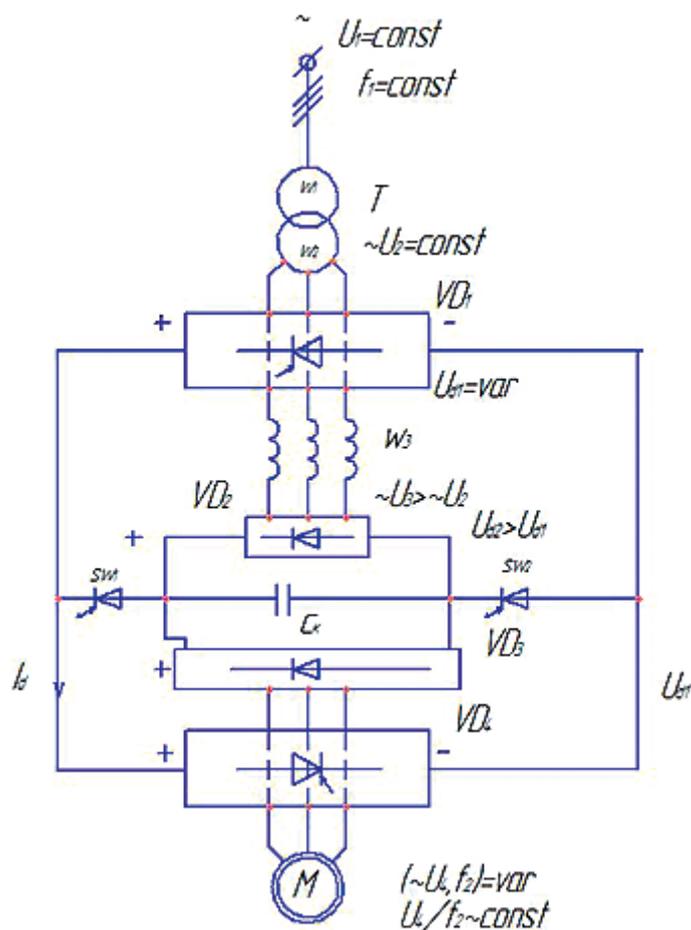


Fig. 1. Power scheme of frequency electric drive

The artificial commutation facility contains a diode bridge  $VD_2$ , and commutation condenser  $C_c$  is attached parallel to its direct current outputs, and corresponding keys of the condenser  $C_c$  are linked to the outputs of the inverter feed. As in well-known transistor invertors, reverse diode bridge  $VD_3$  serves to limit overpower and energy exchange between condenser  $C_c$  and motor  $M$ . Input of alternative current of diode bridge  $VD_2$  is plugged into volt-adding winding  $W_3$  of transformer  $T$  that is corresponding-

ly-logically to secondary winding  $W_2$  of the mentioned transformer.

The design functions as follows: Let keys  $SW_1$  and  $SW_2$  close at a moment  $\omega t_1$  (Fig. 2). Then, loading current  $I_d$  from any operative pair of transistors of bridge  $VD_1$  transfers into a corresponding pair of diodes of bridge  $VD_2$  under the impact of volt-adding winding  $W_3$ , and then into inverter  $VD_4$  through the mentioned closed keys (there a corresponding pair of transistors of inverter  $VD_4$  is opened simul-

taneously with the keys). Bridge  $VD_1$  deenergizes almost instantly and feed of motor  $M$  is delivered from condenser  $C_c$  and bridge  $VD_2$ . By the moment of  $\omega t_2$  (Fig. 2), in other words, in void time interval  $t_1-t_2$  that is necessary for deenergizing thyristors of bridge  $VD_1$ , commences a «discharge» of electromagnetic energy that has been accumulated in phases of motor  $M$  and inductances of dispersion of transformer  $T$ . By the moment  $\omega t_3$  (Fig. 2), current in phases of transformer  $T$  and inverter  $VD_4$  decreases down to zero.

The first stage of commutation is finished. Further, at the moment  $\omega t_3$ , unlocking impulses for the corresponding thyristors of rectifier  $VD_1$  and inverter  $VD_4$  are supplied from the control system (not displayed in Fig. 1). From the moment  $\omega t_3$  to  $\omega t_4$  current in the corresponding phases of transformer  $T$  and motor  $M$  increases to a value that preceded  $\omega t_1$ , and the process restarts in intervals that are defined by a given frequency  $f_2$  and, correspondingly, frequency of keys  $SW_1$  and  $SW_2$  response.

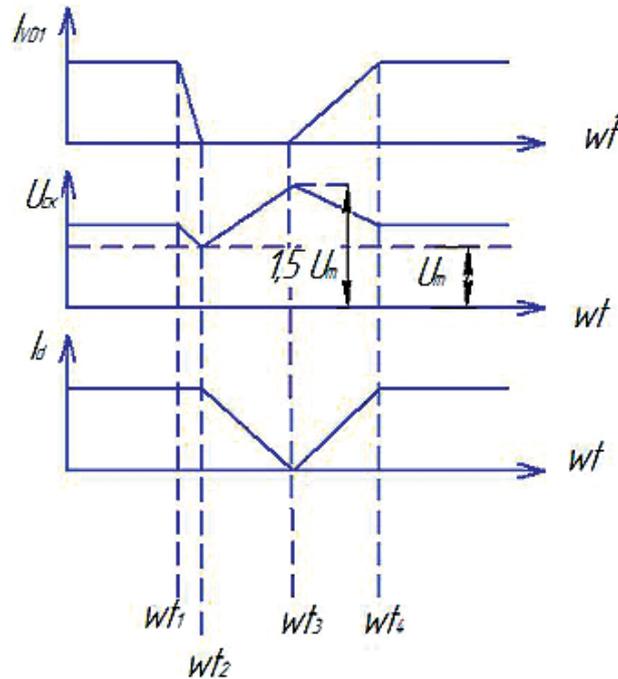


Fig. 2. Simplified diagrams of currents and voltage under  $f_2 = f_1$ ;  $I_{VD1}$  is current in trysistors of rectifier  $VD_1$ ;  $U_{C_c}$  is voltage on condenser  $C_c$ ;  $I_d$  is current at the input of the inverter

Calculations of capacity of  $C_c$  considering transformer and motor inductances show us that, within the frame of voltage oscillations,  $U_{ck}$  of the commutation condenser (Fig. 2) increases along with an increase of frequency  $f_2$ . Particularly, if  $f_2 \approx 150$  Hz, overpower altitude reaches  $1,5 u_m$  (Fig. 2), where  $U_m$  is an altitude of linear voltage  $U_2$  at ends of volt-adding winding  $W_3$  (voltage of the very winding  $W_3$ ) does not exceed (6–7) V).

**Resume**

1. Frequency-regulated electric drive with three-phase anisochronous or synchronous engine has been described. Engine feed is carried out from an autonomous voltage inverter with an original facility of group commutation that is general for rectifier and inverter.

2. Rectifier and inverter represent identical three-phase bridges on general-industrial thyristors that allows us to remove limitations of electric drive power.

3. Artificial commutation provides for regulation of motor rotation frequency from null to

nominal value under a constant moment, and over nominal – under a constant power, general range of regulation varies from null to triple nominal speed.

4. Facility of artificial commutation that contains two keys at locked transistors, one unipolar condenser, and diode bridge provides for an even commutation throughout the whole mentioned range and free circulation of the reactive power between a feed source, load, and commutation condenser.

5. The developed frequency inverter can be used in electric drives of average and high power as well as for other active-inductive loads that are regulated in voltage and frequency.

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*Materials of Conferences***SOCIOLOGICAL METHODS  
AS THE MEANS OF OBTAINING  
THE COMPLEX EVALUATION  
OF A STUDENT'S QUALITIES**

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The object of pedagogical research – a student's personally – is very complex. There is a necessity to obtain more precise characteristics of the object itself and analyze them. Humanitarian sciences don't explain the facts, but generally interpret them, and it doesn't allow an educator who makes a research to obtain the reliable confirmation expressed in the quantitative indexes. Социологические методы позволяют получить более достоверные данные. Usage of sociological methods helps us to obtain the data of the extent of each student's set of qualities' being expressed, in particular, such important qualities as reflective and creative; it helps the educator to work out individual educational trajectory for each student. Using the method of observation, which is traditional for pedagogy, it is practically impossible to measure the extent of the development of a student's reflective skills. We can say the same about a student's creative potential which is often blocked and difficult to diagnose.

Questioning, one of the methods of sociological research, is used by us for complex evaluation of a student's extent of both creative and reflective skills being expressed. We were using S.A. Mednick's test (test of verbal creativity), A.V. Karpov's questionnaire of the level of reflectivity, Johnson's questionnaire of creativity and H.J. Eysenk's test 'Verbal abilities' in order to achieve this aim.

The reason of studying the extent of the student's expression of reflectivity was the results of the survey of the health care providers about the necessity of reflection and reflexive culture for their professional activity.

In order to confirm the extent of the importance of the reflexive culture's components we have invited 32 experts – the teachers from the clinical departments of Kursk State Medical University and the practical healthcare workers (physicians, dentists and pharmacists). The experts were asked to

point out the components of reflexive culture most important for their professional activity, less important components and those not necessary for healthcare workers.

Taking into account the results of the survey of the experts we have chosen the most important components of reflexive culture: the ability to communicate clearly and competently, the ability to analyze professional knowledge in order to improve it, creative professional thinking, not standardized thinking, the ability to establish and support the contact with an interlocutor, the ability to focus on the irreversibility of professional activities, to take into account the limited time factor.

The components of reflexive culture marked by the specialists as those making maximum influence on its formation were the additional guiding point for working out methodical support of reflective culture's skills' formation.

Reflective and creative approach promoting formation of critical and non-standard professional thinking and inculcated by us in the educational process supposes the determination of both creativity and reflectivity expressed quantitatively. The survey of the level of reflectivity used by us consists of 27 statements, evaluated by the respondents using the scale of 7 points. The extent of reliability of this method reflecting the precision and steadiness of its results corresponds to the demands of psychological testing. Among the first and second year students polled by us only 13% showed the low level of reflectivity, 85% of the respondents displayed the average level of reflectivity and only 2% of the students – the high level of reflectivity.

Methodical support of teaching medical students English with the usage of reflective and creative approach worked out by us is adequate the most students' average level of reflectivity. In its turn, creative process of studying will stimulate the further development of reflectivity and reflective culture of the medical students as its manifestation.

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*Short Reports***OLYMPIAD IN A FOREIGN LANGUAGE  
FOR CADETS OF HIGHER MILITARY  
EDUCATIONAL INSTITUTIONS  
AS A MEANS OF DEVELOPING  
COMMUNICATIVE COMPETENCE**

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The author analyzes the communicative competence in a foreign language as a criterion for evaluating the educational level of university graduates. Olympiad in a foreign language is regarded as a form of control and verification of the level of foreign language communicative competence formation. The author describes the process of preparation for the competition taking into consideration the teaching means, educational technologies as well as methodological forms of educational process organization. The description of the three rounds of the All-Army Olympiad in the English language is presented in the article as well as the criteria for assessing the participants' answers.

With economic globalization and the integration of Russia into the world economy the knowledge of a foreign language has become a key competitive factor for young professionals. The importance of language skills of graduates of institution of higher education is no longer in doubt. This is due to at least two reasons: firstly, a foreign language, as a training course, performs the humanistic function of development of creative and logical qualities of a personality, and secondly, in today's interrelated and interdependent world the knowledge of a language as a means of communication enables to establish business contacts between professionals. Obviously, the formation of communicative competence in a foreign language has become the criterion for evaluating the educational level of university graduates.

One of the most important components of training a highly qualified specialist is to master a foreign language as a tool of professional communication, including skills of professional translation (translation of the authentic literature on specialty): lexical and grammatical knowledge (building of vocabulary and grammar skills) and skills of monologic speech that determine language competence [2]. The aims of a foreign language course in an institution of higher education are defined by the communicative and cognitive needs of the professionals in an appropriate specialization.

The teaching aim is to acquire communicative competence by trainees. The level of communicative competence enables to use a foreign language in professional communication as well as for the

purposes of self-studying at different stages of language training. So there is a need not only for significant updating, but also for controlling the level of formation of foreign language communicative competence of graduates of institution of higher education [1]. Olympiad can be regarded as a form of control and verification of knowledge and skills, but it should be taken into consideration that this contest is not only an independent, objective examination of knowledge, but it is also a competition. Participation in the Olympiad gives cadets the opportunity to adequately assess their level of language knowledge and to stimulate them to further improvement.

In April, 2013 the Baltic Naval Institute as well as 39 other higher military institutions took part in All-Army Olympiad in the English language which was held for the second time. The preparation for the competition was very intensive as a tough deadline had been defined by the organizer. Furthermore, the content of the Olympiad turned out to be extremely diverse and complicated.

While preparing for classes our teachers made efforts to find appropriate teaching materials as well as to reconsider educational technologies. A wide range of teaching means was involved, including the Internet resources, video fragments, authentic periodical press, etc. A large amount of information necessary for assimilation by cadets required using new educational technologies as well as methodological forms of educational process organization. The trainees

Competition in the professional foreign language for cadets of higher military educational institutions included three rounds.

The first round included tasks on writing an essay on a professional military topic and monologic utterances of participants on a given topic. Criteria for assessing writing and oral presentations embraced such parameters as the topic completeness (the text integrity), the introduction, presenting the theme of a composition/speech, a concluding part with conclusions, logical and consistent presentation of ideas, the presence of reasoning elements and expression of one's thoughts, as well as the use of a wide range of lexical, modal means, various tense forms, including those beyond the training program.

The second round included military-cultural study test on issues related to the military and geographical situation of Britain and the USA and their Armed Forces, as well as the solution of military-specific tasks – listening to a speech about the preparation for the combat training task performing, answering the sounded questions and explaining one's position. This task checked not only basic communication skills: reading, listening and speaking, but

also paid considerable attention to proficiency in professional vocabulary and the ability to find and make the right decision quickly. The complexity of the task lied in its subject matters as themes represented different branches of troops, so cadets had to be aware of aspects of all arms of the service. In carrying out this task participants were assessed for reading comprehension (understanding of their role, situation, orders), listening skills (understanding of rank, position of an addressing officer, information on situation changes, the essence of requests), speaking skills (presenting one's own utterances in a foreign language, highlighting the most important information or translating it into a native language and transferring the response of the commander). To fulfill this part of the test cadets were required to have knowledge of basic lexical and grammatical structures in English, the laws of their compatibility and the ability to use them.

The third round «Briefing in a foreign language» was held in a form of defense of a pre-arranged presentation using video and computer technology. Topics were chosen by the cadets in the specified themes. Participants of the third round were to answer the jury and audience questions related to their topic, to debate logically, showing initiative in the case of question misunderstanding. The main criteria of presentation assessment were precise structure (introduction, main part, conclusion), the connection between the components of

the speech, the oral presentation itself (the contestants did not read), absence of mistakes, usage of various grammatical structures and professional vocabulary. Overall, the results of the Olympiad indicated the desire of cadets to acquire communication skills in the field of foreign language communication.

Holding of such competitions has many advantages. Firstly, the Olympiad involves cadets from different higher military educational institutions, and this allows identifying talented cadets among a large number of participants. Secondly, it increases the motivation of cadets for studying foreign languages and stimulates their intellectual and linguistic activity, which, in its turn, intensifies the cogitativity and provides the opportunity for implementing an effective cross-cultural interaction. Thirdly, the event has pedagogic value: the cultural level of cadets increases thereby their imagination and creativity skills develop. And finally, the work carried out in the form of Olympiads has positive psychological impact on the relationship between teachers from different institutions, creates an atmosphere of cooperation and creativity.

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