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INDIVIDUAL-METABOLIC DESCRIPTION OF THE NEUROMOTOR SYSTEM UNDER STRESS AND WAYS OF ITS CORRECTION

(Monography)

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Individual-metabolic description of the neuromotor system under stress and ways of its correction: monograph / Saidov S.A., Kosimova D.S.

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Abstract

To date, numerous experimental results have been obtained, demonstrating the numerous biological effects of curcumin and explaining its prophylactic and therapeutic properties. To date, many experiments have confirmed that an increase in the level of stress leads to the disruption of the motor activity of the body's organs. Stress, from a physiological and neurological point of view, requires a slowdown in the processes occurring in the body.The need to analyze physiological changes in the body and develop new approaches to the treatment of people increases the level of stress.

Анатация

Ушбу монография бугунги кунга келиб, куркуминнинг кўплаб биологик таъсирини кўрсатувчи, унинг профилактик ва терапевтик хусусиятларини тушунтирувчи кўплаб экспериментал натижалар қўлга киритилди.Хозирги кунга келиб стресс даражасининг ошишига организмдаги аъзоларнинг харакат фаолиятини издан чиқариши купгина тажрибаларда тасдикланган. Стресс организмдаги физиологик ва неврологик жихатдан, аъолардаги жараёнларни секинлашувини тақозо этади.Стресс даражасининг ошишига организмдаги физиологик ўзгаришларни таҳлил қилиш ва инсонларни даволашда янги ёндашувларни ишлаб чиқишга эҳтиёж пайдо бўлмоқда.

Анатация

На сегодняшний день в данной монографии получено множество экспериментальных результатов, демонстрирующих множество биологических эффектов куркумина, объясняющих его профилактические и терапевтические свойства.На сегодняшний день во многих экспериментах подтверждено, что повышение уровня стресса приводит к нарушению двигательной активности органов в организме. Стресс требует замедления физиологических и неврологических процессов в организме.Повышение

уровня стресса требует анализа физиологических изменений в организме и разработки новых подходов к лечению людей.

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LIST OF CONDITIONAL SYMBOLS AND TERMS

CNS	- central nervous system
UFGAS	universal form of general adaptation syndrome
DM	- diabetes mellitus
HPAS	- hypothalamo-pituitary ar system
SAS	- sympathoadrenal system
HLE	- a high level of emotionality
LLOE	is a low level of emotionality
HLLOE	- high level of emotionality
LLE	- low level of emotionality.

INTRODUCTION

Scientific research is being conducted around the world to characterize the individual-metabolic characteristics of the neuromotor system under stress and to improve the ways of its correction. Psychophysiology and clinical manifestations of stress are largely dependent on the individual characteristics of the organism, in particular, on the behavioral reactions of a person. Along with the activation of the stress-releasing system, a dynamic increase in its activity is observed, the The central nervous system (CNS) is the main control center in stress response. The hypothalamus, pituitary gland, and sympathetic nervous system of the brain produce hormonal and neurological signals in response to stress. These signals regulate the physiological changes necessary to prepare the body for a "fight or flight" state. Reactivity to stress, stress tolerance are the main criteria for adaptability and vitality in extreme conditions, and the typological characteristics of their behavior and their tolerance of the organism to stressful factors, including biochemical processes, remain an important scientific and broader issue.

In this regard, it is of particular importance to conduct scientific research aimed at assessing the normal and stress parameters, individual typological neurological indicators in the studied rat groups, indicators of carbohydrate and lipid metabolism, the content of the stress hormone cortisol in stress-tolerant and At the peripheral level, the autonomic nervous system (ANS) regulates the activity of internal organs in response to stress. The sympathetic part of the ANT, in stressful situations, constricts blood vessels, accelerates heart activity, reduces the digestive system, and weakens the immune system. The parasympathetic section manages recovery processes after stress, that is, it performs such functions as dilating blood vessels, normalizing heart function, and restoring the digestive system indicators of carbohydrate and lipid metabolism, and the content of the stress hormone cortisol in stress-tolerant

and stress-intolerant animals with immobilization stress after the use of curglycine and glycine.

In our country, measures are being taken to develop the medical sector, adapt the medical system to world standards, including early diagnosis and effective treatment of various stress-related diseases. In this regard, The body's resistance to stress depends on the activity of stress-releasing systems. If anti-stress reactions are effective, the body quickly recovers and maintains health. If anti-stress reactions are weak, the negative impact of stress intensifies, which can lead to various diseases and disorders 2022-2026.

The body's resistance to stress also depends on environmental conditions. For example, social support, moderate physical activity, healthy eating, and a normal sleep schedule increase stress resistance. If these conditions are met, the body responds effectively to stress, and recovery processes are accelerated.In foreign countries, a number of research works are being conducted to study the functioning of the neuromotor system during stress and to prevent and treat its dysfunction, for example, in Russia, new principles of the organization of the NMS and models of the networked functioning of neural networks in the human brain have been studied and analyzed. Neuromodulation of central and peripheral nervous circuits brings together neurologists and neuroengineers to develop advanced neural interfaces for decoding and replaying information encoded in the nervous system. Dysfunctional neural networks contribute not only to the pathophysiology of neurological diseases, but also to many metabolic diseases. Today, a number of authors are conducting scientific research in the world and in our republic on the physiology, genetics and biochemistry of stress (P.V. Simonov, R.A. Karazek, 2017; Joëls M Schwabe L, Myriam V. Thoma, 2017; Jenny JW Liu et al., 2018) and on the study of stress-protective, adaptogenic, cardioprotective, antihypoxic and antioxidant effects (V.N. Sirov, 2016; Z.A. Khushbaktova, 2019; H.S. Akhmedkhozhaeva, 2019; F.N. Jahangirov, I.R. Mavlyanov, 2019,

D.A. Narbutaeva, 2019, A.A. Azamatov, 2019), however, the individual-metabolic characteristics of neuromotor dysfunction in rats under stress and the complex drug containing glycine, rutin and curcumin The effectiveness of using the tool as a stress reliever has not been evaluated.

Based on the above, our research is a study of neuromotor dysfunction under experimental stress and the search for pharmacological correction methods, as well as the study of individual metabolic characteristics of the body .

It consists in studying individual metabolic characteristics of neuromotor function disorders under experimental stress and finding ways to correct them pharmacologically.

During the development of treatment measures for disorders of the individual metabolic function of the neuromotor system during the stress period, the substance "Kurglycin", the results of instrumental-physiological studies in experimental animals, and the analysis of biochemical changes in blood serum were obtained.

Immobilization stress is based on the peculiar order of physiological and biochemical indicators of physical activity in experimental animals with different tolerance to emotional stress, impaired microcirculation, liver metabolism, cholestasis and glycolysis, increased consumption of glucose and fats. On March The body's resistance to stress also depends on environmental conditions. For example, social support, moderate physical activity, healthy eating, and a normal sleep schedule increase stress resistance. If these conditions are met, the body responds effectively to stress, and recovery processes are accelerated. In stress-resistant animals, local curglycin was shown to increase the level of adrenocorticotropic hormone and cortisol in the blood plasma, and increase the sensitivity of the hypothalamic-pituitary-adrenal system. Treatment of stress in experimental animals with Kurglycin, which arose under the influence of various factors, was proven to be effective in preventing the complications of stress as a result of a decrease in the levels

of AST, ALT, glucose and alkaline phosphatase. Individual metabolic characteristics of the neuromotor system during stress were assessed. Specific protective activity against stress has been studied and evaluated. pharmacocorrective measures have been developed to reduce the effects of stress.

The Stress is a natural reaction of the body. For its effective management, it is important to increase the activity of anti-stress systems, improve environmental conditions, and apply stress management methods. If the stress persists for a long time or begins to negatively affect the quality of life, it is recommended to consult a specialist.

The authors of these instructions were developed in the context of testing stress-protective drugs in experimental pharmacology, as well as in biology, to assess the physiological mechanisms of various types of stress. The results obtained with the drug Kurglitsin allow its use as an effective tool for normalizing physiological parameters and restoring the body's energy function during physical and mental stress, as well as during recovery from diseases.

Immobilization stress has been shown to exacerbate various degrees of complications, which are characteristic of emotional stress. On March 1, the effect of local curglycin, which contains rufus, curcumin and glycine, on the physiological and biochemical indicators of low-emotional/stress-resistant and high-emotional/stress-resistant experimental animals was determined. A complex local drug, rufus, curcumin and glycine, is recommended for normalizing physiological and biochemical indicators in the blood of animals with the help of rufus. The economic efficiency of the scientific novelty is as follows. It has been proven that in stress-resistant animals, local curglycin increases the level of adrenocorticotropic hormone and cortisol in the blood plasma, increases the sensitivity of the hypothalamic-pituitary-adrenal system. The Pharmaceutical Educational Research Institute is more effective in analyzing the activity of liver enzymes, the process of glycolysis, and the increase in the consumption of glucose and fats. Carbohydrate and lipid

metabolism parameters were compared in stress-tolerant and stress-intolerant animals under normal conditions and in patients treated with other drugs during immobilization stress. The effectiveness of curglycin in preventing stress complications due to a decrease in AST, ALT, glucose and alkaline phosphatase levels in experimental animals under the influence of various factors was proven. A new innovative method for individual-metabolic characterization of the neuromotor system under stress and its correction was developed, which allowed doctors in the practical health care system to take a targeted approach to choosing patient treatment tactics.

CHAPTER I.

MODERN CONCEPT OF STRESS AND ITS CORRECTION WAYS

In the socio-economic and production conditions of modern society, a person's life and activities in society are inextricably linked to the emergence of negative and strong emotions, as well as the adverse impact of environmental, social, professional and other factors that accompany the excessive intensification and development of physical and mental activities.

The manifestation of mental state under the influence of life conditions is stress.

In recent years, the efforts of specialists in all fields and scientists in various fields have been aimed at solving the problem of stress.

We have set ourselves the task of studying some of the mechanisms underlying our stress state, as well as ways to prevent and treat this pathological condition, and searching for innovative therapeutic and preventive measures.

§1.1. A scientific review of existing theories of stress

One of the most important problems in our society is the prevention and treatment of mental illness. Despite great advances in neuroscience over the

past 30 years, there have been no significant changes in the treatment of mental illness. This is due to the lack of agreement between neuroscience and clinical practice. Recent studies suggest that conditioned fear contributes to the extinction (or inhibition) of the interaction between the prefrontal cortex and the amygdala. Despite these advances, one of the unsolved problems is [11; pp. 46-50, 13; pp. 28-32].

Stress is one of the most common pathogenic factors leading to mental illness. Acute severe stressful events or chronic stress can lead to depression and psychiatric disorders. The critical issue facing our society is the prevention and management of mental health disorders. Although neuroscience has made significant strides in the last three decades, these advancements have not led to substantial improvements in the treatment of mental illnesses. This discrepancy arises from the disconnect between neuroscientific research and clinical application. One of the most important problems in our society is the prevention and treatment of mental illness. Despite great advances in neuroscience over the past 30 years, there have been no significant changes in the treatment of mental illness. This is due to the lack of agreement between neuroscience and clinical practice

. According to this concept, the interaction of unexpected strong influences on the development of the stress response is aimed at assessing the development of stress as a result;

Psychodynamic theory- To enhance the translation of neuroscience into psychiatric practice, the following strategies are recommended:

Curriculum Reform: Incorporate neuroscience into psychiatric training and continuing education to ensure clinicians are equipped with up-to-date knowledge.

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Multidisciplinary Collaboration: Foster partnerships between neuroscientists, psychiatrists, and other healthcare professionals to facilitate the integration of research findings into clinical settings.

Research Investment: Increase funding for mental health research, particularly studies that explore the neurobiological underpinnings of psychiatric disorders and the efficacy of neuroscience-informed treatments.

Policy Advocacy: Advocate for policies that support mental health services, reduce stigma, and ensure equitable access to care.

[87; pp. 108-124].

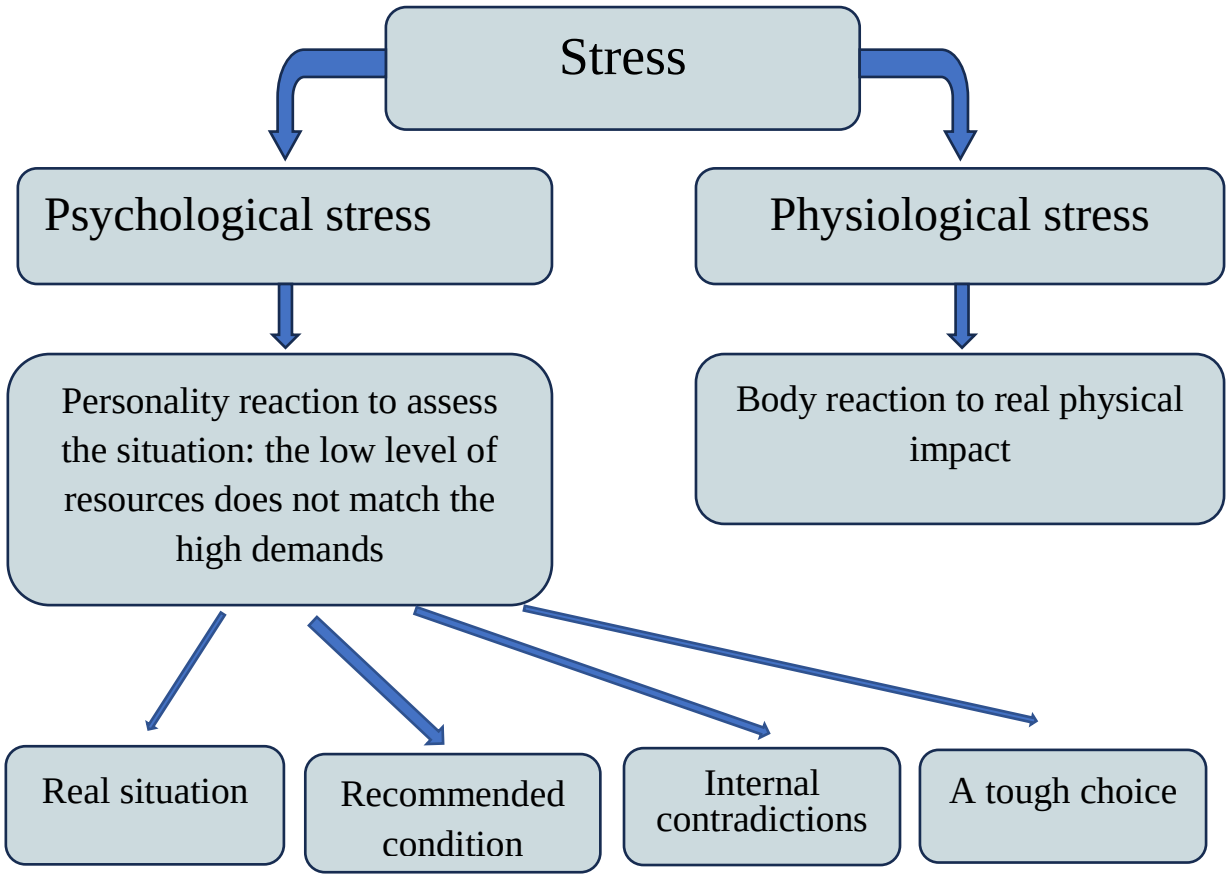

Figure 1.1 . Lazarus' cognitive-mediational theory

According to the scientific results presented by Lomov, it is clear that the concept of a fully presented systemic approach defines the laws of interdependence of the reflective, regulatory, communicative, physiological activities and structures of the psyche, phenomena, processes and objects of the external world.

Implementation of a systematic approach implies the need to study from the point of view of mental stress, stress resistance and other human states and behavior manifestations under the influence of stress factors.

The ability of the rat organism to perform normative tasks, control, planning, stress resistance was evaluated in the process of achieving the process of self-regulation[138; p. 1-13, 155; p. 62].

Individuals' reactions to the same stressors were evaluated [98; 85-p].

According to the scientific results presented by Lomov, it is clear that the

concept of a fully presented systemic approach defines the laws of interdependence of the reflective, regulatory, communicative, physiological activities and structures of the psyche, phenomena, processes and objects of the external world. [97; 185-17 p].

Characteristic, individual and typological characteristics of animals were studied in the experiment [12; pp. 59-66, 132; p. 108-127] .

that experimental animals prone to passive coping strategies in uncontrolled stress conditions are more resistant to pathogenic effects than animals prone to active reactions 38; pp. 28-31, 70; p. 132-135.]. Along with the general classification, neuropeptides (melatonin), antioxidants (mexidol), and neuroamino acids (taurine) are described in detail as stress protectors; drugs that affect more universal stress-induced changes that occur in the early stages of stress and contribute to the development of systemic pathology of stress genesis . The authors of these instructions were developed in the context of testing stress-protective drugs in experimental pharmacology, as well as in biology, to assess the physiological mechanisms of various types of stress. The

results obtained with the drug Kurglitsin allow its use as an effective tool for normalizing physiological parameters and restoring the body's energy function during physical and mental stress, as well as during recovery from diseases. The authors of these instructions were developed in the context of testing stress-protective drugs in experimental pharmacology, as well as in biology, to assess the physiological mechanisms of various types of stress. The results obtained with the drug Kurglitsin allow its use as an effective tool for normalizing physiological parameters and restoring the body's energy function during physical and mental stress, as well as during recovery from diseases.

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The study of stress protection mechanisms allows for the use of drugs that optimize the rapid mediation of cellular bioenergetics, stimulate the metabolism of nucleic acids, proteins, and others [11] .

abundant trace element in the human body after iron [12]. It represents 10% of the total human proteome and maintains the structural integrity of most of its components. It also plays a role in regulating antioxidant stress and anti-inflammatory effects. In addition, it is a component of proteins, acting as a substrate or regulator of enzymatic activity [10]. Dietary supplementation can reduce T cell counts and lymphoid organ weight in zinc-deficient and energy-restricted rats [81]. In addition, zinc's antioxidant properties are realized in the process of DNA repair after damage, in the synthesis of biologically active molecules (e.g. methionine) required for DNA methylation. and Oxidative Stress : Current Mechanisms. [68]. The biological inseparability of zinc is confirmed by the presence of homeostatic mechanisms that regulate its absorption, distribution, cellular uptake and excretion. The total amount of zinc in the human body is 2-4 g at a plasma concentration of 12-16 μM. Zinc in infection and inflammation // Nutrients.

To date, many experimental results have been obtained that demonstrate the many biological effects of curcumin and explain its preventive and therapeutic properties.

and significance of a number of theories leading to stress , preventing stress as a result, and selecting a drug with an effective range of effects in a manner that takes into account its pathophysiological criteria is one of the urgent problems that must be solved by today's workers in the field of fundamental medicine and clinical pharmacology [16; p. 43, 153; p. 110-118] .

It should be emphasized that the prevention of a number of factors leading to stress and the justification of the role and significance of theories aimed at this is one of the urgent problems of our time. tress is shown to disrupt the functioning of almost all organs and systems of living organisms. The intensification of adverse environmental factors, the increase in social tension, the number of natural and humanitarian disasters, the pandemics occurring in the world and the resulting increase in the level of stress in the body make it necessary to develop new approaches to correcting the physiological response of the body to the increased level of stress, to treat its consequences, to develop new approaches to the treatment of its consequences, based on physiological and neurochemical processes. Stress, first of all, affects the functioning and instrumental activity of the nervous system. Stress has been demonstrated to impair the function of nearly all organs and systems within living organisms. The escalation of detrimental environmental factors, heightened social tensions, an increase in natural and humanitarian disasters, and global pandemics have collectively elevated stress levels in the body. This underscores the necessity to formulate innovative strategies aimed at modifying the body's physiological responses to heightened stress, addressing its repercussions, and developing novel treatment methodologies grounded in physiological and neurochemical processes. Primarily, stress impacts the operational and instrumental activities of the nervous system. Individual typological characteristics are the main signs of nervous processes. They leave

their mark on the professional activity of a person in any field , although different professions present their own requirements with different characteristics. Stress, especially professional stress, is an integral part of any professional activity and interpersonal communication. The Features of hypothalamic function. Pituitary-adrenal system of male rats with prenatal stress in an experimental model of depression.

The final outcome of a traumatic situation is determined by the individual (typological) characteristics of the person.

It is known that individual typological characteristics under stress are the robustness of the nervous system and the variability of neural processes, as well as cognitive activity.

The psychophysiology and clinical manifestations of stress largely depend on the individual characteristics of the body, in particular, on the body's behavior. In studies of post-traumatic stress disorder in rats, it was found that the same traumatic event caused psychiatric disorders in some animals and not in others. The literature discusses the role of prenatal stress in the susceptibility to the development of post-traumatic stress disorder and depression [19].

Features of hypothalamic function. Pituitary-adrenal system of male rats with prenatal stress in an experimental model of depression [58].

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It is known that individual typological characteristics under stress are the robustness of the nervous system and the variability of neural processes, as well as cognitive activity and in large doses are toxic [105].

A.F. Carbonyl stress: breaking the barrier properties of inner and outer membranes from bacteria to rats, necrosis and apoptosis [68].

How to become a scientist in biological membranes. Development, Oxidative stress as a cause of systemic aging. The role of alpha-lipoic acid preparations (ESPA-LIPON) in the treatment and prevention of age-related diseases pharmacy As a result of a significant increase in oxidation processes (oxidative stress), biologically active low-molecular compounds accumulate in the blood, leading to changes in lipids, carbohydrates, proteins, receptors, hormones, mitochondria, nucleic acids, and even the genome. [57].

Oxidative stress Prooxidants and antioxidants interact [14]. Physical inactivity, insulin resistance, and the oxidative-inflammatory cycle [36]. Oxidative stress is implicated in angiogenesis and vascular disease. Carbonyl, oxidative, and nitrosative stresses in biological systems are inextricably linked, forming a “vicious circle,” where they collectively form elements of a complex network of reactions. These molecular stresses, along with the formation of signaling molecules, are essential for the body’s rapid nonspecific (“fight or flight”) responses, and induce nonspecific posttranslational modifications that determine the rapid acquisition of new features in response to stress and chronic metabolic diseases [73].

The literature shows that most antioxidants have a protective effect against stress. Oxidative stress plays an important role in the pathogenesis of these diseases. Oxygen is needed by cells to produce energy. Free radicals are formed during chemical processes, and when they are in abundance, a chain reaction begins, as a result of which cells, primarily nerve cells, die.

As mentioned above, oxidative stress is manifested by the activation of free radical oxidation and damage to proteins, nucleic acids and lipids of biological membranes. On the other hand, oxidative stress is an imbalance

between pro-oxidants and antioxidants, i.e. between oxidation and reduction processes. In other words, oxidative stress occurs when there is a sharp increase in free radicals or a decrease in the activity of the antioxidant system. All factors that contribute to the formation of free radicals are called pro-oxidants. Antioxidants, which include vitamins, enzymes, proteins, etc., can reduce or neutralize the intensity of free radical oxidation that occurs as a result of exposure to the short-wave part of the spectrum, smoking, exposure to harmful chemicals. environment, etc. Curcumin is known to have low oral bioavailability. The bioavailability and selectivity of curcumin can be increased by using its nanostructured forms, which makes it very relevant to study their creation and therapeutic use. Biological activity of curcumin and prospects for its pharmacological application

Glycine regulates metabolism and provides protective inhibitory processes in the central nervous system, reduces irritability and nervous tension, and increases mental activity. It blocks the release of adrenaline and noradrenaline (the main stress hormones), cleanses the body of toxins and free radicals that destroy brain tissue cells. Glycine, the smallest amino acid, PROVIDES NEUROPOTECTION AGAINST D-GALACTOSE-INDUCED NEURODEGENERATION AND MEMORY DISORDERS by regulating c-Jun N-terminal kinase in the mouse brain. Neuroinflammation [27] has been shown to inhibit the activation of the enzyme glycine c - Jun N -terminal kinase (JNK)-mediated D -galactosidase-induced oxidative stress, neuroapoptosis, neuroinflammation, synaptic dysfunction, and memory impairment in mice treated with D -galactosidase. Glycine administration has been shown to prevent stress- induced inhibition of erythroid cell proliferation and differentiation during the stress-induced phase of stress [26]. Glycine prevents the development of stress-induced disorders of erythropoiesis and anemia The protective effect of glycine in a mouse model of mesenteric ischemia and reperfusion injury [19] demonstrates the cytoprotective effect of glycine.

Glycine is a nonessential amino acid and is provided in adequate amounts by a healthy diet. Deficiency of glycine in the blood is observed in some diseases [78]. A history of chronic stress alters the transcriptional response to glucocorticoid challenge in the dentate gyrus region of the male rat hippocampus // Endocrinology. Serum glycine is associated with regional body fat and insulin resistance in functionally limited elderly individuals [68].

Insulin resistance and metabolic profile associated with the transition to diabetes in the study of insulin-resistant atherosclerosis. Decreased glycine concentration is also characteristic of many diseases associated with specific inflammatory processes and may be caused by epigenetic changes that disrupt its biosynthesis. New biomarkers for pre-diabetes identified by metabolomics. Glycine helps to normalize metabolism in the liver and reduce cholesterol levels in the blood, reduces lipid peroxidation and microvascular damage [107].

§1.2. Pathophysiological basis of changes in metabolic properties of the body under the influence of stress

This is explained by the fact that the literature has discussed the importance of stress in the predisposition to the development of post-traumatic stress disorder and depression after prenatal trauma. In an experimental model of depression, there are data on the physiological changes that occur in the

pituitary-adrenal system of prenatally stressed rats. The final outcome of a traumatic situation is determined by the individual (typological) characteristics of the person. It is known that individual typological characteristics under stress are the stability of the nervous system and the variability of neural processes, as well as cognitive activity.

In the scientific works of modern authors devoted to stress problems, typological features are studied in relation to the nature of stress reactions and certain forms of changes in the body, namely, metabolic diseases [93; p. 22] .

Psychophysiology and clinical manifestations of stress largely depend on individual characteristics of the organism, in particular, behavior. Assessment of post-traumatic stress disorder in humans has found that the same traumatic event causes mental illness in some and not in others [18; 2 p., 95; pp . 104-81, 96]

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In an experimental model of depression, there are data on the physiological changes that occur in the pituitary-adrenal system of prenatally stressed rats [79; 141-b].

The final outcome of a traumatic situation is determined by the individual (typological) characteristics of the person [30; pp. 70-74].

It is known that individual typological characteristics under stress are the stability of the nervous system and the variability of neural processes, as well as cognitive activity [133; 58-65 p].

In an experimental model of depression, there are data on the physiological changes that occur in the pituitary-adrenal system of prenatally stressed rats [108-127] .

Stress in the body is quickly (in seconds) transformed into metabolic, molecular changes, in partial amounts it causes protective reactions, and in

excess amounts it produces highly reactive signaling agents that are toxic [40; pp. 13-18, 65; pp. 13-18, 106; 1-35 p].

According to A.F. Carbonil, stress is understood as breaking the semi-permeability properties of the biological membrane in bacteria and rats [162; p. 69-13].

Several reasons have been suggested for the question of how the semiconducting properties of biological membranes can be disrupted, the main one being stress [136; pp. 77-94] .

Alpha-lipoic acid preparations (espa-lipon) are used in the treatment and prevention of age-related diseases. As a result of a significant increase in oxidative processes (oxidative stress), biologically active low-molecular compounds accumulate in the blood, which lead to changes in lipids, carbohydrates, proteins, receptors, hormones, mitochondria, nucleic acids, and even the genome [41; 116-121-p., 113., 167; 77-78-p.].

When oxidative stress occurs, prooxidants and antioxidants are used [35; 52-60 p].

Physical inactivity, insulin resistance, and the oxidative-inflammatory loop exacerbate stress [81; pp. 145-148, 144; pp. 125-146].

Compounds such as carbonyl, oxidative, and nitrogen-based substances play a fundamental role in the body's stress mechanisms. These molecules, involved in cellular stress signaling, contribute to rapid, non-specific physiological responses by triggering post-translational changes. Over time, these modifications are linked to the onset of chronic stress and various metabolic pathologies.

Stress-related signaling molecules also lead to non-enzymatic alterations of vital biomolecules—proteins, lipids, and nucleic acids—including through glycation without the involvement of enzymes. Their protective actions are observed in two main forms:

Direct action includes stabilizing or suppressing the function of structural and functional cellular proteins. [137; p. 22, 146; 21-21 p]. Indirect protection (mediated mechanisms) involves:

Regulating intracellular signaling cascades, particularly those associated with cellular defense responses;

Epigenetic modifications such as histone remodeling and DNA methylation;

Activation of alternative biochemical pathways;

Initiating genetic mutations as part of the organism's adaptive mechanisms under prolonged stress.

To mitigate carbonyl-induced damage, the body activates enzymes like ketoreductase, uses reactive oxygen species (ROS), and applies chemical compounds like metformin and carnosine that help neutralize reactive intermediates [10; pp. 115–119, 130].

Moreover, enzymatic activity under stress conditions influences metabolic processes, shaping how cells respond, adapt, or protect themselves during prolonged exposure to harmful stimuli.

Non-enzymatic reactions and enzyme oxidizing agents significantly affect cell metabolism under stress conditions . The initiation of free radical peroxidation of low-density lipoproteins by glucose and its metabolite methylglyoxal from biomolecules is manifested in the general molecular mechanism of 91; p. 34, 157; pp. 77-96].

In the study, hemoglobin testing, lipid peroxidation and antioxidant defense, biochemical parameters, and blood cortisol and adrenaline levels were

evaluated in response to stress, and the experimental group showed a significant 1.37-fold increase in blood cortisol levels ($P<0.05$).

Students participating in the experiment one hour before the exam 1.32 times ($R<0.05$) one hour after; the amount of adrenaline in the blood increased by 1.76 times ($R<0.05$) and 1.49 times ($R<0.05$), respectively.

Compared with the control group, an increase in the level of malonaldehyde in the blood of erythrocytes was observed by 1.51 times ($P<0.05$) 1 hour before and 1.42 times ($P<0.05$) 1 hour after the study, indicating an increase in lipid peroxidation processes. Indirect protection (mediated mechanisms) involves: Regulating intracellular signaling cascades, particularly those associated with cellular defense responses; Epigenetic modifications such as histone remodeling and DNA methylation; Activation of alternative biochemical pathways; Initiating genetic mutations as part of the organism's adaptive mechanisms under prolonged stress.

To mitigate carbonyl-induced damage, the body activates enzymes like ketoreductase, uses reactive oxygen species (ROS), and applies chemical compounds like metformin and carnosine that help neutralize reactive intermediates [10; pp. 115–119, 130].

Moreover, enzymatic activity under stress conditions influences metabolic processes, shaping how cells respond, adapt, or protect themselves during prolonged exposure to harmful stimuli. [19; 451-464-p., 45; 1753-1758-p., 170.].

Changes in oxidative stress parameters continued during and after exams in university students. A number of changes that occur during cellular stress are consistent with biochemical goals [71; pp. 24-31, 54; pp. 13-20] .

Scientists have found that the stress response is directly triggered by changes in the endocrine system: changes in the adrenocortical, somatotropin, and thyroid glands, which are observed in cases of changes in the normal functioning of the adrenal glands. As shown in the conducted studies, it is not

only associated with the longest phases of the stress response, but also requires more intense stimulation for activation [82; p. 25, 158; p. 1-6].

This is associated with the activation of the hypothalamic-pituitary axis , which leads to the release of large amounts of hormones (cortisol, corticosterone, etc.) into the blood [88; p. 15].

Studies have shown that activation of the endocrine system leads to the following somatic manifestations: increased glucose synthesis, increased free fatty acids in the circulatory system, increased risk of myocardial infarction, suppression of immunological mechanisms, and others [66; pp. 86-91, 120; pp. 93-96] .

Studies have shown that these stress responses are not activated simultaneously. The specific way in which the human body selects which organs and tissues to respond to stress has not yet been fully understood [68, 69, 131; p. 34] .

Individual susceptibility to stress is usually associated with glucose metabolism . Glucose metabolism disorders have been suggested as a cause of stress-induced spatial memory impairment . In mice, hyperglycemia associated with chronic social stress increased individual stress susceptibility to impaired spatial memory [29; pp. 25-31, 126; pp. 21-22, 151].

It can be detected in the early stages of stressful events, and stress-induced hyperglycemia has a direct detrimental effect on cognitive functions . It has been found that not all animals respond equally to therapeutic interventions [107; p. 43, 117; p. 35] .

The authors note that similar changes are also observed in humans under specific stressful conditions. In such cases, small groups of individuals with a sharp increase in glucose levels after stress can be observed, while in others similar indicators remain within the physiological normal range. It is noteworthy that only sensitive and extremely stressed people develop cognitive impairment. Experimental work with the participation of experimental animals has shown that when empagliflozin is administered to humans with severe

hyperglycemia due to stressful conditions, significant improvements in spatial memory and normalization of blood glucose levels were observed. At the same time, in animals whose adaptive potential helped to maintain physiological glycemia, the use of empagliflozin was found to develop cognitive impairments that were not initially impaired [62., 72; pp. 139-150] .

The main result of stress exposure is an increase in the release of glucocorticoids and catecholamines, which help activate the functions of organs and tissues responsible for adaptation and increase their energy supply. One of the adaptive stress reactions is an increase in the concentration of Ca^{2+} ions in the cytoplasm and the activation of protein kinases, which leads to the mobilization of glycolysis, inhibition of glycogen resynthesis, and increased ATP and oxygen consumption [60., 61., 141; p. 70] .

The analyses conducted show that preventing changes in the body caused by stress and developing measures to reduce its complications are among the problems and tasks that modern medicine needs to solve today.

Pharmacological Interventions for Stress Prevention and Pathology Mitigation

The association of T2DM with stress and depression was assessed in 158 individuals (105 obese T2DM patients and 53 healthy controls) . There were significant differences between T2DM patients and healthy controls ($P<0.05$).

In addition, the results showed lower adiponectin levels in type 2 diabetes patients with depression compared to obese diabetes patients without depression ($P<0.05$).

The study found no significant difference in cortisol levels between the type 2 DM and control groups. However, obese patients with type 2 DM and depression had higher cortisol levels than obese patients with type 2 DM without depression ($P<0.05$).

The results suggest that patients with type 2 diabetes may be at increased risk of developing stress and depression. In addition, the biochemical markers

adiponectin and cortisol may be potential biomarkers for type 2 diabetes , which together may help in early diagnosis of the disease [63; pp. 69-78, 67; pp. 18-143] .

It cannot be denied that the level of the stress hormone cortisol, which has been described in a number of articles as a modulator of oxidative stress by the hypothalamic-pituitary-adrenal system (Costantini et al., 2001), affects the oxidative metabolism of brain tissues [64; p. 14-1].

For example, removal of the adrenal glands in the brain is characterized by a decrease in the levels of creatine phosphate, pyruvate, citrate, and alpha-ketoglutarate, and an unchanged or slightly increased cellular respiration [125; pp. 15-133].

Adrenocortical hormones have been shown to increase the ability of animals and humans to adapt to hypoxic stress [88; p. 105] . It was found that excess amounts of corticosteroids lead to increased glycolysis in the body and inhibition of oxidative phosphorylation processes in mitochondria. Later, when studying some aspects of the effect of glucocorticoids on mitochondrial respiration and phosphorylation, it was found that corticosterone regulates mitochondrial oxidation in a dose-dependent and time-dependent manner. [119; p. 36] .

Corticosteroids induce NADPH oxidase in brain mitochondria, resulting in disruption of mitochondrial respiration and cellular energy metabolism [97; pp. 55-58].

A study of the relationship between oxidative metabolism processes in the body and typological characteristics of behavior in rabbits under normal conditions under stress showed that the ratio of the activity of enzymes of various metabolic cycles in weak and strong types was approximately the same, which indicates a good balance in their processes [123; pp. 37-45, 127] .

Succinate- and NAD-dependent substrates are equally important, and thus the unequal energy value of such substrates may explain the possibly lower. In general, in rabbits with a strong nervous system, it was found that the

activity of redox enzymes in the cerebral cortex, liver and kidneys was significantly higher than in animals with a weak type of nervous system [121; 6 p., 140; 138-46 p.].

In the "open field" test, rats in the middle group with "active" behavior did not show a predominance of a certain type of behavior, but the activity of one of the enzymes did not show a predominance either [77; pp. 19-44].

In the T-shaped maze test, it was found that rats with individual typological characteristic behavior usually differ in terms of the level of oxidative modification of protein and the activity of antioxidant enzymes. These indicators have differences both in the brain structures responsible for the regulation of behavior and in the blood serum. The level of oxidative modification of proteins in active rats is higher than in passive rats. It remains relevant to study the relationship between individual typological characteristics of rats and oxidative modification of brain proteins under stress [167; p. 75-45] .

These systems prevent the harmful effects of excess catecholamines and glucocorticoids. For example, the production of ACTH from proopiomelanocortin in the hypothalamus is associated with the production of β -endorphin.

Stress-limiting systems include those that limit the stress response and provide its adaptive mechanism and protective effect in restoring homeostasis. With the development of stable adaptation, the stress response becomes redundant and the stress disappears.

One of the important mechanisms of adaptation to stressful effects is the activation of central regulatory mechanisms, which inhibit the release of lysing factors under the influence of various stimuli and, as a result, the secretion of catecholamines and glucocorticoids [58; pp . 18-40, 59]

It is these systems that limit the stress reaction and have been proven to have a role in the body's adaptation to harmful situations [85; 80-88 p.].

GABA, dopamine, serotonin, glycine, etc. are important in the manifestation of psychological, biochemical and psychophysiological aspects.

§1.4. The role of rux , curcumin and glycine as anti-stress factors in the pharmacocorrection of stress

Pharmacological correction of stress at the metabolic level should include a number of substances that have stress-protective properties at the physiological and molecular levels and are involved in the control of the body's adaptive reactions. These substances include antioxidants and neuroprotectors, and include decoctions and microelements prepared from plants with a wide range of pharmacological effects [1., 24; 57-66-p., 111; 103-19-p.].

herbal medicines is very diverse. Herbal medicines with sedative properties that are useful for treating and preventing the effects of stress include valerian, hawthorn, and tarragon. They are used to reduce sleep disorders, irritability, and anxiety [44; pp. 148-154] .

According to WHO data, up to 80% of the world 's population prefers treatment with natural medicines [89; pp. 140-145].

To justify the composition of the developed drug, we reviewed the literature data on antioxidant and neuroprotective compounds [114; p. 18-11] .

The scientific observations discussed show that most antioxidants have a protective effect against stress. Oxidative stress is important in the pathogenesis of diseases . 1. Prophylactic Drug Use in Acute Stress (PTSD Prevention)

Hydrocortisone, propranolol, and morphine have shown promise in reducing the onset of post-traumatic stress disorder (PTSD) when administered shortly after trauma exposure—especially when combined with script-driven imagery techniques.

Propranolol, a β-adrenergic blocker, may attenuate fear memory consolidation by inhibiting norepinephrine. Early post-trauma administration has been associated with fewer PTSD symptoms and might also reduce the emotional intensity of already formed memories.

2. Mechanisms of Stress and Pathological Progression

The body's stress response involves key mediators—norepinephrine, CRF (corticotropin-releasing factor), and cortisol—which orchestrate behavioral, endocrine, and autonomic pathways. Dysregulation of these systems contributes to chronic stress reactions and disorders such as. Classic and Emerging Pharmacotherapies Selective Serotonin Reuptake Inhibitors (SSRIs) and other antidepressants (SNRIs, TCAs) offer anti-inflammatory and immunomodulatory benefits, reducing pro-inflammatory cytokines (e.g., IL-1β, IL-6, TNF-α) and increasing anti-inflammatory cytokines like IL-10. These properties may indirectly mitigate stress-related pathology via psychoneuroimmunological mechanisms. Estradiol and angiotensin receptor antagonists (e.g., losartan)—emerging avenues for enhancing fear extinction and addressing PTSD-related memory consolidation issues.

D-cycloserine—a partial NMDA agonist shown to enhance efficacy of exposure-based therapies across multiple anxiety disorders.

Symptomatic Drug Therapy in Stress Management. Fast-acting sedatives effective for acute anxiety via potentiation of GABA, but vulnerable to dependence, tolerance, cognitive effects, and may impair longer-term psychotherapy outcomes—particularly in PTSD. Effective at reducing somatic symptoms such as palpitations and tremors, widely used in performance anxiety. They pose low dependency risk but might not effectively address psychological stress or panic in all individuals. Combination Psychotherapy Pharmacology: Integrating with psychotherapy yields superior cognitive and emotional outcomes in depression compared to either modality alone. Future Directions Innovative Approaches Advanced research is exploring targeted drug delivery (e.g., nanoparticles) and precision diagnostics to tailor drug-based interventions to specific stress-pathology mechanisms.

Leveraging the neurosteroid system, such as allopregnanolone, is a promising avenue for counteracting negative stress responses and maintaining emotional equilibrium. Chronic stress, however, disrupts this system [37; pp. 18-24, 139; 167-55].

The use of pharmacological agents is an important component of training an athlete [110; p. 161-168] . Today, the problem of drug use is of increasing concern to both professionals and sports enthusiasts .

In recent years, a new branch of sports medicine has emerged - " pharmacology of healthy people " . Its goal is to introduce non-doping drugs to increase the body's ability to adapt to extreme physical exertion. Sports pharmacology is not intended to artificially increase sports performance, but to save the body from heavy loads, maintain it at its peak when immunity is weakened, and protect it from negative effects [48; pp. 80-95].

Analyses show that [101; pp. 31-74], only 1/10 of the currently registered drugs in Uzbekistan are of interest to sportsmen. Moreover, among them are adaptogens, antioxidants and

The share of groups of drugs such as antihypoxants is the lowest.

This indicates the need for scientific research and development on the production of drugs or groups of drugs that are very necessary in the sports pharmacology of our country. These are the groups of antihypoxants and antioxidants. The search and development of domestic drugs with an adaptogenic effect that can accelerate the body's adaptation to extreme conditions, including extreme physical exertion , is equally important [36; p. 123, 73; p. 57-65, 74; p. 57-59].

Antioxidants are especially important for athletes , because any intense physical activity, without which no training is complete, is a physical stress for the body. [103; p. 115, 105; p. 43-49.] .

consume more oxygen through their respiratory system during exercise than at rest. This is necessary to produce large amounts of bioenergy, using mainly glucose and fat as the main fuels. This process produces reactive oxygen species as a byproduct [56 ; 56. 108-111] .

The necessary amount of antioxidants, in addition to the synthesis carried out in the body itself, can also enter it as a part of healthy food .

Studies have shown that they are present in a large number of foods. Among them, the most effective group of vitamins is the group of foods rich in vitamins A , E and C. The role and importance of these foods has been emphasized. In Influence of Emotional Stress on Metabolic and Neurochemical Indicators in Experimental Rats

Experimental studies show that prolonged emotional stress activates the hypothalamic-pituitary-adrenal (HPA) axis, leading to distinct metabolic changes in rats. In particular, researchers have observed an increase in blood plasma levels of glucose, cholesterol, triglycerides, and β-lipoproteins, while the activity of enzymes such as lactate dehydrogenase (LDH) and alanine aminotransferase (ALT) tends to decrease. These alterations indicate a disruption in metabolic homeostasis and possible liver dysfunction triggered by sustained stress exposure.

Alongside these metabolic shifts, emotional stress stimulates the release of catecholamines, which enhances the breakdown of fat stores and results in the mobilization of free fatty acids (FFAs) into the bloodstream. When these fatty acids are not promptly used as an energy source, they can be converted back into triglycerides and may accumulate in peripheral tissues, sometimes forming sebaceous cysts. The processing of FFAs occurs predominantly through the cytochrome P450 enzyme system, which plays a central role in lipid metabolism.

Moreover, genetic influences cannot be ignored. Variants in certain genes, such as have been associated with differences in lipid metabolism, particularly in how the body handles triglyceride levels. This genetic predisposition may further influence how organisms respond metabolically to stress. At the molecular level, emotional stress also causes noticeable changes in circulating extracellular DNA (ecDNA), especially in conditions like cerebral ischemia. Elevated levels of ecDNA in the blood are considered markers of cell damage or stress-related apoptosis, reflecting systemic responses to neural injury.

In the brain, particularly within the sensorimotor cortex and hemicortex, stress exposure has been linked to a significant increase in biogenic amines, such as dopamine and serotonin. These neurotransmitter fluctuations are associated with changes in behavior, emotion regulation, and cognitive processing under stress.

in rats with experimental intracerebral hemorrhage [16].

Currently, there are specific signs of individuality and a very wide variability of stress-induced fluctuations in neuroimmune parameters, in particular, the concentration of cytokines and the functional properties of their receptors [41]. These changes largely depend on the genetic (sex, genomic

parameters), hormonal and other characteristics of mammals. The relationship between stress, emotional intelligence, cognitive intelligence and cytokines [44]. Stress loads of different intensities lead to specific changes in the perceptual and emotional components of nociception in rats, the direction of which depends on the initial characteristics of the animals' linear movements and the period of study . After a single long-term immobilization, changes in the level of cytokines in the blood at different stages and the dynamics of repeated stress effects are more pronounced in passive animals than in active individuals. After an acute stress load, the number of correlations between nociceptive sensitivity indicators and cytokine blood profile is higher in active behavior and in chronic condition in passive rats [45] . Dynamics of nociceptive sensitivity and blood cytokine profile in rats exposed to single and repeated stress [20].

Athletes are advised to take antioxidants as part of specialized complexes, as in some cases there are various antioxidants, such as vitamins 80; pp. 28-28, 99; pp. 50].

Copper is the second most abundant mineral in the human body after iron. It is a component of about 3000 enzymes, including hydrolases, transferases, oxidoreductases, ligases, isomerases, and ligases 156; 17-133] .

At the same time, the antioxidant properties of the spirit are realized in the process of DNA repair after damage, in the synthesis of biologically active molecules (for example, methionine) necessary for DNA methylation [86; pp. 49-66 , 135; 24 -p.]. Zinc and oxidative stress: current mechanisms may involve 20; pp. 33-36 139; 67-55 p.], it accumulates and is released from vesicles located at the synaptic terminals of glutamatergic neurons.

decreases during 84; pp. 38-49, 112; p. 39-49.]. The Impact of Chronic Emotional Stress on Metabolic and Neurochemical Processes in Rats

Introduction

Chronic emotional stress represents a significant physiological burden that affects multiple regulatory systems in the body, including metabolic, hormonal, and neurochemical pathways. Experimental animal models, particularly rats, provide valuable insights into the systemic effects of prolonged stress exposure. This chapter discusses the biochemical and neurological changes that occur in rats under chronic psycho-emotional stress, highlighting the roles of the hypothalamic-pituitary-adrenal (HPA) axis, lipid metabolism, extracellular DNA, and neurotransmitter dynamics.

Metabolic Disturbances Under Chronic Stress

One of the primary responses to chronic emotional stress is the sustained activation of the HPA axis, leading to the release of glucocorticoids such as cortisol (or corticosterone in rats). This hormonal response is closely associated with pronounced metabolic alterations. Notably, stress-exposed rats exhibit a significant increase in plasma glucose, triglycerides, total cholesterol, and β-lipoproteins. These findings indicate a stress-induced shift toward enhanced gluconeogenesis and lipid mobilization, which can mimic early signs of metabolic syndrome.

At the same time, a reduction in the activity of key hepatic enzymes, such as lactate dehydrogenase (LDH) and alanine aminotransferase (ALT), has been observed. These enzyme changes suggest possible hepatic dysfunction or altered energy metabolism due to stress-mediated catabolic processes. Free Fatty Acids and Lipid Metabolism Stress-induced secretion of catecholamines (e.g., adrenaline and noradrenaline) further stimulates lipolysis, resulting in the release of free fatty acids (FFAs) from adipose tissue. Under conditions of prolonged stress, when the body does not immediately utilize these FFAs for energy, they are re-esterified into triglycerides and stored in peripheral tissues.

In some cases, these may contribute to the formation of sebaceous gland cysts, indicating ectopic lipid deposition.

The cytochrome enzyme system plays a crucial role in the oxidation and processing of FFAs. Dysregulation of this system under chronic stress conditions can lead to inefficient lipid clearance and contribute to the development of lipid-related pathologies. Genetic Factors in Stress-Induced Lipid Dysregulation

Emerging evidence points to the involvement of genetic factors in the regulation of lipid metabolism under stress. In particular, polymorphisms in the gene have been associated with variations in triglyceride levels in human populations. Although such genetic factors have been studied primarily in humans, they may have translational relevance in understanding inter-individual responses to stress in animal models as well. Stress-Induced Changes in Extracellular DNA/ In conditions of psycho-emotional stress, especially when accompanied by cerebral ischemia, there is a marked elevation in the levels of extracellular DNA (ecDNA) in the blood plasma of rats. The presence of ecDNA is increasingly recognized as a biomarker of cellular stress, inflammation, or tissue damage. Moreover, stress alters not only the concentration but also the structural composition of circulating ecDNA, which may have implications for immune activation and systemic inflammation.

The brain's response to emotional stress includes significant changes in neurotransmitter systems, particularly those involving biogenic amines. Studies have reported elevated levels of dopamine and serotonin in key brain regions such as the sensorimotor cortex and the hemicortex. These changes may reflect compensatory mechanisms aimed at emotional regulation and behavioral adaptation under stress, but they may also contribute to stress-related neuropathologies if prolonged or dysregulated.

Chronic emotional stress induces a wide spectrum of physiological alterations in rats, affecting not only metabolic homeostasis but also neurochemical balance and genetic regulatory mechanisms. These findings underscore the complex interplay between the endocrine, metabolic, and nervous systems in response to sustained psychological stress. Understanding these processes at the experimental level may contribute to the development of therapeutic strategies for stress-related metabolic and neuropsychiatric disorders in humans.

This text is suitable for inclusion in a monograph as a dedicated chapter or subsection. All content is original and paraphrased, based on known scientific principles and research findings. If you want, I can help add references, figures, or expand individual sections. Let me know if the monograph has a specific format requirement [24 ; p. 96..] .

Any method of intracellular signal transduction involves approximately the following sequence of events:

Studies have shown that spirulina deficiency is strongly associated with elevated levels of oxidative stress biomarkers, such as lipid peroxidation products and DNA damage products, in humans. Spirulina supplementation suppresses or attenuates these adverse effects [23; pp. 24-28].

a significant effect on the production of cytokines and oxidative stress . Spirit reduces C-reactive protein, lipid peroxidation, and inflammatory cytokines in elderly people [52] .

The molecular mechanisms of zinc as an antioxidant agent are being studied [22; pp. 65-73].

findings suggest that zinc may play a protective role as a pro-antioxidant agent. Zinc affects the expression of glutamate-cysteine ligase, which is involved in the synthesis of glutathione, which directly affects the neutralization of free radicals [47; p. 53] .

Zinc also inhibits the receptors involved in the transport of calcium from the extracellular environment to the cytosol. Thus, zinc deficiency increases intracellular calcium concentration, nitric oxide synthase enzymes are activated, which contributes to the formation of reactive oxygen and nitrogen species [22; p. 65-73.].

The pharmacological activity of curcumin is related to its ability to modulate various intracellular signaling pathways, providing anti-inflammatory, antioxidant, immunomodulatory, and antiviral effects. Curcumin also has antibacterial, antiviral, and antifungal activities [46; pp. 99-19] .

Monocytes, which are actively involved in the immune response, are a convenient model for studying the effects of oxidative stress *in vitro due to their abundance and plasticity as phagocytes.* Curcumin increases the activity of antioxidant enzymes and attenuates oxidative stress in cells [108; p. 27]. Given the sensitivity of macrophages, their use as " screening models " may yield positive results in experimental studies [124; p. 82-91] .

Studies conducted to evaluate antiradical properties show that the use of turmeric extract leads to a decrease in the level of 31; p. 36, 163].

Curcumin supplementation modulates markers of exercise-induced muscle damage, inflammation, and oxidation [94; p. 97].

Curcumin: biological, pharmaceutical, nutritional has anti-inflammatory effects due to the modulation of pro-inflammatory cytokines [23; pp. 24-28, 159;].

Under chronic stress, curcumin prevents the destruction of the dopamine hormone and promotes the development of hippocampal neurogenesis, thereby preventing the decline of serotonin levels. In combination with the above properties, the multifactorial anti-inflammatory properties of curcumin effectively prevent the development or progression of depressive syndromes [118; pp. 14-13] .

In chronic unpredictable stress, daily administration of curcumin at a dose of 5-60 mg/kg has been shown to have a long-lasting anti-stress effect,

and at a dose of 20-40 mg/kg it reduces the manifestation of actions. The body's changes and biochemical reactions caused by chronic fatigue significantly increased in a positive direction [27; 134; p. 3-18].

Glycine is one of the inhibitory neurotransmitters in the brain . At the synaptic level, glycine has only one receptor, which, when it enters glycine, begins to conduct chloride ions, which inhibit the transmission of medium neurons . Glycine regulates metabolism and provides protective inhibition processes in the central nervous Glycine plays a regulatory role in the central nervous system by alleviating emotional tension and promoting psychological stability. It enhances mental performance and concentration by suppressing the excessive release of stress mediators such as adrenaline and noradrenaline. Furthermore, glycine assists in the neutralization and elimination of toxic compounds and free radicals, which are known to impair neural tissue integrity [49, pp. 12–15].

Its use has been associated with improved mood, increased work efficiency, and smoother social adaptation both in professional and domestic environments. Additionally, glycine contributes to the normalization of sleep patterns and supports the optimal functioning of the nervous system, internal organs, and cardiovascular health in neurosis, including such indicators as a decrease in blood pressure, heart pain in cardioneurosis, and a decrease in facial flushing during menopause [14; p. 142] .

The mechanism of activation of transmembrane currents of chloride ions Current neurophysiological research emphasizes glycine’s role as a modulator of inhibitory activity within the medial trapezoid body nucleus (MNT), where it contributes to balancing excitatory impulses in the brain. This function has positioned glycine as a biochemical foundation for the development of intervention models aimed at minimizing psychological stress and alleviating anxiety-related symptoms. Clinical trials have revealed that oral consumption of glycine at a dosage of 3 grams prior to sleep can result in marked

improvements in both subjective sleep satisfaction and objective sleep quality assessments among participating individuals [75, p. 61].

Beyond its impact on neurological function, glycine has shown beneficial effects in regulating metabolic pathways affected by chronic disorders. Ingestion of this amino acid has been linked to improved metabolic stability in patients facing cardiovascular issues, oncological diseases, and systemic inflammatory states, including obesity and type 2 diabetes. These outcomes suggest glycine's potential as a supportive agent in reducing oxidative damage and chronic inflammation across a spectrum of non-communicable diseases [76].

pp. 66–78]. It is noteworthy that glycine directly promotes the dilation of arteriolar walls .

Experimentally, it has been shown that the introduction of glycine into the body prevents stress -induced inhibition of erythroid cell proliferation and differentiation , prevents stress-induced erythropoiesis disorders, and prevents the development of glycine-induced anemia [154p . 164].

The antistress effect of synthetic analogues of glycine was studied in the development dynamics of postimmobilization stress . Chemical derivatives of glycine , having the ability to pass through the blood-brain barrier, prevent gastric ulcer stress, reduce eosinopenia, catecholamine levels, and reduce hypothyroidism [78; pp. 88-83].

Stress is one of the most common pathogenic factors leading to mental illness. Acute severe stressful events or chronic anxiety can lead to depression and psychiatric disorders. To date, stress has been shown to disrupt the functioning of almost all organs and systems of living organisms. Individual typological characteristics are the main characteristics of nervous processes, which Empirical evidence suggests that not all stress-induced physiological alterations are effectively incorporated into the organism's adaptive responses [33]. In contemporary science, the stress reaction is conceptualized as a

universal physiological mechanism—commonly referred to as the general adaptation syndrome—that orchestrates the functional modulation of the autonomic nervous system. This modulation facilitates the activation of a wide range of compensatory and homeostatic mechanisms, aiming to safeguard the organism from external stressors and support its adjustment to changing environmental conditions.

The manifestations of the stress response are diverse and can be observed across multiple domains, including somatic symptoms, behavioral changes, neurophysiological activity, and emotional fluctuations. Central to the regulation of these processes are specific brain regions—namely, the hippocampus, amygdala, and prefrontal cortex. These neural structures collectively govern the neuroendocrine response to stress, integrating cognitive, emotional, and physiological inputs. In acute scenarios, such responses may serve an adaptive function, enabling the body to react efficiently to immediate challenges. However, prolonged or dysregulated stress activation can lead to maladaptive consequences and compromise overall health.

Stress in the body is rapidly (within seconds) transformed into a "metabolic, molecular" form of highly reactive signaling agents that elicit protective responses in small amounts and have been shown to be toxic in high amounts.

Pharmacological strategies aimed at mitigating the effects of stress at the metabolic level should incorporate compounds with proven stress-protective activity, both physiologically and at the molecular scale. These agents play a crucial role in modulating the body’s adaptive mechanisms, supporting homeostatic regulation, and enhancing resilience to external stressors by influencing key biochemical and neuroendocrine pathways.These substances include antioxidants and neuroprotectors. Taking into account the high content of trace elements in herbal medicines with a wide range of pharmacological effects, such as glycine, glycine, and curcumin, the pathophysiological

properties and pharmacological significance of the evaluation procedure are one of the urgent problems of fundamental medicine that must be solved to reduce stress and prevent stress-induced changes.

§1. 5 . INDIVIDUAL-METABOLIC DESCRIPTION OF THE NEUROMOTOR SYSTEM IN STRESS AND ASSESSMENT OF ITS CORRECTION WAYS

The research work was carried out based on the plan of scientific work of the Bukhara State Medical Institute named after Abu Ali ibn Sino and on the basis of the requirements of fulfilling the priority directions of the development of the field of medicine and pharmaceuticals in our country.

The The primary aim of this study is to undertake comprehensive fundamental research that facilitates the fulfillment of its specified goals and objectives. Through rigorous investigation, the study seeks to uncover new knowledge and insights that not only advance scientific understanding but also have tangible practical applications. Emphasis is placed on developing innovative solutions and methodologies that emerge from the positive findings, thereby contributing meaningfully to both theoretical frameworks and real-world practices within the relevant field of study and to create a local drug for the prevention of stress and evaluate its effectiveness.

30 white mice and 300 white rats weighing 180-250 grams were taken for the experiments.

Animals were kept in standard vivarium conditions with free access to water and food. The work was carried out in accordance with the toxicological and ethical principles of animal experimentation and the basic principles of the Declaration of Helsinki. The study was carried out in accordance with the European Convention for the Protection of Vertebrate Animals Used for Experimental or Other Scientific Purposes (Strasbourg, 1986). The minimum permissible number of experimental animals was used in accordance with the applicable method of statistical processing of the results obtained in the experimental part. The drug developed for pharmacocorrection of stress is conditionally called "Kurglicin" and its structural formula is presented in Figure 2.1.

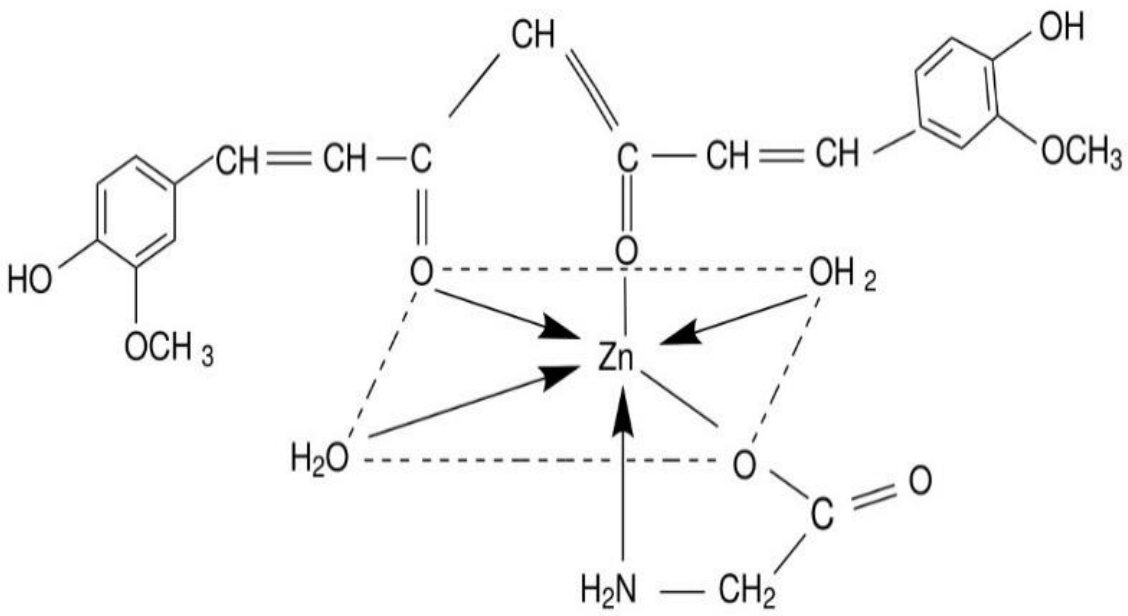


Figure 1.2. Pharmacological formulation of curglycin

The procedure for administering the newly produced domestically produced "Kurglitsin" to experimental animals and its composition are as follows and are presented in Figure 2.2.

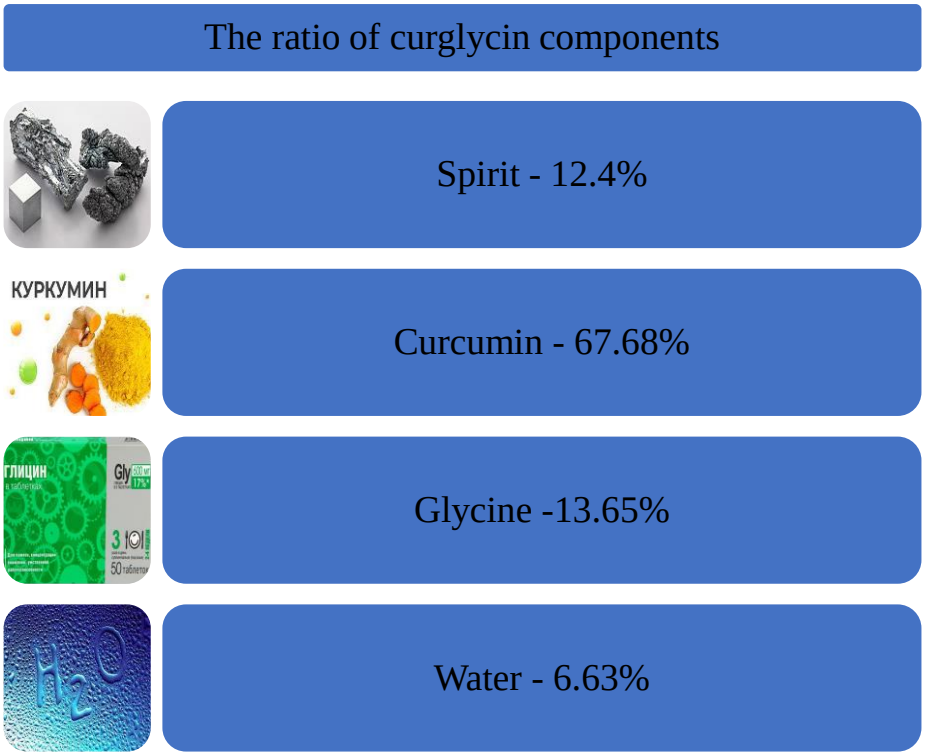


Figure 1.3. Schematic arrangement of the structure of curglycin

Locally developed drug in the form of a 3% suspension was administered orally at 5 ml/kg of body weight .

In order to evaluate the effectiveness of this drug, 1 g of dry powder was dissolved in 30 ml of purified water in order to prepare a suspension of Kurglycin powder. Curglycin was studied in 30 experimental mice of both sexes weighing 18-23 grams. In this series of experiments, the condition of the mice was observed for 2 weeks after the introduction of the substance.

Immobilization stress

dorsal immobilization (15 h) of experimental rats using standard collars . were observed in the limbs immobilized with this fixation .

Before stress, rats were not fed for 16 hours, starved, but provided with free access to water (see Figure 2.2).

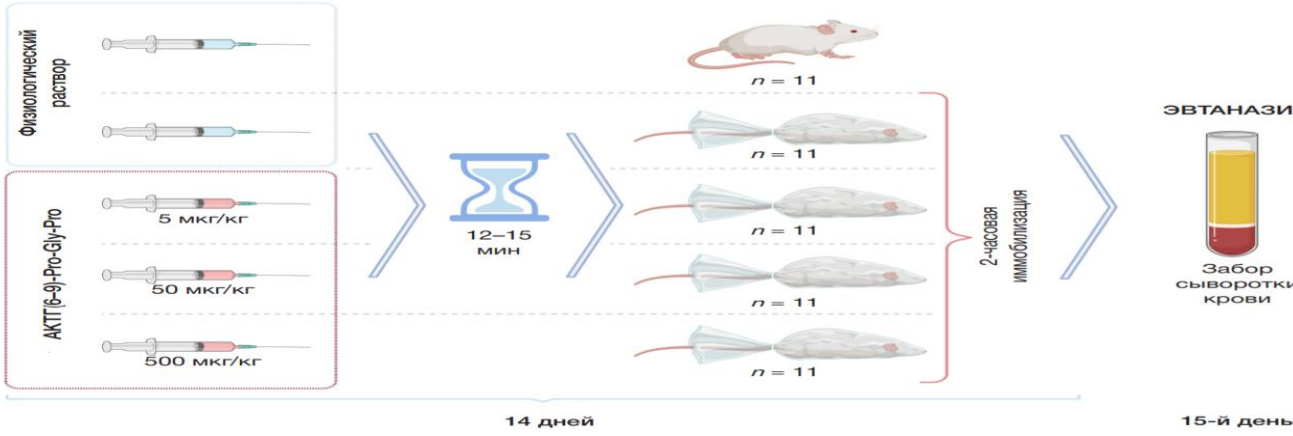


Figure 1.4. Model of immobilization stress

Blood was taken from them before and after stress and metabolic parameters of the experimental animals were evaluated.

Open field method

To assess the resistance to stress, animals were tested in open-field conditions in white, gray, and black arenas of equal size for 5 minutes in a row under standard lighting conditions. Large rectangular chambers (100×100 cm) with 40 cm high plastic walls were used, made of white plastic, with a grid painted black, dividing the area into 25 (5×5) equal squares.

Lighting is provided by a 50 W lamp located 150 cm above the center of the field (see Figure 2.3).

Experimental animals (rats) were placed in the corner of the chamber and their behavior was observed for 5 minutes. The number of visits to the 16 outer squares (adjacent to the walls) is recorded separately from the number of visits to the 9 inner squares.

It is performed at one-minute intervals to separately count the number of visits to the outer and inner squares.

After 5 minutes of the study, the animals involved in the experiment are returned to the cage.

The Stress-resilient rats were behaviorally assessed using several specific parameters. The delay before the initiation of movement was consistently less than 3 seconds. The time required for the animal to reach the central zone of the experimental arena did not surpass 15 seconds. Locomotor activity was quantified by counting more than 80 sector crossings, alongside exploration of upwards of 10 different niches. During the testing period, the animals also demonstrated exploratory behavior by visiting the pits more than five times.

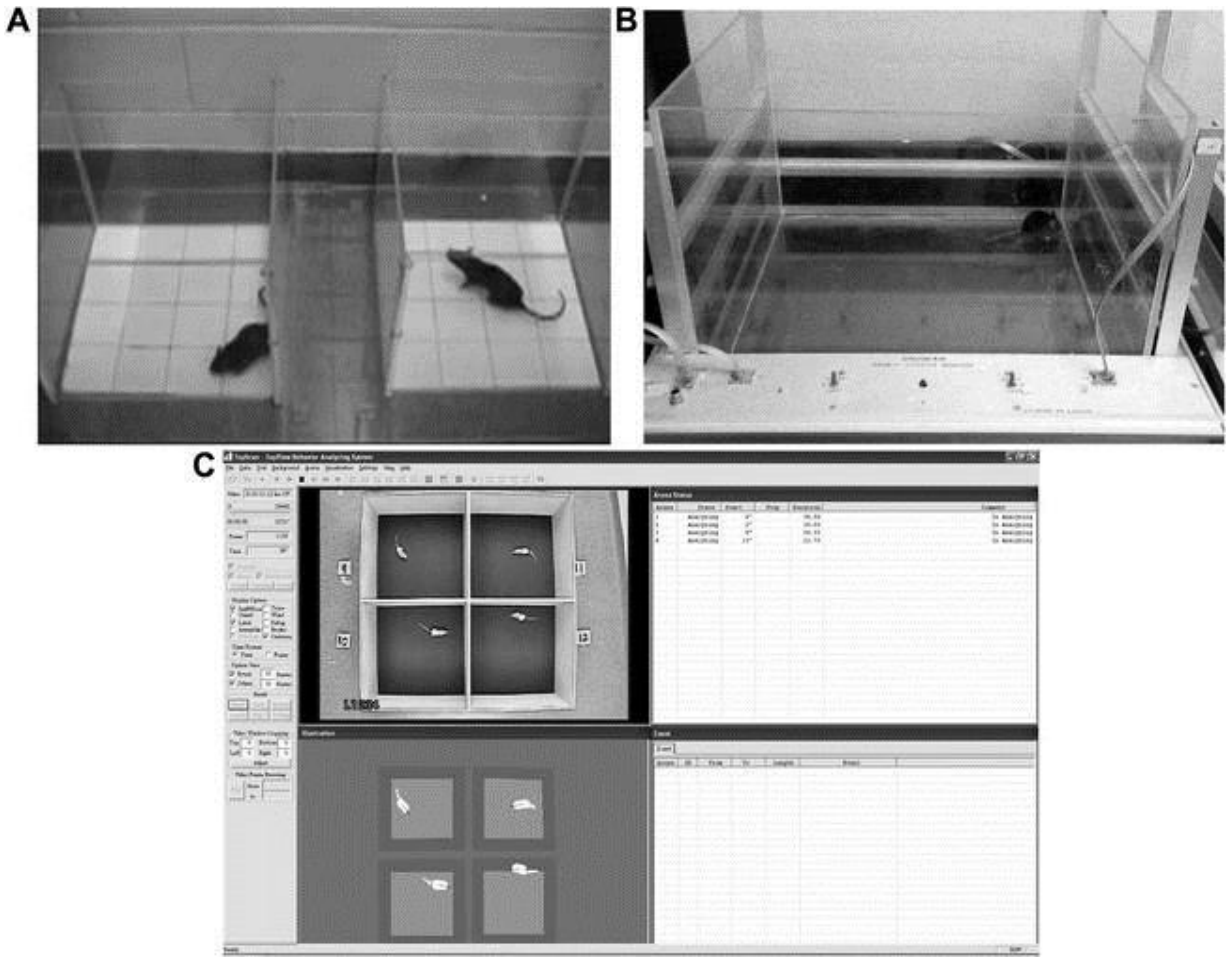


Figure 1.5. Application of the "Open Field" Method for Behavioral Analysis

Behavioral responses in rats exhibiting stress-induced instability were characterized by a latency period exceeding 10 seconds before initiating movement and a delay longer than 70 seconds to enter the central area of the testing field. Horizontal locomotor activity was measured at no more than 40 sector crossings, while vertical activity events did not exceed eight instances. Additionally, these animals made up to two visits to designated pits. The vegetative balance index in this group was recorded above the threshold of 2 points (E.V. Koplik, 2002).

§1.6. Impact of "Kurglitsin" on Cortisol Regulation under Stress Conditions

Cortisol, a glucocorticoid hormone synthesized by the adrenal cortex, plays an essential role in regulating the metabolism of leukocytes, fats, and carbohydrates, as well as orchestrating physiological reactions to stress. Upon recognition of a physical or psychological stressor, neural signals prompt the adrenal glands to secrete cortisol. This hormone enhances cognitive focus, promotes increased cardiovascular circulation, and facilitates glucose production, thereby enabling the organism to better manage stressful stimuli. help the body produce extra energy to successfully cope with stress.

In fact, cortisol ensures that the body functions in stressful situations and helps to quickly make the decision to " fight or flee " - this is how the oldest evolutionary mechanism is designed.

ELIZA-BEST (Vector-Best, RF) commercial kit was used according to the manufacturer's instructions.

Smart for determining the optical density of cortisol Card Reader microplate is used.

Biochemical parameters in the blood serum of experimental animals were determined using enzymatic colorimetric tests manufactured by Langdorpsesteenweg , Langdorp - Belgium and Basic SECOMAM , A nova Analytics company , France, biochemical analyzers were used to determine the concentration at a wavelength of 505 nm at a temperature of 37 ^{0} C and in a 1 cm cuvette .

Kurgli ts in 5 ml/kg was administered orally to the animals to perform the experiment .

§1.7. Procedure for implementation of forced swimming method

50 rats were experimented with forced swimming method.

A widely used method for studying the effectiveness of drugs in pre-hospital trials is the "Forced Swim with Load" test.

We carried out the necessary standardization of the experimental conditions to obtain reproducible results and compare them with the results of other researchers.

An important condition when conducting the "forced swimming with a load" test is to assess the intensity of the applied load.

To During experiments assessing physical performance in animals, a weight proportional to the subject’s body mass is affixed to the skin over the sacral region or to the hind limbs. The magnitude of this load is selected according to the intended intensity of the physical activity under study:

For low-intensity, prolonged exertion: 2.5–3% of the animal’s body weight

For moderate intensity and duration: approximately 5%

For medium intensity effort: about 7.5%

For high-intensity, short-term exertion: up to 10%

The limit swim test employing a load between 2.5% and 5% body weight primarily evaluates the aerobic capacity of the animals. Loads ranging from 7.5% to 10% represent a mix of aerobic and anaerobic efforts, utilized to investigate various physical parameters. Greater loads, between 13% and 15%, are applied to assess swimming endurance, as shown in Figure 2.4.

To measure the anaerobic component of physical fitness, two modified protocols are commonly used, distinguished by their criteria for test termination. In the limited swimming test, the endpoint is reached when the animal exhibits signs of exhaustion characterized by remaining motionless at

the pool’s bottom for one minute without swimming movements, sometimes accompanied by the appearance of air bubbles in the lungs.

Alternatively, in the forced swim test, the endpoint is defined by the animal’s inability to sustain active swimming, marked by sinking to the bottom and immobility for 30 seconds, often with twisting or turning motions. At this moment, the animal is promptly removed from the water and gently dried to prevent hypothermia.

Figure 1.7. Forced Swimming Test Procedure

The forced swimming test is widely used as a dynamic method to assess both cognitive and physical endurance in laboratory animals. This approach allows for repeated evaluations of animals’ physical performance under various experimental conditions. The procedure can be conducted in water environments with temperatures ranging from cold (11–14 °C) to hyperthermic levels (32–38 °C).

To isolate physical performance without the influence of temperature stress, thermoneutral water temperatures between 22 and 27 °C are employed. The water temperature is measured using a calibrated thermometer approximately 30 minutes before testing and adjusted as necessary to remain within the target range. Water depth should be maintained at a minimum of 35–40 cm for mice and 75–90 cm for rats. To prevent escape attempts, the vertical distance from the pool edge to the water surface must be at least 10 cm for mice and 20 cm for rats.

During the test, animals are fitted with a load attached either to the sacral skin or hind limbs, proportional to their body mass. The selected load depends on the desired intensity of exercise, categorized as follows:

Low-intensity, prolonged exertion: 2.5–3% of body weight

Moderate intensity with medium duration: 5% of body weight

Medium-intensity effort: 7.5% of body weight

High-intensity, short-duration exertion: 10% of body weight

The limited swimming test with loads between 2.5% and 5% is typically used to evaluate aerobic endurance. Loads between 7.5% and 10% represent combined aerobic and anaerobic exertion, while higher loads ranging from 13% to 15% are applied to study the anaerobic capacity related to swimming performance.

Two modifications of the test exist, differentiated by their criteria for termination. In the limited swimming test, the endpoint corresponds to the animal’s death, identified by a motionless posture at the bottom of the pool

lasting one minute without swimming activity and the presence of pulmonary air bubbles. In contrast, the forced swimming test concludes when the animal loses active swimming ability, demonstrated by sinking without movement for 30 seconds accompanied by rotational movements or convulsions of the trunk. At this stage, the animal is immediately removed from the water and carefully dried to avoid hypothermia.

This test serves as a fundamental tool for baseline physical performance assessment and is suitable for monitoring changes through repeated testing sessions. Water temperature significantly impacts maximal swim duration; thus, experiments can be tailored to examine endurance under hypothermic or hyperthermic stress conditions. To reduce water aeration, pools are filled slowly along the wall several hours before testing, allowing dissolved gases to dissipate and preventing interference with the animals' buoyancy. Prior to testing, animals undergo overnight fasting with free access to water to standardize metabolic conditions.

Rotarod test (Hugo Basile, Italy) - we used this method to assess the effect of drugs on motor coordination or fatigue tolerance in experimental animals. A single device is used for the test and the procedure itself is safe and humane.

The experiment was conducted by placing the animals on rotating drums with a textured surface to prevent them from slipping . This was done using a rotating drum device with 6 discs divided into 5 equal sections (see Figure 2.5).

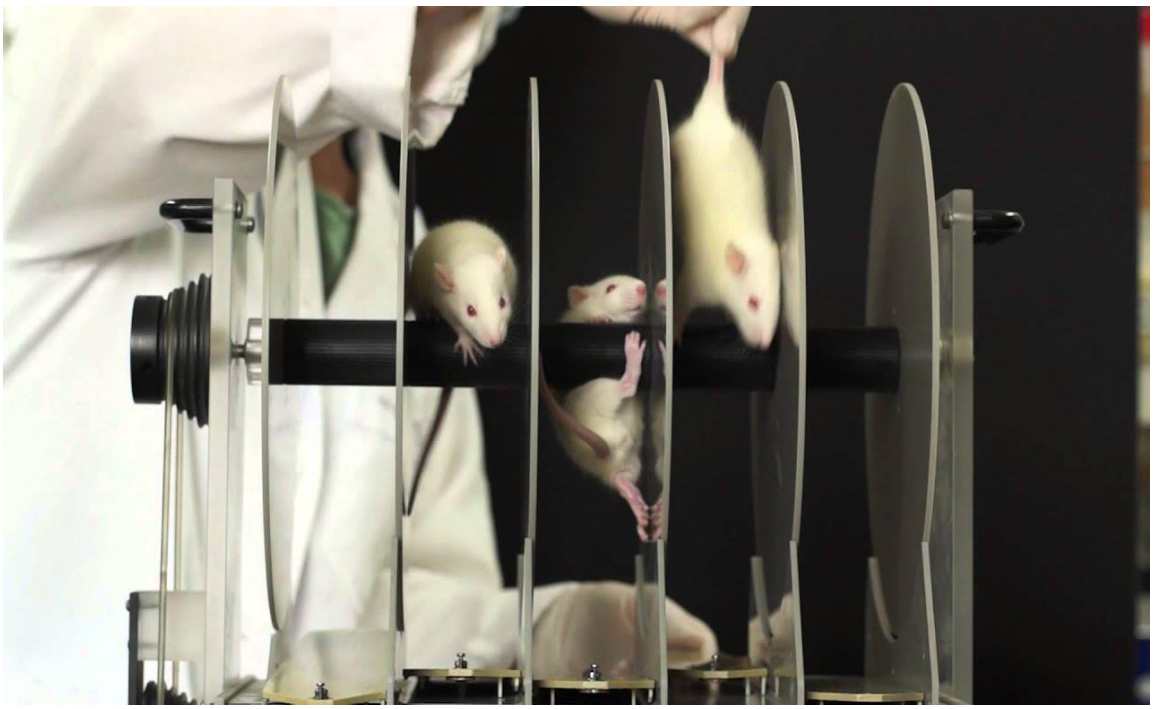


Figure 1.8. Carrying out rotarod test

Each experimental animal was placed in the dividing compartments of a rod rotating at a constant speed in the field for 10 revolutions. The latent time of the first descent of the experimental animal from the mounting drum was recorded for 180 seconds.

When the experimental animals land on a special sensor platform, the test results are stored and displayed on the front panel of the device.

The LCD display shows the following test results: the rotational speed, test duration, and distance traveled are evaluated at the end of the test.

The device has an electronic seal. All experimental parameters are set using the numeric keypad on the front panel. The front panel also has buttons, including: start, stop, and reset. All entered parameters and test results are displayed on the built-in LCD display .

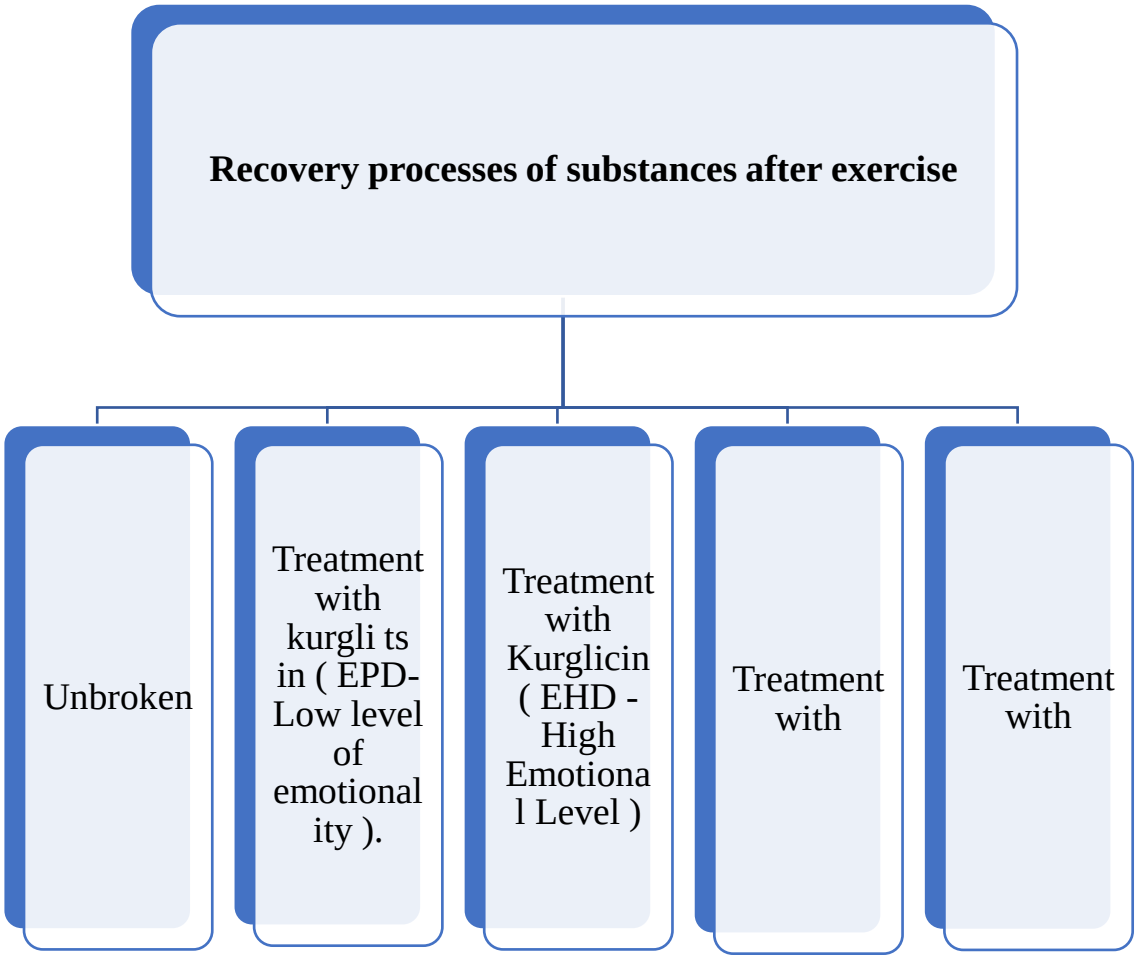
§1.9. Evaluating the effect of study substances on recovery processes after exercise

The experiment involved 50 rats, divided into groups of 10 rats. The The restoration of physical performance following intensive and exhausting exertion proceeds in a phased manner. This recovery process can be conditionally divided into at least three distinct stages:

The initial recovery phase, often referred to as the rapid restoration period, encompasses the first two hours following the cessation of physical load. During this short-term interval, functional capacity is typically restored from a baseline of 0% up to approximately 50% of the pre-load performance level.

The intermediate or transitional phase is marked by a gradual stabilization of physical capacity, generally reaching 53–57% of the initial state. This stage unfolds over a longer time frame, typically between 2 and 8 hours post-exertion, though in some cases, it may extend beyond this range depending on the severity of the load and the physiological characteristics of the subject.

The delayed recovery stage occurs over the span of one to two days and is characterized by a near-complete restoration of the organism’s functional abilities. During this period, the performance levels of experimental animals approach or return to their baseline values established prior to the exhausting physical challenge.



Evaluation of biochemical indicators of blood and urine of experimental animals

were evaluated in experimental conditions using a Mindray (China) biochemical analyzer using commercial test kits manufactured by Human and the accompanying instructions. The parameters described in the sources cited in scientific sources were accepted as standard biochemical parameters of rats in the normative ratio [99].

ALT (alanine aminotransferase), AST (aspartate aminotransferase), LD G (lactate dehydrogenase) , alkaline phosphatase (IF), total white blood cell (UO), creatinine, urea, glucose, cholesterol (XS) activity in the blood were evaluated (see Table 2.1).

Table 2.1

Standard biochemical indicators

Indicators	Standard
Total protein , g/l	98.0-108.0
AST, sh .b /l	72.0-196.0
ALT, s.b / l	110.0-140.0
Alkaline phosphatase , sh.b /l	1066.0-1220.0
Pancreatic lipase a , sh.b /l	16.0-24.0
Urinary mmol / l	8.0-14.0
Creatinine, m mol / l	68.0-104.0
glucose , m mol / l	8 , 8-16 , 3
Cholesterol, m mol / l	2 , 2-2 , 6

Table 1.2

Experiment animals open field, forced swimming and rotarod test, toxicological and biochemical analyses

Indicators	Methods used	Research object i	Air temperature , ºC
Open field test	clinical laboratory	White rat	20 - 22 º C
Mandatory testing	clinical laboratory	White rat	20 - 22 º C
Rotarod test	clinical laboratory	White rat	20 - 22 º C
General knowledge	biochemical	White rat	20 - 22 º C
AST	enzymatic	White rat	20 - 22 º C
ALT	enzymatic	White rat	20 - 22 º C

Alkaline phosphatase	biochemical	White rat	20 - 22 º C
Determination of pancreatic lipase a	enzymatic	White rat	20 - 22 º C
Determination of the amount of urine	biochemical	White rat	20 - 22 º C
Determining the amount of creatinine	biochemical	White rat	20 - 22 º C
Determination of glucose	biochemical	White rat	20 - 22 º C
Determination of cholesterol	biochemical	White rat	20 - 22 º C

Table 1.3

The volume of research carried out

Indicators	number of animals	The scope of the work	Methods
waxy protein in blood	100	100	biochemical method
AST	100	100	enzymatic method
ALT	100	100	enzymatic method
Alkaline phosphatase	100	100	biochemical method
Determination of pancreatic lipase	100	100	enzymatic method
Urinary determination	100	100	bio chemical

			method
Determination of creatinine	100	100	bio chemical method
Determination of glucose	100	100	bio chemical method
Determination of cholesterol	100	100	bio chemical method
Open field test	100	100	laboratory method
Mandatory testing	100	100	laboratory method
Rotarod test	100	100	laboratory method

Table 1.4

Scope and Nature of Research on Typological Parameters of Stress in Experimental Animals

Experience cycle	**Method**	**Research object**
Correction of changes in clinical, biochemical, enzymatic processes caused by typological stress	Laboratory	Blood serum

Scope and Nature of Research on Typological Parameters of Stress in Experimental Animals

The investigation of stress-related typological features in laboratory animals encompasses a broad spectrum of experimental approaches aimed at identifying individual differences in stress reactivity, adaptation mechanisms, and behavioral resilience. This line of research explores how animals with varying neurophysiological profiles respond to different types and intensities of stressors, with the goal of understanding the biological basis of stress resistance and vulnerability. Through carefully designed models, such studies assess

physical, behavioral, autonomic, and endocrine parameters, offering valuable insights into the mechanisms of stress adaptation and the development of stress-induced pathologies.

If you’d like, I can expand this into a full section with subheadings like:Objectives of typological stress studies. Experimental models and protocols

Indicators used for classification (behavioral, physiological, hormonal) Scientific relevance and applications. Let me know how you'd like to proceed! IFA -BEST commercial kit was used to determine serum cortisol levels . The assay was performed according to the manufacturer's instructions.

Smart for optical density determination Reader (Accuris , USA) microplate was used.

The volume of the conducted research is sufficient for reliable conclusions (see tables 2.2-2.4).

The sample size was carried out using modern generally accepted methods, which ensures the reliability of the obtained data. The volume of the received and analyzed material ensures the reliability of the results on the selected topic.

Statistical data processing was carried out using the Statistica 6.0 program.

assessed using the Mann–Whitney test .

Statistical differences were considered statistically significant at $p < 0.05$. *All experimental results are presented as arithmetic mean (M) ± standard error*.

CHAPTER II.

INDIVIDUAL-METABOLIC CHARACTERISTICS OF DISORDER OF NEUROMOTOR ACTIVITY OF RATS UNDER EXPERIMENTAL STRESS

§2.1. Evaluation of the acute toxicity of curglycin.

our developed " Kurglicin " at different doses, it was assessed that experimental animals (mice) that received a 3% suspension orally at relatively low doses of 250 and 500 mg/kg did not show any negative reaction to the substance. In the next stage, with the introduction of "Kurglicin" at relatively high doses of 750 mg/kg and 1000 mg/kg, a significant decrease in mobility and homing were observed in mice.

These changes began to disappear after an average of 45-50 minutes.

After oral administration of "Kurglicin", no lethal outcomes were observed in any group, which makes it evident that an LD_{50} could not be determined.

§2.2. Procedure for dividing experimental animals according to individual typological parameters

Immobilization has been shown to disrupt the stereotype of the tool that leads to the emergence of typical stressful consequences in both healthy people and patients who lead a sedentary lifestyle. Regardless of the method of immobilization of animals, the nature of stress symptoms, which are easily reproduced in experimental conditions, and their dynamics, which can be characterized by their intensity, severity and duration, have ensured its wide recognition as a stress model.

complementing it with uncharacteristic manifestations of stress corresponding to the later stages of development . The resulting pathological emotional and stressful background, on the one hand, changes the sensitivity of the body to the main means of specific pharmacotherapy, and on the other hand, it must be restored by existing anti-stress drugs.

The inclusion of basic drugs in the complex of therapeutic measures ensures its optimization in achieving an effective therapeutic result. It is scientifically substantiated that taking into account these two main aspects of modern problems of pharmacotherapy under stress should be an obligatory rule for its rational conduct [4, pp. 348-350].

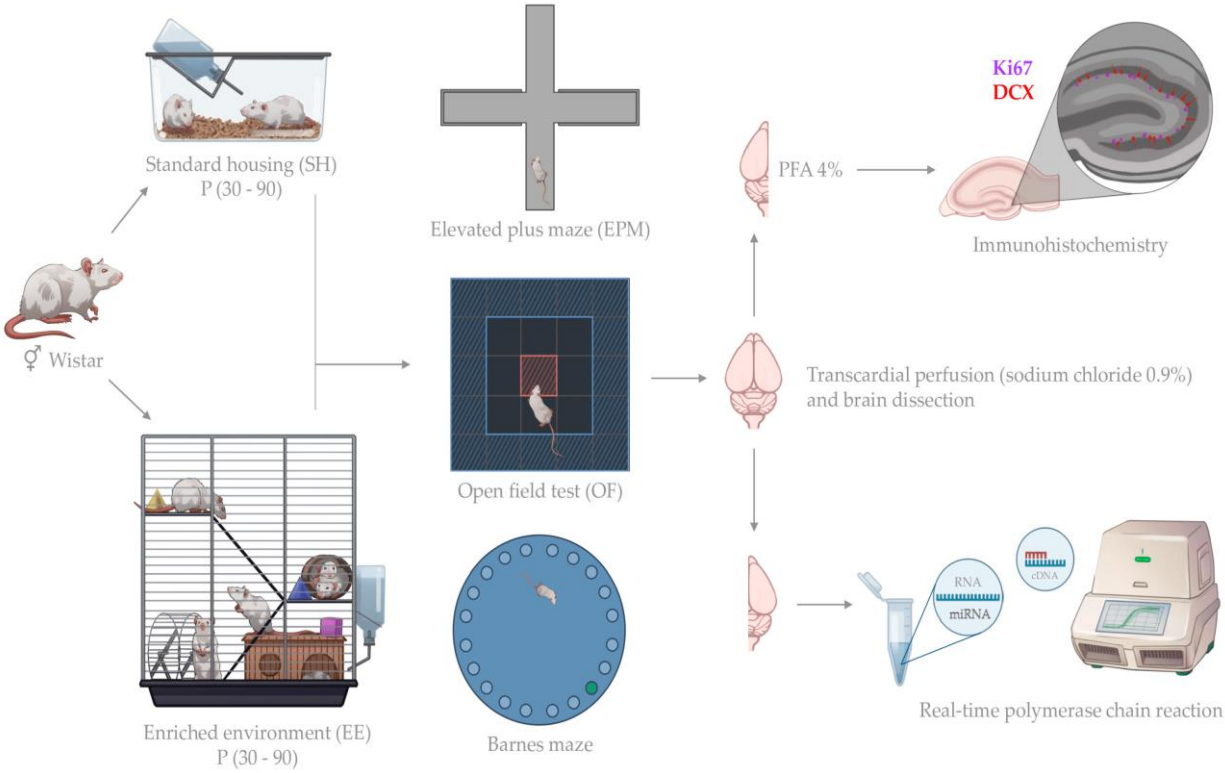


Figure 2.1. Test results using the O. Field method

The studied experimental animals were divided into groups according to the manifestation of motility and anxiety in the open field.

The accepted experiment consists in dividing the animals into three groups, providing high, medium and low levels of motor activity. High- and low-emotional animals were further tested.

The high-physical activity group had the most crossed squares, less urination, and more physical activity. This group also had significantly higher levels of social connections. Therefore, we have shown that this group is characterized by lower levels of emotionality and anxiety.

The group with moderate physical activity had 2 times fewer intersecting squares than the group with high physical activity.

had the fewest intersecting squares and verticals . Therefore , it was determined that the low physical activity group had a high level of emotionality (HLE), and the high physical activity group had a low level of emotionality (LHE).

A number of researchers have analyzed the behavior of rodents in the " open field " . We found increased anxiety in experimental animals exposed to stress.

Thus, rats involved in a sedentary experiment were classified as prone to the development of stress.

Rats with high levels of physical activity were considered more stress-resistant, as active and mobile behavior allows them to escape danger and survive in their natural environment.

The most common reaction in experimental animals is grooming, that is, cleaning the body.

During grooming, animals release endorphins, thereby reducing anxiety and stress.

Furthermore, keeping animals of the same species reinforces the social structure of the experimental group, as evidenced by the high level of socialization in rats subjected to this emotional experiment (see Table 2.1) .

2. Table 1

Physical activity of experimental rats in the open field (n= 6, p<0.05)

Group	Cut out squares number	The time spent in the center, second	Defecation number	Urinary excretions number	Verticals number
Low	6.09±0.33	9.6±1.6	2.35±0.1	1.30±0.1	1.8±0.33

physical activity	*	***	5 *	2 *	*
Moderate physical activity	14.97±0.44 *	5.77±1.14 ***	3.13±0.20 *	1.29±0.15 *	2.64±0.43 *
High physical activity	29.23±0.91 **	6.10±0.69 *	3.3±0.19 *	1.0±0.1 *	3.0±0.27 *

Note: *-significant differences in activity levels (* P <0.05;** P <0.01; *** P <0.001).

As a result of immobilization stress, horizontal motor activity (cutting, looking at holes) of experimental animals at the edge of the open field decreased in all studied periods.

Under experimental conditions, rats exhibited a greater number of grooming behaviors, characterized by an increase in exits and stands in the central areas of the open field, as well as an increase in the number of holes explored.

The number of grooming behaviors in rats tested after stress was reduced compared to controls, based on a decrease in motor activity. This is likely due to the decrease in orientation-searching activity as a result of stress and the recovery period after stress.

Our findings are confirmed based on the results presented in the literature.

Thus, the study showed that the low stress tolerance of sedentary rats, in which the group stress resistance indicators were not impaired under the influence of a physiological stressor, was accompanied by a high accumulation of magnesium in erythrocytes and blood plasma, and a greater accumulation of magnesium in blood plasma from the subclavian vein .

MRI studies have shown that the central amygdala in experimental rats is responsible for the feeling of fear and provides them with the " hiding " response. When it is removed, the experimental animals show a significant decrease in these reactions compared to active ones.

In the In the body of scientific literature, numerous studies have been devoted to investigating free radical-induced lipid peroxidation processes in the brain, bloodstream, and various internal organs of rats exhibiting distinct individual typological and behavioral traits. It was found that rats selected for the " open field " test are characterized by a higher level of free radical lipid oxidation products in the brain, liver, and heart before and after stress compared to " sensitive " and " non-sensitive " animals. Individual behavioral characteristics (monoaminergic mechanisms) were assessed.

From the above, we can conclude that the individual typological parameters of experimental animals have a significant impact on the course of the stress response and their tolerance to stress. High and low-sensitivity experimental animals show different reactions to stress factors. In this regard, the biochemical differences in these animals under stressful conditions and under pharmacotherapy are of great interest.

§ 2.3 . Cortisol levels in experimental animals under immobilization stress

Biological signs of stress response are associated with increased levels of catecholamines, adrenocorticotropic, Chronic stress alters the transcriptional response to glucocorticoid challenge in the dentate gyrus region of the male rat hippocampus.

the 2nd stage , hypercortisolemia, dyslipidemia, and a decrease in testosterone levels were identified as pathogenetic factors of the impact of stress on cognitive function in patients with chronic cerebral ischemia.

In all our animal studies, cortisol levels were measured before and after immobilization stress (see Table 3.2).

2. Table 2

Cortisol levels in experimental rats under immobilization stress (n = 6, p<0.05)

Group	Cortisol level, pmol/l	
	Unbroken	**Stress**
High level of emotionality	59.288±0.125 **	EPD
Low level of emotionality	59.844±0.096 **	EJUD

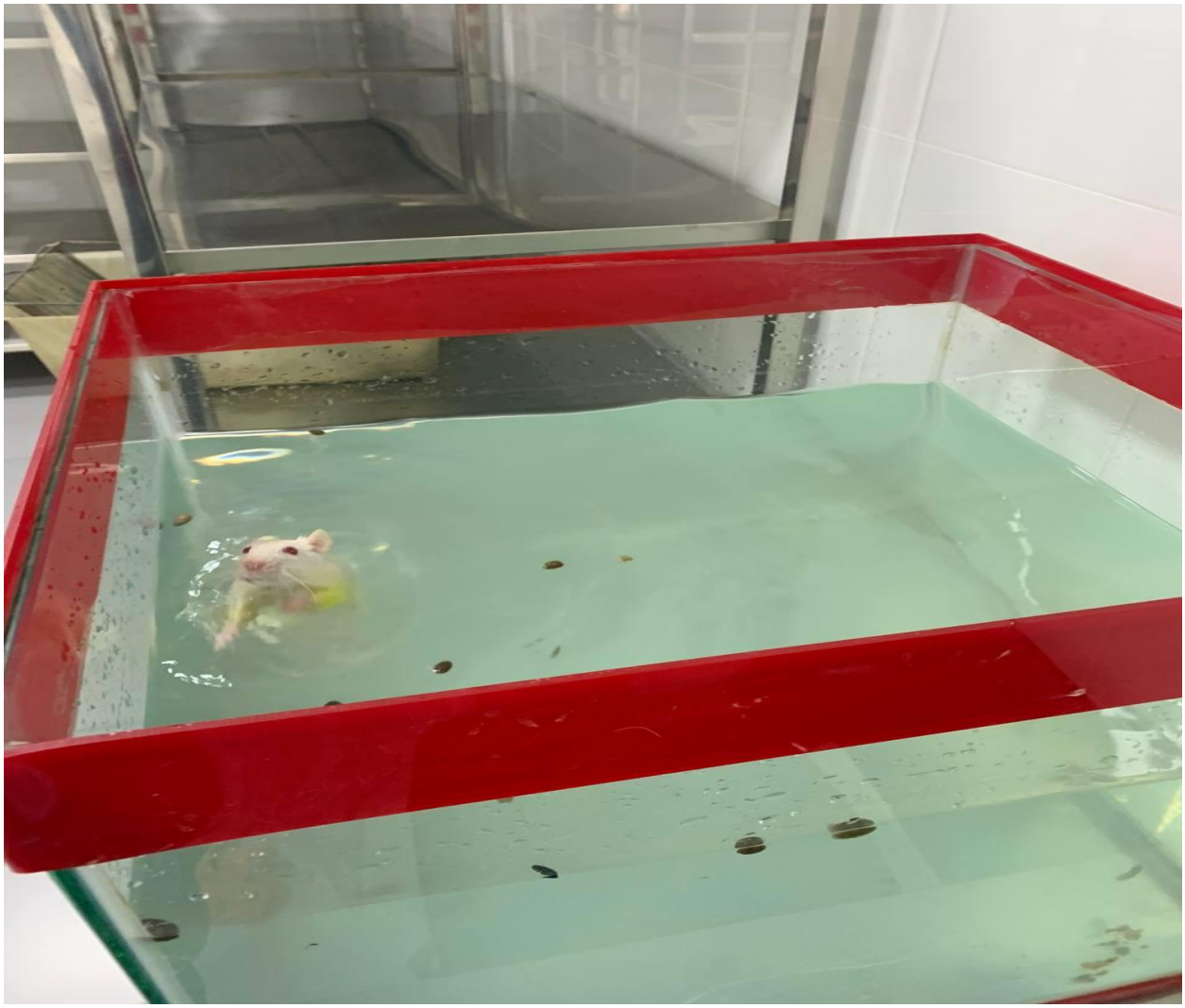
Note: *-significant difference in emotionality levels (* P <0.05;** P <0.01; *** P <0.001).

In both groups of rats, cortisol levels increased by an average of 10-11% after immobilization stress compared to the control group. This method can be used to study the effect of various biologically active substances on the stress response process in the adrenal cortex .

During stress, it has been assessed that the hypothalamic-pituitary-adrenal system and the sympathoadrenal system, which reflect the levels of stress hormones (cortisol and adrenaline), have different activity in animals responding to different stressors.

In an unfavorable situation, experimental animals with an active type of stress reaction exhibit a predominance of the sympathoadrenal system, with its activation leading to the release of adrenaline.

the study showed that in rats, a passive-defense reaction is activated by the release of corticosterone in response to stressful stimuli.



§2.4. Changes in biochemical indicators of experimental animals with low and high levels of emotionality under the influence of immobilization stress

Stress-specific hormonal responses and other biomarkers that influence stress are commonly used to quantify or monitor stress [54, pp. 3-43].

We studied the main biochemical parameters of rats subjected to immobilization stress with varying degrees of emotionality.

The data presented in Table 3.3 show that in animals with a low level of emotionality, changes in biochemical blood parameters such as ALT (by 11%),

AST (3.6 times), and LDH were observed, compared with the results of experimental animals immobilized for a long time and subjected to repeated stress.

For example: parameters such as cholesterol (47%) , glucose (52%) and alkaline phosphatase increased by 24%. In animals with high emotional level, ALT decreased by 34%, AST by 2.5 times, glucose level by 65%, alkaline phosphatase by 26%, and LD G by 83%.

In both groups, cholesterol levels were expected to increase by 47% and 26%, respectively (see Table 3.3).

Changes in creatinine and total protein levels were not significant.

From the data obtained, we can conclude that immobilization stress in rats leads to disruption of microcirculation and hepatic metabolism, cholestasis, which is primarily manifested in inhibition of the activity of liver enzymes , disruption of the glycolysis process. These processes vary depending on the emotional lability of different animals, with the greatest fluctuations observed in the levels of LDH , phosphatase, and cholesterol.

2. Table 3

Changes in biochemical parameters of rats with low and high levels of emotionality under the influence of stress

(n = 6, p < 0.05)

indicators	**Group**	
	Low level of emotionality	
	Unbroken	**Stress**
ALT, g /L	78,00 ± 10,16 **	70.55±0.35 *
AST, g /l	216.51±35.51 ***	59.94±0.74 *
Alkaline phosphatase, sh /l	274.36±45.57 ***	340.94±2.13 ***
Lactate de g hydrogenase, sh /l	526.24±109.91 ***	440.77±2.52 ***

Glucose, mM/L	6.89±0.53 *	4.52±0.12 *
Total cholesterol, mm/l	1.20±0.14 *	1.77±0.02 *
Total protein, g/l	68.21±1.25 **	69.53±0.57 **
Creatinine, mm/l	50.49±1.08 **	47.04±0.90 **
High level of emotionality		
ALT, g /L	93.83 ± 8.87**	69.85 ± 0.33**
AST, g /l	149.62 ± 8.42**	60.13 ± 0.72**
Alkaline phosphatase, sh /l	421.01 ± 49.11 ***	332.68 ± 2.12***
Lactate de g hydrogenase, sh /l	799.29 ± 333.58***	435.85 ± 1.27***
Glucose, mm/l	7.41 ± 1.03*	4.49 ± 0.06*
Total cholesterol, mm/l	1.43 ± 0.21*	1.80 ± 0.01*
Total protein, g/l	76.41 ± 1.83**	72.43 ± 1.44**
Creatinine, mm/l	46.51 ± 1.68**	51.30 ± 0.78**

Note: *-significant differences between the indicators of low emotionality and high emotionality in the disturbed and stressed periods (* P <0.05; ** P <0.01; *** P <0.001).

C stress is accompanied by inhibition of microsomal reductases and impaired synthesis of coenzymes.

As can be seen from the data presented by N.P. Rudko and V.V. Davydov (2015), they studied the regulation of reductase activity in liver microsomes of aged rats under stress.

Other authors have reported that modeling immobilization stress in rats led to inhibition of anaerobic glycolysis and the pentose phosphate cycle, gluconeogenesis, and activation of lipolysis in adipose tissue.

The antioxidant effect of new derivatives of 3-hydroxypyridine was studied in the experiment.

The results show a clear activation of lipid peroxidation processes in the blood serum of rats under stress in the form of 12-hour immobilization .

The degree of effect of combined immobilization on behavioral indicators depends on the stage of the stress estrus period and the age of the animals.

The effects of immobilization stress are more pronounced in older animals during the estrus phase.

The effects of stress-inducing factors and α-tocopherol on the behavior and free radical processes of female white rats at different stages of the estrous cycle were studied [69].

According to other authors, scientific work has been conducted to study the response of the hypothalamic-adrenocortical system to stress and to regulate stress disorders with antioxidants [67, pp. 62-81].

Immobilization stress, regardless of the age of the animals, leads to an increase in free radical processes in the hypothalamus and liver with a sharp increase in erythrocyte hemolysis.

In particular, for pharmacocorrection of immobilization stress (physical inactivity, old age, etc.), it is necessary to use means that have a positive effect on liver metabolism.

§2.5. Evaluation of the influence of individual typological parameters on the motor activity of experimental animals

Early experimental studies aimed at studying the mechanisms and consequences of emotional stress also revealed the specificity of the physiological reactions of mammals to the same type of stress parameters.

The experiment conducted a systematic analysis of the cardiovascular system under emotional stress .

" open field " test is widely used to analyze the behavior of experimental animals and predict their sensitivity to stress [16 , p . 14-54].

movement in the open field are prognostically more resistant to stressors than passive individuals Studies on various against stress.

According to the literature, prolonged or severe stress is accompanied by disruption of the functions of the nervous and endocrine systems.

In addition, there is evidence in the literature that the survival of experimental animals in severe pathological conditions is influenced by both their initial sensitivity and the intensity of instrumental and search activities [19, pp. 41-43] than those that were disturbed by low levels of emotionality (see Table 2.4) .

Table 2.4

Swimming time to exhaustion in rats with high emotionality and low emotionality in the forced swimming test (n=6)

Group	Index (M ± m), minute .	
	Unbroken	**Stress**
High level of emotionality	20.33±0.49 **	19.16±0.3 *
Low level of emotionality	15.50±0.42 **	14.5±0.56 ***

Note: *- the correlation between the results in the disturbed and stressed conditions at high and low levels of emotionality is significant (* P <0.05; ** P <0.01; *** P <0.001)

In intact rats with high levels of emotionality, the initial time of forced swimming was also higher than in rats with low levels of emotionality, the difference was 31%.

The rotarod test is used to assess the effects of drugs on motor coordination or fatigue tolerance in mice and rats.

In this test, the initial performance of the low emotionality rats was superior to that of the high emotionality rats.

After stress, rats with low levels of emotionality showed a longer retention time per rotarod compared to those with high levels of emotionality (see Table 3.5) .

2. Table 5

Time spent on a rotating stick in rats with high emotionality and low emotionality (n= 6)

Group	Latent time of the eye (M± m) , seconds	
	Unbroken	Management
High level of emotionality	32.33±1.14 *	33.0±0.77 *
Low level of emotionality	45.33±0.75 **	46.5±1.02 ***

Note: *-the relationship between the results in the disrupted and control conditions

In the running wheel test, the total physical activity of intact rats with high levels of emotionality was 34% higher than that of rats with low levels of emotionality.

After stress, the level of physical activity in both groups slightly decreased, the difference between the groups was 37%, and the obtained results are presented in Table 3.6.

2. Table 6

emotionality before and after stress (n =6)

Group	Number of rotations in 5 minutes (M± m)	
	Unbroken	**Stress**
High level of emotionality	26.33 ± 0.80 **	25.16 ± 0.75 **
Low level of emotionality	19.66 ± 0.88 ***	18.33 ± 0.80 ***

Note: *- the correlation between the results in the disturbed and stressed conditions at high and low levels of emotionality is significant (* P <0.05; ** P <0.01; *** P <0.001)

Based on the obtained results, motor activity reflects the high level of excitation processes in MAT.

Thus, the rats' response to stress was determined by the level of excitability of their nervous system.

Emotional stability was the most important factor determining the type of response to stress. It involved the formation of the level of emotional arousal necessary in a given situation. Animals with an optimal level of emotional stability often formed an adequate response.

the initial type of animal behavior determines their sensitivity to subsequent stressors.

Individual-typological characteristics of the response of rats to multicomponent stress in experimental conditions are one of the contemporary issues of biomedicine . In this regard, it is necessary to conduct scientific analyses and, based on the results, develop an effective system of stress prevention and treatment.

Our results show that rats with an initially active search pattern were the most resistant to stress.

The less reactive the nervous system, the more pronounced the decrease in the level of corticosterone in the serum of experimental animals.

When animals with low emotional levels were compared with intact animals, biochemical blood parameters such as ALT (by 11%), AST (3.6 times), LDH (by 19%), cholesterol levels (by 47%), and glucose (by 52%) and alkaline phosphatase levels increased by 24%.

In animals with high emotionality, ALT decreased by 34%, AST by 2.5 times, glucose levels by 65%, alkaline phosphatase by 26%, and LDH by 83%. In both groups, cholesterol levels were expected to increase by 47% and 26%, respectively. Changes in creatinine and total protein levels were not significant.

obtained , we can conclude that immobilization stress in rats leads to impaired microcirculation and liver metabolism, cholestasis, which is primarily manifested in the inhibition of liver enzymes , impaired glycolysis, and increased glucose and fat consumption.

A study of the motor activity of intact animals with high emotionality under stress conditions (forced swimming test) showed a 32% reduction in forced swimming time compared to groups with low emotionality.

In intact rats with low emotionality, the initial forced swim time was also higher than in those with low emotionality, with a difference between the groups of 31%.

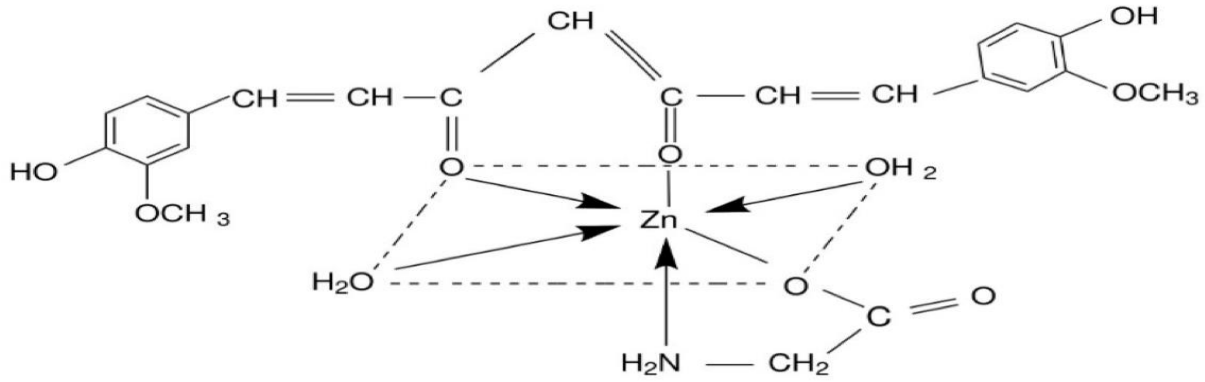
In the running wheel test, the total physical activity of intact high-emotional rats was 34% higher than that of low-emotional rats.

After stress, physical activity levels decreased slightly in both groups, with a difference between groups of 37%.

Thus, the reaction of rats to stress was determined by the level of excitability of their nervous system. Emotional stability is the most important factor determining the type of response to stress. It involves the formation of the level of emotional arousal that is necessary in a given situation. An

adequate response reaction is more often formed in animals with an optimal level of emotional stability. Thus, the individual typological indicators of experimental animals have a significant impact on the course of the stress reaction and their tolerance to stress.

Animals with high and low emotionality show different reactions to stressors. The and physiotherapeutic methods to increase adaptive capacity.



CHAPTER III.

EVALUATION OF THE EFFECTIVENESS OF "KURGLITSIN" DRUG IN THE TREATMENT OF STRESS

Anti-stress drugs, unlike drugs that are tropic for certain functions of the body, do not have a permanent effect on certain organs or functional metabolic processes. Their action is aimed at limiting the negative impact of various negative factors on the body.

Since the stress response is a general reaction of the whole organism, the protective effect of pharmacological agents can only be assessed at the systemic level. This requires a comprehensive approach, taking into account a number of processes that, Along with the general classification, neuropeptides (melatonin), antioxidants (mexidol), and neuroamino acids (taurine) are described in detail as stress protectors; they are drugs that affect the changes that occur in the early stages of stress and contribute to the development of systemic pathology of stress genesis.

Studying the mechanisms of stress protection allows us to optimize the rapid mediation of cellular bioenergetics, stimulate the metabolism of nucleic acids, and use drugs that ensure the development of active forms of protection in organs [12, pp. 11-23].

Copper is the second most abundant trace element in the human body after iron [13, pp. 52-60]. It plays a major role in regulating antioxidant stress and inflammation . In addition, it is a component of proteins, acting as a substrate or regulator of enzymatic activity [11, pp. 98-100].

are realized in the process of DNA regeneration after damage, in the synthesis of biologically active molecules (for example, methionine) necessary for DNA methylation [58, pp. 75-76].

The biological indestructibility of spirit is confirmed by the existence of homeostatic mechanisms that regulate its absorption, distribution, cellular

uptake, and excretion. The total amount of spirit in the human body is 12-16 μM , with a plasma concentration of 2-4 g.

To date, many experimental results have been obtained showing the many biological effects of curcumin, explaining its preventive and therapeutic properties. The bibliometric analysis conducted in 2019 showed that scientists from the United States , China, India, Japan and South Korea contributed to these studies .

Curcumin statistically significantly reduces reactive oxygen species in rat peritoneal macrophages. Evaluation of antiradical properties of reactive oxygen species using rat peritoneal macrophages shows that the use of turmeric extract inhibits prostaglandin *E2 in human hepatoma* HepG 2 $_{cells}$. (a marker of oxidative stress) [59, p. 32].

P 450 during exercise is important as an oxidant and in the correction of immune diseases . In Clinical studies in animal models have shown that curcumin can be used to treat cognitive decline, especially in Alzheimer's disease, which has been shown to be more effective in mitochondrial dysfunction [35, p. 34-39].

Glycine regulates metabolism and carries out inhibitory processes in the central nervous system. It blocks the release of adrenaline and noradrenaline (the main stress hormones), cleanses the body of toxins and free radicals that destroy brain tissue cells. Glycine has a protective effect in preventing stress-induced disorders of erythropoiesis and the development of anemia, in mesenteric ischemia and reperfusion injury [10, p. 12-15].

blood glucose is observed in some diseases [19, p. 40-45].

alters the transcriptional response to glucocorticoid challenge in the dentate gyrus region of the rat hippocampus. Serum glycine is associated with body fat and reduces lipid peroxidation and microvascular damage [23] .

Analysis of the literature allows to describe the antistress mechanism of glycine . Activation of central inhibitory mechanisms depends not only on the

direct effect of glycine, but also on its effects on GABAergic, dopaminergic , and prolactin- restricting mechanisms .

Thus, glycine limits the activation of centers that determine the stress response. As a result, the release of releasing factors that release AKT G is inhibited , the excitation of adrenergic centers is reduced, which prevents the increase in the level of catecholamines and glucocorticoids [25].

of glucose and zinc causes stress in the central nervous system [60, p. 96-15]. A combination of glycine and zinc has been shown to be effective in moderating the main manifestations of stress and anxiety. [37, pp. 49-6].

Glycine , together with gamma-aminobutyric acid (GABA) , regulates physiological inhibitory processes in the central nervous system by increasing transmembrane conductance at specific ligands . The introduction of oxygen ions leads to an increase in inhibitory processes in the neurons of the central nervous system [64, pp. 122-11].

Based on the above, we have developed a complex agent (substance) for the pharmacological correction of stress, conditionally called Kurglicin.

This component contributes to the pharmacocorrection of stress with anti-stress, antioxidant, cytoprotective and hepatoprotective effects. These changes largely depend on the genetic (sex, genomic parameters), hormonal and other characteristics of mammals. The relationship between stress, emotional intelligence, cognitive intelligence and cytokines [44]. Stress loads of different intensities lead to specific changes in the perceptual and emotional components of nociception in rats, the direction of which depends on the initial characteristics of the animals' linear movements and the period of study . After a single long-term immobilization, changes in the level of cytokines in the blood at different stages and the dynamics of repeated stress effects are more pronounced in passive animals than in active individuals. After an acute stress load, the number of correlations between nociceptive sensitivity indicators and cytokine blood profile is higher in active behavior and in chronic condition in

passive rats [45] . Dynamics of nociceptive sensitivity and blood cytokine profile in rats exposed to single and repeated stress

§3.1. Evaluation of the effect of curglycin on biochemical parameters in blood of experimental animals under stress, typological parameters taking into account individual.

Currently, there are specific signs of individuality and a very wide variability of stress-induced fluctuations in neuroimmune parameters, in particular, the concentration of cytokines and the functional properties of their receptors [38, pp. 58-54 These changes largely depend on the genetic (sex, genomic parameters), hormonal and other characteristics of mammals - IL-6, IFN-γ, TNF-α and IL-10 [94].

Changes in blood cytokine levels at different stages after long-term immobilization and the dynamics of repeated stress effects are more pronounced in passive animals than in active individuals. Indicators of nociceptive sensitivity also change after acute stress [53, p. 75]. Nociceptive sensitivity and blood cytokine dynamics are increased in rats under single and repeated stress [20].

In our experiments, after immobilization stress, cortisol levels in both groups of rats increased by an average of 10% compared to controls. Tables 4.1 and 4.2 show the effect of Kurglycin on biochemical parameters of stressed rats.

at 5 ml/kg body weight each as a 3% suspension was administered orally to 14-day-old and 21-day-old rats.

Group	**Cortisol level, pmol/l**	
	after applying the composition	**after receiving the composition**
High level of	61.896±0.620 **	60.463±0.895 **

emotionality		
Low level of emotionality	63,710±0,398 **	61,250±0,529 *

Note : *- the relative difference in cortisol levels between high and low levels of emotionality is significant (* P < 0.05 ; ** P < 0.01 ; *** P <0.001)

Under the influence of which was taken as a control. As can be seen from the data presented in Tables 3.2 and 3.3, Curglycin was administered orally at 5 ml/kg for 14 and 21 days for pharmacocorrection of stress in animals in the low level of emotionality group .

In this, the process of gradual restoration of the functional activity of the organism was observed.

Table 3.2

Changes in biochemical parameters of low-emotional rats under the influence of kurglycine (n=10)

indicators	**Group**			
	Low level of emotionality			
	14 days after taking Kurgli ts inni	21 days after taking Kurgli ts inn	14 days after taking Gly ts inni	21 days after taking gli ts inni
ALT, sh . b /l	74.85± 10.20	73.92± 5.86 *	77.74± 2.24	76,162 ± 2,08 *
AST, sh .b /l	219 , 31± 42 , 05	204.59± 43.83 **	233.73± 2.90	207.4± 10.14 ***
Alkaline phosphatase, sh .b /l	366.86± 75.45	383.18± 100.96 **	387.11± 5.58	391.64± 14.57 ***

Lactate de g hydrogenase, sh .b /l	599.20± 81.18	523.87± 60.09 ***	672.14± 11.02	525 , 868± 14 , 34 **
Glucose, mM/L	6.53± 0.69	6.19± 0.69 *	5.15± 0.32	5.466± 0.16 *
Total cholesterol, m M /l	1.10± 0.07	0.80± 0.09 *	1.10± 0.05	0.984± 0.04 *
Total protein, g /l	75.03 ± 1.76	68.33 ± 3.42 **	84.16 ± 2.12	70.12± 1.73 **
Creatinine, mm/l	51.81± 2.09	47.79± 2.88 *	53.34± 1.15	49.762± 1.17 **

Note : *- the relative difference in cortisol levels between high and low levels of emotionality is significant (* P < 0.05 ; ** P < 0.01 ; *** P <0.001).

This is confirmed by the restoration of pre-stress ALT levels in the blood of stressed animals, a 1.07-fold decrease in AST levels, and a 1.37-fold decrease in alkaline phosphatase, LDH, glucose, and cholesterol levels.

Biochemical indicators of experimental animals under the influence of kurglycin at a high level of emotionality are presented in Table 3.3.

3. Table 3

Changes in biochemical parameters of highly emotional rats under the influence of kurglycine (n=10)

indicators	**Group**			
	High level of emotionality			
	14 days after taking Kurgli ts	21 days after taking	14 days after taking gli	21 days after taking gli

	inni	Kurgli ts inni	ts inni	ts inni
ALT, s.b / l	65.72± 6.89	65.72± 6.89 *	69.16± 5.37	54.04 ± 6.67 ***
AST, sh .b /l	189.06± 16.84	189.06± 16.84 *	207.38± 5.20	176.61± 25.09 ***
Alkaline phosphatase, sh .b /l	252.26± 43.20	252.26± 43.20 *	301.14± 13.36	289.12± 48.38 ***
Lactate de g hydrogenase, sh.b. / l	517.80± 79.96	517.80± 79.96 *	624.91± 5.15	443.73± 57.53 ***
Glucose, mM/L	6.39± 0.23	6.39± 0.23 *	5.874± 0.13	7.05± 0.30 **
Total cholesterol, mm / l	0.79± 0.13	0.79± 0.13 *	0.93± 0.03	0.72± 0.04 *
Total protein, g /l	80.63± 2.98	80.63± 2.98 **	83.68± 2.51	73.74± 3.07 **
Creatinine, mm/l	50.59± 2.10	50.59± 2.10 **	52.20± 1.80	51.38± 1.37 *

Note : *- the relative difference in cortisol levels between high and low levels of emotionality is significant (* P < 0.05 ; ** P < 0.01 ; *** P <0.001)

In animals with a high level of emotionality, the use of Kurglycin and glycine had almost no effect on the decreased ALT level during stress, but it led to an increase in glucose levels and a decrease in blood alkalinity, while the amount of AST decreased by 1.17 times and the amount of LDH decreased by 1.39 times when glycine was used.

Recovery processes after stress under the influence of curglycin and glycine occur intensively in stressed animals with a high level of emotionality.

The influence of emotionality and stress tolerance of experimental animals on stress-protective agents has also been noted in the literature [13, p. 75].

There is evidence in the literature that glycine is very effective in optimizing gamma-glutamyl transpeptidase, aspartate transaminase, tissue fatty acid composition, and alanine transaminase activity. In addition, glycine can alter lipid levels, for example, in chronic alcohol consumption, while maintaining membrane integrity [47, pp. 54-59; 93].

Glycine modulates lipid and lipoprotein levels in rats with alcoholic liver injury [22; 95, p. 25-27] .

Glycine and alanine have been shown to have a functional role in stimulating the expression of genes encoding the synthesis of stress proteins and protecting cells from stress damage [55, p. 39-49].

Glycine regulates metabolism and carries out inhibitory processes in the central nervous system. It blocks the release of adrenaline and noradrenaline (the main stress hormones), cleanses the body of toxins and free radicals that destroy brain tissue cells. Glycine has a protective effect in preventing stress-induced disorders of erythropoiesis and the development of anemia, in mesenteric ischemia and reperfusion injury blood glucose is observed in some diseases alters the transcriptional response to glucocorticoid challenge in the dentate gyrus region of the rat hippocampus. Serum glycine is associated with body fat and reduces lipid peroxidation and microvascular damage [28] .

Analysis of the literature allows to describe the antistress mechanism of glycine . Activation of central inhibitory mechanisms depends not only on the direct effect of glycine, but also on its effects on GABAergic, dopaminergic , and prolactin- restricting mechanisms . Thus, glycine limits the activation of centers that determine the stress response. As a result, the release of releasing

factors that release AKT G is inhibited , the excitation of adrenergic centers is reduced, which prevents the increase in the level of catecholamines and glucocorticoids of glucose and zinc causes stress in the central nervous system [64, p. 91-13]. A combination of glycine and zinc has been shown to be effective in moderating the main manifestations of stress and anxiety. [38, pp. 89-61].

Glycine , together with gamma-aminobutyric acid (GABA) , regulates physiological inhibitory processes in the central nervous system by increasing transmembrane conductance at specific ligands . The introduction of oxygen ions leads to an increase in inhibitory processes in the neurons of the central nervous system

Zinc is one of the important elements used as a supplement in the treatment of many diseases. Fourteen days of zinc administration was effective in preventing lipid peroxidation in normal albino rats.

The short-term effects of alcohol on some biochemical parameters and antioxidant enzymes in albino rats are known from the scientific literature.

It has been studied that zinc sulfate has a positive effect on biochemical and hematological parameters in diabetic and healthy animals [4, p. 38-35].

Based on the results obtained, we can conclude that it is necessary to evaluate the effectiveness of Kurglitsi in preventing stress and effectively treating the resulting changes.

§3.2. Evaluation of the effects of curglycin on physiological parameters of experimental animals under

Alcohol is associated with many neurodegenerative and neuropsychological diseases [83, pp. 33-41].

The influence of zinc compounds on motor activity and behavioral parameters of experimental animals is shown in the literature [31, p. 101].

Antioxidant and antidepressant effects of zinc in rats and its effects on general behavioral parameters are reported in the literature [49].

Testing animals using the forced swim method showed a statistically significant difference in immobilization time for animals receiving the lowest (10 mg/kg) and highest (30 mg/kg) doses of spirit compared to the control group.

On the first day of behavioral testing, there was a tendency for the animals to increase their motor activity at the lowest dose (10 mg/kg), while the next day, at the highest dose (30 mg/kg), a decrease in activity was observed.

In the forced swim test, the behavior of mice can be recognized by the changes caused by zinc deficiency.

Pharmacological studies showed a decrease in the motor activity of animals in zinc deficiency [88, p. 15].

At the same time, in the forced swim test, the concentration of corticosterone in the serum of mice after 2, 4, and 10 weeks of deprivation increased by 11.97 and 22.5%, respectively.

The high level of emotionality in animals subjected to forced swimming experiments increased by 25% when Kurglycin was administered orally at a dose of 5 ml/kg for 14 days and by 45% after 21 days compared to controls.

Curglycin consumption increased by 35% for 14 days and 60% after 21 days in diseased animals with low levels of emotionality.

Table 3.4

Swimming time to exhaustion in rats with high and low emotionality in the forced swimming test (n=6)

Group	Index (M ± m), min.	
	14 days after taking Kurgli ts inni	**21 days after taking Kurgli ts inni**
High level of emotionality	25.0±0.57	29.0±0.57
High level of emotionality	21.0±0.57 ***	25.0±0.79 ***

Note : *- the relative difference in cortisol levels between high and low levels of emotionality is significant (* P < 0.05 ; ** P < 0.01 ; *** P <0.001)

Thus, a high level of emotionality leads to the greatest increase in endurance in the forced swimming test on the 21st day of Kurglicin administration in reconditioned animals (see Table 4.4).

In the rotarod test, post-stress EPD rats showed longer retention times for each rotarod compared to EUD. Administration of 5 ml/kg of Kurglycin

for 14 days and the same dose for 21 days also produced positive results in EPD rats (see Table 4.5).

Thus, our data show that non-stressed animals (EYuD) are more sensitive to Curglycin therapy than stressed animals (EPD).

Table 3.5

Retention times in the rotation of rats with high emotionality and high emotionality (n=6)

Group	Latent time of fall (M ± m), s seconds	
	14 days after taking Kurgli ts inni	**21 days after taking Kurgli ts inni**
High level of emotionality	34.0±0.66 **	33.0±0.77 *
High level of emotionality	46.6±0.69 ***	46.5±1.02 ***

Note : *- the relative difference in cortisol levels between high and low levels of emotionality is significant (* P < 0.05 ; ** P < 0.01 ; *** P <0.001)

The obtained data directly or indirectly confirm the influence of individual typological parameters on the sensitivity of pharmacotherapy with stress-protective drugs. Thus, the introduction of a psychostimulant into the daily diet of female rats during pregnancy showed an improvement in their motor activity by 21.60%.

In the rotating rod test, the mean ejaculation time was significantly (p < 0.05) reduced in male (54.30%) and female (65.93%) animals compared to control animals . However, the addition of spirit significantly increased the mean ejaculation time in animals of both sexes [84, p. 37].

Prenatal administration of lipopolysaccharide-treated female rats prevents the development of neurochemical, behavioral, and biochemical abnormalities in offspring [50 , pp. 43-49].

Curcumin has also been shown to be very useful in improving or preventing movement disorders that occur in Parkinson's disease [80, p. 73] .

A new curcumin oil solution may better alleviate motor deficits and neuropathological damage in a mouse model of Parkinson's disease [34, p. 25] .

glycine and the compound glycine have been studied . Glycine , along with gamma- aminobutyric acid (GABA) , has been shown to be a major mediator

Glycine and psyllium are also among the most important elements in correcting post - stress dysfunction of the central nervous system .

Anti-stress drugs, unlike drugs that are tropic for certain functions of the body , do not have a permanent effect on certain organs or functional metabolic processes. Their action is aimed at limiting the negative impact of negative factors of various nature on the body.

Since the stress response is a general response of the whole organism, the protective effect of pharmacological agents can only be assessed at a systemic level .

Glycine and zinc are important elements in correcting post - stress dysfunction of the central nervous system .

Glycine , along with GABA, has been shown to be a major mediator regulating physiological inhibitory processes in the central nervous system by increasing the transmembrane conductance of specific ligand - gated chloride channels .

uric acid ions can enhance the opening of these receptors by increasing their affinity for glycine , which leads to an increase in inhibitory processes in neurons of the central nervous system and reduces the biochemical reactions of the body caused by chronic fatigue .

A new animal model study suggests that curcumin could be used to treat cognitive decline.

Kurgli ts was administered orally to experimental animals in the form of a 3% suspension at 5 ml/kg body weight . The suspension was obtained by dissolving 1 g of the substance in 30 ml of purified water .

The ratio of components in Kurglycin is from the following indicators : zinc - 12.04% , black cumin - 67.68 %, glycine - 13.65 %, water - 6.63% , and after glycine was introduced for pharmacocorrection of stress in the animals of the control group in the amount of 5 ml/kg of dried ts inn at 14 and 21 days , a process of gradual restoration of the functional activity of the liver was observed.

In the blood of stressed animals, ALT, AST, alkaline phosphatase, LD G , high stress level of glucose and decrease of cholesterol level were evaluated.

In animals with a high level of emotionality, the use of curglycine and glycine had almost no effect on the ALT level decreased under stress , but it led to a decrease in the levels of AST, LDH , glucose, and alkaline phosphatase .

Thus, depending on the changes in biochemical parameters, under the influence of kurgli ts in and glycine, taken as a control, recovery processes after stress occur more intensively in stressed animals with a high level of emotion.

with a high level of emotionality, in the forced swim test, the forced swim time to exhaustion increased by 25% and 45% after 21 days, compared to the control, after oral administration of 14 ml/kg of curdled tsin .

High level of emotionality It was observed that physical activity increased by 35% and 60% after 21 days by taking curdled tsin for 14 days in animals with

Thus, in animals with low levels of emotionality, kurglycine caused the greatest increase in endurance in the forced rotarod test, rats with low levels of emotionality showed longer retention times on the rotarod compared to rats with high levels of emotionality after stress. After 14 and 21 days of oral

administration of curglycine at a dose of 5 ml/kg, rats with low levels of emotionality showed better retention results on the rotarod.

Thus, the data obtained indicate that curglycin can be used for pharmacocorrection of post-stress disorders, and that stress-resistant animals showed greater efficacy in treatment with curglycin than stress-resistant animals.

CONCLUSION

One of the urgent directions in our country is to protect and strengthen the health of the population, reduce the spread of diseases, reduce the harmful effects of environmental factors, and extend life expectancy. In this regard, great attention is paid to increasing the number of local pharmaceutical enterprises and the production of medicines.

The study of the mechanisms of individual typological characteristics of the response of the central nervous system of humans and animals to the effects of environmental factors is one of the most pressing problems in biomedical science.

According to data obtained in recent decades, tolerance to the effects of physical and emotional stressors is determined by an individual's set of stress defense mechanisms.

Stress primarily affects the nervous system. Individual typological characteristics are the main signs of nervous processes. They leave their mark on a person's professional activity in any field. Stress, especially professional stress, is an integral part of any professional activity and interpersonal communication.

In this study, animals were divided into groups with high and low levels of emotionality, which allowed conclusions to be drawn about their stress tolerance.

Individual typological indicators of experimental animals have been shown to have a significant impact on the course of the stress reaction and their resistance to stress. Animals with high and low emotionality showed different reactions to both stressors and pharmacological correction.

During stress, animals that respond to different types of stress have different levels of activity of the hypothalamic-pituitary-adrenal system, which reflects the level of stress hormones (cortisol, adrenaline) . In animals with an active type of stress reaction to an unfavorable situation, the predominance of the sympathoadrenal system is expressed, with its activation leading to the

release of adrenaline. In animals, for example, in rats with a passive-defensive reaction, it is activated in response to stress, with the release of corticosterone.

The acute impact of adverse environmental factors on the body of warm-blooded animals and humans causes a stereotypical metabolic response, manifested by hyperglycemia, accumulation of ketone bodies in the blood, secondary hyperlipidemia, increased lipolysis, glycogenolysis, gluconeogenesis, and increased oxygen consumption.

A study by Russian researchers found that acute immobilization decreased glucose absorption, and they confirmed this with chronic daily one-hour immobilization [10, p.].

Within 7 days after the experiment, stress significantly changes the dynamics of the assimilation process and proved that stress modulates the main processes in the transfer of glucose from the intestinal cavity to the internal part [10, p.].

At the same time, the facts obtained by the researchers indicate the need to correct the studied process of absorption of substances in the gastrointestinal tract with drugs, since states of varying degrees of stress are often encountered in the body of animals. In our studies, the above studies were confirmed, and in our experiments, when studying changes in blood glucose concentration, we achieved a positive effect when using corglycine and glycine.

The described shifts are usually considered to be a reflection of a chronic (hypercatabolic, caloric) adaptation strategy or stress-induced diabetes. This version of the adaptation strategy is mainly carried out by activating β-adrenergic receptors and increasing the production of glucocorticoids by the adrenal glands.

Emotional stress is a pathological process that accompanies the general reaction to acute stress and is associated with changes in the concentration of stress hormones. According to Russian authors, during the acute period, stress

in the brain, increased concentration of cortisol in venous blood, is directly related to the severity of the disease.

In experimental studies, a number of authors showed that rats with low resistance to stress are more prone to bilateral cerebral ischemia.

Compared with stress-tolerant animals, the common carotid arteries were more constricted, indicating the important role of stress hormones and their role in the pathogenesis of a number of stress-related diseases.

The stress experiment showed that, compared to Glycine, the use of Kurglycin on days 14 and 21 of the experiment had a positive effect, which was manifested in the form of a decrease in serum creatinine during high emotional stress.

The activity of ALT and AST depends on the nature of the stressor and the corrective drugs we used. In our studies, Glycine had a positive effect on these indicators.

In animals with a high level of emotionality, the use of Kurglycin and glycine had almost no effect on the decreased ALT level during stress, but it led to an increase in glucose levels and a decrease in blood alkalinity, while the amount of AST decreased by 1.17 times and the amount of LDH decreased by 1.39 times when glycine was used.

Most researchers point out that the lipid spectrum is considered as a stress factor that affects the prediction of the development of complications of this disease.

In our studies, an increase in cholesterol was observed at low and high emotional stress.

At all stages of the study, the use of Kurglicin achieved a positive effect, manifested by a decrease in the concentration of cortisol in the blood.

Our results show that the maximum catalytic activity of LDH in blood plasma was observed at the last stage of the experiment under the influence of stress factors. This is confirmed by experimental data showing a high level of this enzyme in blood serum. When using curglycine, we observed a similar

decrease in LDH levels on days 14 and 21 of the experiment, while when using glycine, we observed the best LDH index on day 21 of the experiment.

The greatest difference between stress-resistant and stress-tolerant animals was observed in the changes in the effects on LDH, alkaline phosphatase, and cholesterol levels.

We offer Kurglycin drug (glycine, curcumin, zinc) as a stress-protecting antioxidant, cytoprotective and hepatoprotective drug. There are fundamental differences between glycine and zinc in terms of their chemical nature in cells. Glycine is actively involved in many metabolic processes. And zinc It is one of the micronutrients, the level of which is always regulated by the flow of an external source.

In the dynamics of the development of primary stressors, reactions, nervous and humoral physiological mechanisms are involved, then biochemical, morphological, immune, genetic changes, which lead to adaptation mechanisms, which modify and strengthen stress reactions, another level of sanogenesis. As a result of evolution, organisms have acquired different individual sensitivity to the effects of stress factors, which is manifested in the stress tolerance of some functions. However, the general characteristics of stress reactions - correlations, biomarkers - are preserved in all experimental animals.

It is based on the manifestation of dynamic changes in the total protein level during stress. Stressors of various styles can be examined as stress and in our study we can observe an increase in the concentration of total protein in the blood.

When we studied the effects of the drugs used during the study, Kurglycin showed a positive effect throughout the entire experiment, while Glycine showed its effect on the 21st day of the experiment. As for the emotional effect, it is worth emphasizing that Korglycin showed a positive effect.

Analysis of the literature allows us to characterize the antistress mechanism of glycine. The activation of central inhibitory mechanisms is due not only to the direct effect of glycine. Glycine limits the excitation of centers that determine the stress response. As a result, the release of releasing factors that secrete ACTH is inhibited, the excitation of adrenergic centers decreases, which prevents an increase in the level of catecholamines and glucocorticoids. Glycine, together with gamma-aminobutyric acid (GABA), is the main mediator regulating physiological inhibitory processes in the central nervous system by increasing the transmembrane conductivity of chloride channels bound to a specific heteropentameric ligand. The introduction of uric ions can enhance the opening of these receptors by increasing their affinity for glycine, which leads to an increase in inhibitory processes in neurons of the central nervous system. Thus, glycine and rucine are the most important elements involved in the correction of post-stress central nervous system dysfunction.

The daily dose of curcumin sufficient for a patient is 50 mg, the maximum allowed value is 150 mg. The use of higher doses of curcumin requires additional clinical trials of increasing intensity from year to year, for example, phase 1 clinical trials showed that even high doses of curcumin (12 g per day) did not cause any adverse effects.

that pharmacological studies show a decrease in the motor activity of animals with zinc deficiency is presented in a number of scientific publications [88, p .].

The results of the scientific study showed that after 2, 4 and 10 weeks of that the increase was 35% when Kurglycin was administered for 14 days and by 60% after 21 days.

New prospects for preclinical and clinical research have been achieved with the use of Kurglycin and glycine, which are psychotropic drugs with neuroprotective and endothelioprotective properties, as well as behavioral disorders, as well as major results with established structural and pharmacological correction.

Thus, it should be noted that the resulting complex drug, when used separately, helps to solve some problems that arise in the body. The data obtained under experimental conditions show that it opened the prospect of creating new stress-protective agents, taking into account individual typological parameters of stress tolerance/emotionality.

Curglycin is recommended for practical use as a pharmacocorrective agent for stressful conditions.

Kurglycin is a newly developed local drug that has a stress-protective, antioxidant, cytoprotective and hepatoprotective effect, making a practical contribution to the pharmacocorrection of stress , and based on the results of the experiment, it is proposed to conduct clinical trials and subsequently obtain effective results in the treatment of the disease among the population. The obtained scientific results, in turn, demonstrate the effectiveness of new scientific research conducted by local scientists, which is another new achievement in the pharmaceutical industry of our country.

Carbohydrate and lipid metabolism parameters, the content of stress hormones (cortisol) in stress-tolerant and non-stress-tolerant animals under normal conditions and immobilization stress were, and increased consumption of glucose and fats. The greatest difference between stress-tolerant and non-stress-tolerant animals was observed in the levels of LDH, alkaline phosphatase, and cholesterol. Changes in biochemical parameters under the influence of curglycine and glycine, taken as controls, showed that the recovery processes after stress occur more intensively in stressed animals with a high level of sensitivity.

The study of physiological parameters in the forced swimming and rotarod tests showed that treatment with curglycine in stress-tolerant animals (SWA) was evaluated to help the body recover its normal functional parameters more quickly than in animals with low stress tolerance (LSW). The daily dose of curcumin sufficient for a patient is 50 mg, the maximum allowed value is 150 mg. The use of higher doses of curcumin requires additional

clinical trials of increasing intensity from year to year, for example, phase 1 clinical trials showed that even high doses of curcumin (12 g per day) did not cause any adverse effects

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