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"LABORATORY BIOCHEMICAL PARAMETERS AND THEIR IMPACT ON ORGANS AND SYSTEMS IN RATS WITH LOW AND HIGH LEVELS OF EMOTIONAL REACTIVITY"

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Annotation: This scientific article investigates the laboratory characteristics of biochemical parameters in rats with low and high levels of emotional reactivity. Furthermore, it identifies the biochemical properties of hormones, neurotransmitters, neuropeptides, and cytokines secreted during emotional changes in the subjects, while demonstrating their physiological effects on various organs and systems.

Keywords: Organ, System, Hormones, LER (Low Emotional Reactivity), HER (High Emotional Reactivity), Stress, Excretory, Secretory, Metabolism, Reaction, Cortisol, Neurotransmitter, Neuropeptide, Cytokine.

KIRISH: In the modern era, there is a growing interest in the in-depth study of emotional changes and the identification of their specific characteristics. Consequently, in contemporary biomedical research, significant attention is being directed toward emotional reactivity as a crucial factor in maintaining the stability of the organism's internal environment (homeostasis). Individual differences in emotionality levels are reflected not only in the functioning of the central nervous system but also in complex biochemical processes occurring throughout the entire organism. In particular, the distinctions between individuals with low and high levels of emotional reactivity are manifested through stress adaptation mechanisms, hormonal responses, and neurochemical alterations**.**

Experimental models, particularly laboratory rats, play a pivotal role in investigating the physiological and biochemical foundations of emotional states. The response reactions observed in animals with varying levels of emotionality are intrinsically linked to the activity of the **hypothalamic-pituitary-adrenal (HPA) axis** and the **sympathoadrenal system**. In these processes, hormones, neurotransmitters, neuropeptides, and cytokines play a crucial role.

The biologically active substances secreted during emotional arousal exert multifaceted effects on various organs and systems of the organism. Specifically, stress hormones activate metabolic processes, neurotransmitters facilitate signal transmission through the central and peripheral nervous systems, neuropeptides modulate pain sensitivity and behavioral responses, and cytokines regulate immune responses and inflammatory processes. The interaction between these components determines the organism's adaptive capacity.

In this study, the biochemical properties of hormones, neurotransmitters, neuropeptides, and cytokines secreted during emotional changes in rats with low and high levels of emotional reactivity were investigated, and their effects on various organs and systems were analyzed. The findings are of significant importance for gaining a deeper understanding of the biological foundations of emotional reactivity and for elucidating the mechanisms of stress-related pathological conditions.

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Main body: The study was conducted under laboratory conditions using specially maintained albino rats. For the experiment, the animals were divided into two groups based on their level of emotional reactivity:

1. Rats with low emotional reactivity (LER).
2. Rats with high emotional reactivity (HER).

The level of emotionality was assessed using standard behavioral tests, including the **Open Field Test** and the **Elevated Plus Maze (EPM)**. During the experiment, the animals were subjected to short-term stress factors.

Biochemical Analysis: Blood and tissue samples were collected for biochemical evaluation. The following parameters were determined:

- **Hormones:** Cortisol, adrenaline (epinephrine), and noradrenaline (norepinephrine).
- **Neurotransmitters:** Dopamine and serotonin.
- **Neuropeptides:** Endorphins.
- **Cytokines:** Interleukin-6 (IL-6) and Tumor Necrosis Factor-alpha (TNF-α).

The analyses were performed using **Enzyme-Linked Immunosorbent Assay (ELISA)** and spectrophotometric methods. The obtained data were statistically processed, and the differences between the groups were evaluated based on their significance levels.

Laboratory Background on ELISA: ELISA (Enzyme-Linked Immunosorbent Assay) is a highly sensitive laboratory technique used to detect and quantify hormones, cytokines, neuropeptides, and other proteinaceous substances in biological fluids, such as blood serum and plasma.

Principle of the Method

The ELISA is based on the **antigen-antibody reaction**. During the assay, the target substance (antigen) binds to specific antibodies, forming a complex labeled with an enzyme. The enzyme then reacts with a substrate to produce a colored product. The intensity of the color is directly proportional to the concentration of the target substance in the sample.

Assay Procedure (Stages)

1. **Sample Preparation:** Blood samples are centrifuged to separate the serum for further analysis.
2. **Antigen Immobilization:** Antigens or specific capture antibodies are immobilized on the surface of a 96-well microtiter plate.
3. **Antibody Addition:** After adding the sample, the target substance binds to the immobilized antibodies.
4. **Enzyme-Linked Conjugate Addition:** In this stage, the antigen-antibody complex is "labeled" by adding an enzyme-linked conjugate.
5. **Substrate Addition:** A substrate is added, which reacts with the enzyme to produce a measurable color change.
6. **Reading the Results:** The reaction is stopped, and the optical density (OD) is measured using a microplate reader (spectrophotometer) at a specific wavelength.

The intensity of the resulting color is measured using a spectrophotometer (typically at a wavelength of 450 nm). This specific laboratory method enables the precise quantification of hormones and mediators secreted during stress.

We will now examine the effects of these isolated hormones on various organs and organ systems. As is widely established, the organism is regulated through two primary mechanisms: nervous and endocrine regulation. The following table illustrates the physiological impact of increased or decreased secretion of these substances during emotional reactions.

AMERICAN ACADEMIC PUBLISHER
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Table: Physiological effects of biochemical secretions on organ systems in rats with HER and LER

System/Organ	Substances	PER	YER	Effect (physiological result)
1. Nervous System (Central and Peripheral)	Dopamine Serotonin	↑ (stable)	↑/↓ (beqaror)	Regulates behavior, mood, and stress response
2. Cardiovascular System	Adrenaline, Noradrenaline	↑ (medium)	↑↑ (keskin ortadi)	Heart rate increases, blood pressure rises
3. Endocrine System	Cortisol	↑ (under control)	↑↑ (yoqori darajada)	Glucose increases, metabolism accelerates
4. Immune System	IL-6,TNF-a	↔/↑ (light)	↑↑	Inflammatory processes are activated.
5. Respiratory System	Adrenaline	↑	↑↑	Bronchi dilate, breathing accelerates
6. Digestive System	Cortisol, Adrenaline	↓ (light)	↓↓	Digestion slows down
7. Muscular System	Adrenaline	↑	↑↑	Digestion slows down
8. Reproductive System	Cortisol	↔/↓	↓↓	Sexual functions decrease.
9. Excretory System	Cortisol	↑ (light)	↑↑	Water-salt metabolism changes.

Conclusion:

This scientific study conducted a comprehensive analysis of the biochemical changes occurring in rats with low and high levels of emotional reactivity. The research findings indicate that shifts in emotional states are accompanied by significant activation or suppression of hormonal, neurotransmitter, neuropeptide, and cytokine systems within the body.

Specifically, during processes of stress and emotional arousal, an increase in stress hormones such as cortisol and adrenaline was observed, alongside a notable shift in the balance of neurotransmitters like serotonin and dopamine. These changes directly influence central nervous system activity, behavioral reactions, and general adaptive response mechanisms.

Furthermore, variations in the levels of cytokines related to the immune system (e.g., inflammatory mediators) demonstrated the activation or inhibition of inflammatory processes in response to stress. It was also determined that neuropeptides play a crucial regulatory role in modulating emotional responses.

The results obtained clearly demonstrate the differentiation of biochemical responses in organisms with low and high emotionality. This confirms that emotional states are linked to

AMERICAN ACADEMIC PUBLISHER
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profound physiological changes not only at the behavioral level but also at the molecular and cellular levels.

In general, the research findings indicate that emotional reactions are regulated through complex interactions between the body's neuroendocrine and immune systems. Consequently, this study may serve as a significant scientific foundation for future research into stress-related pathological conditions.

REFERENCES

1.Зубков А.Н. Физиология человека и животных. Москва: Мир, 2012.
(Markaziy nerv tizimi, endokrin va stress reaksiyalari bo‘yicha asosiy darslik)
2.Селье Г. Стресс без дистресса. Москва: Прогресс, 1982.
(Stress nazariyasining klassik asoslari)
3.Судаков К.В. Системная организация физиологических функций. Москва: Медицина, 2000.
(Nerv va gormonal tizimlarning integrativ faoliyati)
3.Агаджанян Н.А., Тупицын И.О. Основы физиологии человека. Москва: ГЭОТАР-Медиа, 2015.
(Stress, gormonlar va neyrofiziologik jarayonlar)
4.Каримов М.М. Tibbiy biokimyo asoslari. Toshkent: Ibn Sino nomidagi nashriyot, 2018.
(Biokimyoviy parametrlar va metabolik jarayonlar)
5.Рахимов А.Р. Biologik kimyo va molekulyar biologiya. Toshkent: O‘qituvchi, 2016.
(Neyromediatorlar va hujayra biokimyosi)
6.Курбанов Ш.К., Исмоилов Ж.А. Odam va hayvonlar fiziologiyasi. Toshkent: O‘zbekiston Milliy universiteti nashriyoti, 2019.
(Markaziy Osiyo ta’lim tizimi uchun asosiy fiziologiya manbasi)
7.McEwen B.S. (2007). Physiology and neurobiology of stress and adaptation: Central role of the brain. Physiological Reviews, 87(3), 873–904.
8.Sapolsky R.M. (2004). Why Zebras Don’t Get Ulcers. New York: Holt Paperbacks.
Krukoff T.L. (2015). Stress and the brain: neuroendocrine mechanisms. Journal of Neuroendocrinology, 27(6), 441–452.
9.Porsolt R.D., Anton G., Blavet N., Jalfre M. (1977). Behavioural despair in rats: a new model sensitive to antidepressant treatments. European Journal of Pharmacology, 47(4), 379–391.
10.Carobrez A.P., Bertoglio L.J. (2005). Ethological and temporal analyses of anxiety-like behavior: The elevated plus-maze model. Nature Protocols, 3(9), 1467–1476.
11.McLean J.H., Nakane H. (1974). Periodicity of monoamine oxidase activity in brain and its relation to behavior. Brain Research, 74(1), 1–14.
12.Anisman H., Zacharko R.M. (1992). Depression as a risk factor for immunological disorders. Immunology Today, 13(2), 53–58.
13.Guyton A.C., Hall J.E. (2016). Textbook of Medical Physiology. Elsevier.
14.O‘zbekiston Respublikasi Sog‘liqni saqlash vazirligi (2021). Tibbiy biologiya va fiziologiya asoslari. Toshkent.
15.Toshkent Tibbiyot Akademiyasi (TTA) (2020). Normal va patologik fiziologiya darsligi. Toshkent.
16.O‘zbekiston Milliy universiteti (2022). Biologiya va genetika asoslari. Toshkent.
17.O‘zbekiston Fanlar akademiyasi (2019). Biologik tadqiqotlar va eksperimental tibbiyot ishlari to‘plami. Toshkent.