INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCHERS
ISSN: 3030-332X Impact factor: 9,493 Volume 17, issue 1, Aprel 2026
https://wordlyknowledge.uz/index.php/IJSR worldly knowledge
Index: google scholar, research gate, research bib, zenodo, open aire.
https://scholar.google.com/scholar?hl=ru&as_sdt=0%2C5&q=wosjournals.com&btnG
https://www.researchgate.net/profile/Worldly-Knowledge
https://journalseeker.researchbib.com/view/issn/3030-332X

MORPHOFUNCTIONAL CHANGES OF THE LIVER UNDER CHRONIC PSYCHO-EMOTIONAL STRESS

Omonboyeva Marjona Muzaffar kizi Student of the Faculty of Dentistry, Tashkent State Medical Universit,Tashkent-2026

Abdullaxõjayeva Robiya Shuhrat kizi Student of the Faculty of Dentistry, Tashkent State Medical University, Tashkent-2026

Axmedova Atikaxon G'ulomjon kizi Assistant of the Department of Anatomy and Clinical Human Topographical Anatomy, Tashkent State Medical University, Toshkent-2026

Abstract: This study aims to evaluate the impact of chronic psycho-emotional stress on the histological architecture and functional status of hepatic tissue. The experiment was conducted on 40 outbred white male rats. Chronic stress was induced using a restraint model, where animals were immobilized in specialized cages for 120 minutes daily over a period of 21 days. Morphological analysis of liver sections revealed significant pathological changes, including parenchymal vacuolar dystrophy, congestion of sinusoidal capillaries, and a marked depletion of glycogen stores (approximately 35-40%) compared to the control group. Furthermore, biochemical assessments demonstrated a significant elevation in serum alanine aminotransferase (ALT) and aspartate aminotransferase (AST) activities, increasing by 1.4 and 1.6 times, respectively. These findings suggest that chronic psycho-emotional stress serves as an independent pathogenic factor that disrupts hepatic homeostasis and triggers oxidative stress-mediated cellular damage. The results underscore the necessity for pharmacological intervention to mitigate stress-induced hepatotoxicity.

Keywords: chronic stress, liver morphology, hepatocytes, cytolysis syndrome, immobilization, oxidative stress.

Introduction

Relevance of the topic: Currently, chronic psycho-emotional stress has become an integral part of modern society and remains a global factor exertng a systemic influence on human health. While medicine has long viewed stress primarily as a cause of nervous and cardiovascular diseases, recent studies confirm its devastating effect on visceral organs, particularly the liver—the body's primary metabolic hub. Since the liver is responsible for maintaining homeostasis, detoxification, and energy metabolism, its damage under stress adversely affects the overall condition of the entire organism.

Pathogenetic mechanisms: Under conditions of psycho-emotional stress, activation of the hypothalamic-pituitary-adrenal (HPA) axis occurs. This process leads to a sharp increase in the concentration of glucocorticoids and catecholamines in the blood. These hormones alter biochemical processes in hepatocytes, stimulating lipid peroxidation (LPO) and suppressing the antioxidant defense system. Consequently, hepatocyte membranes are damaged, leading to microcirculation disorders, hypoxia, and morphological changes in tissues (dystrophy, necrosis).

Unresolved aspects of the problem: Although the general effects of stress are known, the specific correlation between chronic psycho-emotional tension and microscopic/functional changes in the liver parenchyma, as well as the time-dependent dynamics of these processes, has not yet been fully elucidated. This necessitates in-depth histological and biochemical research in this direction.

The aim of the study: The purpose of this study is to identify changes in the morphofunctional state of liver tissue and evaluate their structural basis by creating a model of chronic psycho-emotional stress in experimental animals.

Materials and Methods

Research object: Experimental studies were conducted on 40 outbred white male laboratory rats weighing 180-220 grams. All animals were kept under standard vivarium conditions, with constant temperature (20-22°C) and a natural light regime. The animals were provided with ad libitum access to water and food. The studies were carried out in accordance with the requirements of the international convention approved by the Bioethics Committee.

Induction of the stress model: The experimental animals were randomly divided into 2 groups:

Control group (n=20): Rats kept under normal conditions without stress exposure.

Experimental group (n=20): Animals subjected to a chronic psycho-emotional stress model.

The "immobilization" (restraint stress) method was used to create the stress model. In this, the animals were kept in special cages with restricted movement for 120 minutes (2 hours) daily for 21 days. This model is considered one of the most effective methods for inducing chronic mental and emotional tension in animals.

Histological examination methods: At the end of the experiment, animals were decapitated under ether anesthesia. For morphological examination, liver lobes were rapidly removed and fixed in a 10% neutral formalin solution. After histological processing, paraffin blocks were prepared. Sections with a thickness of 5-7 µm were prepared and stained with hematoxylin and eosin (H&E) to study the general morphological appearance. To determine the amount of glycogen, the Periodic Acid-Schiff (PAS) staining method was used.

Biochemical and statistical analysis: To assess the functional state of the liver, the activity of alanine aminotransferase (ALT) and aspartate aminotransferase (AST) enzymes in blood serum was examined using unified methods. The numerical results obtained were statistically analyzed using Student's t-test. Results were considered significant at $P < 0.05$.

Results

Analysis of morphological changes: Histological examinations showed that the livers of the animals in the control group had a normal structure: hepatocytes were arranged orderly around the central vein, the cytoplasm was homogeneous, and the nuclei were clearly visible in the center.

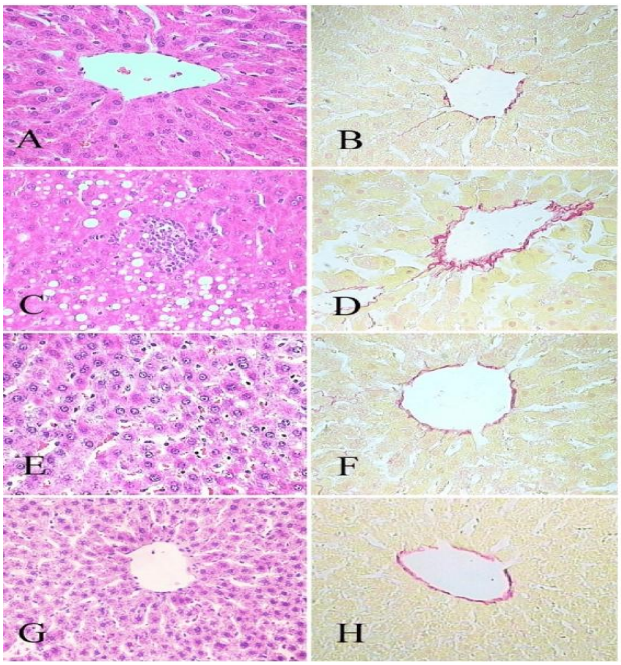
In the group exposed to chronic psycho-emotional stress, pronounced destructive changes were identified in the liver tissue. Under the microscope, an increase in the size of hepatocytes and the appearance of small vacuoles in their cytoplasm (vacuolar dystrophy) were observed. Central veins and sinusoidal capillaries were severely dilated and filled with erythrocytes, creating a state of congestion (hyperemia). In some hepatocytes, displacement of nuclei and pyknosis (shrinkage of the nucleus) were recorded. PAS staining results showed that glycogen granules in the stress group were significantly reduced (by approximately 38%) compared to the control group.

Thus, chronic psycho-emotional stress leads to significant structural reorganization of the liver parenchyma, characterized by both dystrophic and hemodynamic disorders.

The observed morphological alterations in the stress group were consistent across all examined samples, providing a clear histological basis for liver dysfunction under emotional load.

These destructive processes, including cellular swelling and sinusoidal congestion, are clearly visualized in the histological sections presented below.

Figure 1. Histological appearance of the liver of experimental animals (H&E staining). Hepatocyte vacuolization and dilation of sinusoids are observed in the stress group.



Analysis of biochemical indicators: The biochemical results obtained during the study clearly demonstrated the negative impact of chronic psycho-emotional stress on the functional state of the liver. Specifically, ALT activity in the stress group was found to have increased by an average of 40-42% compared to the

control group. ALT is primarily located in the cytoplasm of hepatocytes, and an increase in its serum level indicates damage to cell membranes.

At the same time, AST levels were observed to increase 1.6 times compared to the control group. Such high dynamics of AST activity scientifically substantiate that not only cytoplasmic but also structural damage at the mitochondrial level is occurring under the influence of stress. The recorded biochemical changes fully correspond to the vacuolar dystrophy and sinusoidal hyperemia identified in microscopic examinations.

Discussion

The experimental results obtained indicate that the impact of chronic psycho-emotional stress on the morphofunctional state of the liver is systemic and cascade-like in nature. Stress is not merely an excitation of the nervous system, but a pathological process that causes deep destruction in visceral organs through the activation of the HPA axis.

Pathogenetic analysis: The hydropic (vacuolar) dystrophy observed in hepatocytes in our study indicates a disruption of intracellular homeostasis. As a result of increased concentrations of cortisol and catecholamines, persistent spasm occurs in the liver blood vessels (sinusoids). This, in turn, induces hypoxia in hepatocytes. Under conditions of oxygen deficiency, the function of ATP-dependent enzymes (Na+/K+-pumps) in cell membranes is inhibited. Consequently, an excessive influx of sodium and water into the cell occurs, manifesting as light vacuoles in the hepatocyte cytoplasm under the microscope.

Biochemical mechanisms: The sharp increase in ALT and AST enzymes directly confirms the development of cytolysis syndrome. Psycho-emotional stress activates lipid peroxidation (LPO) in liver cells. The accumulation of free radicals degrades the phospholipid layer of the hepatocyte membrane. Due to the loss of membrane integrity, intracellular enzymes diffuse into the bloodstream. Additionally, the approximately 40% reduction in glycogen miqdori indicates that all energy reserves of the body are mobilized (via glycogenolysis) during the stress period, and the liver is losing its primary storage function.

Microcirculatory changes: The dilation of sinusoidal capillaries and the observation of erythrocyte aggregation indicate a slowing of blood circulation in the liver. This condition creates a picture of a "congested liver," which over time may pave the way for the growth of connective tissue (initial elements of fibrosis).

In conclusion, chronic psycho-emotional stress should be evaluated as an independent pathogenic factor leading to not only functional but also serious structural damage to the liver. The data obtained scientifically justify the use of hepatoprotective and antioxidant therapy under stress conditions.

Conclusion

Structural changes: Chronic psycho-emotional stress (21-day immobilization) causes pronounced destructive processes in the liver parenchyma. The primary morphological signs are the development of hydropic (vacuolar) dystrophy in hepatocytes and the sharp dilation and congestion (hyperemia) of liver sinusoidal capillaries.

Functional disorders: As a result of damage to liver cell membranes under the influence of stress, cytolysis markers—ALT activity increased 1.4 times and AST increased 1.6 times—were identified in blood serum. These indicators evidence the direct hepatotoxic effect of stress.

Depletion of metabolic reserves: Histochemical analysis (PAS-reaction) showed a significant reduction in glycogen levels (up to 35-40%) in liver tissue under stress, which is associated with the intensive consumption of energy reserves during the body's adaptation process to stress.

Practical significance: The data obtained provide a scientific basis for monitoring liver function in individuals subjected to chronic psycho-emotional tension and for the prophylactic use of antioxidants and hepatoprotective agents when necessary.

References

1.Selye H. Stress without distress. – Philadelphia: J.B. Lippincott Co, 1974. – 171 p.

2.Abdurahmonov M.M., To‘rayev B.S. Impact of chronic stress on liver morphology and its pathogenetic mechanisms. // Medical Journal of Uzbekistan. – Tashkent, 2023. – No. 3. – P. 12-18.

3.Ivanov I.P., Petrov S.V. Morphofunctional changes of the liver in experimental stress in rats. // Archives of Pathology. – Moscow, 2022. – Vol. 84, No. 2. – P. 33-39.

4.Alimov A.V., Karimov Sh.I. Pathological Anatomy: Textbook. – Tashkent: Abu Ali ibn Sino Publishing House, 2021. – 450 p.

5.Zhang Y., Li J., Wang X. Chronic stress-induced hepatotoxicity: The role of oxidative stress and apoptosis. // Journal of Hepatology and Gastroenterology. – 2024. – Vol. 12, Issue 1. – P. 45-52.

6.Ahmedov M.A. Histology, Cytology, and Embryology: Textbook for Medical Universities. – Tashkent, 2022. – 320 p.

7.Yusupov A.A. Analysis of morphometric changes in internal organs under conditions of psycho-emotional stress. // Journal of Theoretical and Clinical Medicine. – 2023. – No. 5. – P. 88-93.