

## **MORPHOFUNCTIONAL CHANGES OF THE LIVER IN CONDITIONS OF HYPODYNAMIA**

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### Annotation

This study investigates the morphological and functional changes in liver tissue under conditions of hypodynamia (physical inactivity). The aim was to determine the effects of prolonged physical inactivity on the structure of hepatocytes, blood circulation, and liver function. Hypodynamia significantly affects metabolism, blood circulation, and redox processes in the body, leading to pathological alterations in the hepatic parenchyma.

### Introduction

The liver is one of the most important metabolic organs in humans and animals, performing protein, fat, and carbohydrate metabolism, detoxification, and storage functions. Prolonged hypodynamia leads to a decrease in blood circulation, hypoxia, and disturbances in lipid metabolism, which cause dystrophic changes in the liver. Therefore, studying morphofunctional alterations in hepatocytes under conditions of hypodynamia is essential for understanding adaptive mechanisms in such conditions.

### Materials and Methods

The research was conducted on white laboratory rats weighing 180–200 g. The animals were divided into two groups: 1) Control group – animals with free movement; 2) Experimental group – animals kept under hypodynamic conditions for 7, 14, and 21 days. At the end of each period, liver samples were taken and fixed in 10% neutral formalin, embedded in paraffin, and sectioned at 5 µm. The sections were stained with hematoxylin and eosin (H&E), PAS reaction, and Sudan

III stains. Microscopic analysis was performed using a Leica light microscope. Morphometric parameters such as hepatocyte diameter, sinusoidal width, and central vein diameter were measured.

### Results

Under hypodynamic conditions, the following changes were observed in the liver tissue:

- After 7 days of hypodynamia: hepatocytes showed nuclear condensation and cytoplasmic vacuolization. Sinusoids were narrowed and poorly filled with blood.
- After 14 days: signs of fatty degeneration appeared; small lipid droplets accumulated in the cytoplasm. Blood stasis was observed around central veins.
- After 21 days: marked dystrophic changes developed; hepatocytes had pyknotic nuclei, mitochondrial damage, and focal necrosis. Sinusoids were dilated and filled with stagnant blood.

Biochemical analysis showed an increase in liver enzyme activity (ALT, AST), indicating hepatocellular injury. The glycogen content decreased, while lipid accumulation increased. These changes were associated with intensified oxidative stress in hepatocytes.

### Discussion

During hypodynamia, reduced blood flow leads to oxygen deficiency in the hepatic parenchyma, causing disturbances in energy metabolism. As a result, lipids accumulate in hepatocytes, mitochondrial activity decreases, and cell membranes are damaged. These processes cause a decline in liver function, impairment of detoxification ability, and disruption of the redox balance. The longer the period of hypodynamia, the more irreversible these morphological changes become.

### Conclusion

Hypodynamia induces profound morphofunctional changes in liver tissue characterized by:

- fatty degeneration and vacuolization of hepatocytes;
- narrowing of sinusoids and blood stasis in central veins;
- increased activity of liver enzymes;

- decreased glycogen content.

These alterations are directly related to hypoxia, circulatory disturbance, and metabolic imbalance resulting from hypodynamia. The results demonstrate that restricted physical activity adversely affects liver function and, if prolonged, leads to pathological liver conditions.

**Keywords**

Hypodynamia, liver, hepatocyte, dystrophic changes, histology, morphometry, fatty degeneration, liver enzymes, hypoxia.

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