AMERICAN JOURNAL OF APPLIED MEDICAL SCIENCE
ISSN: 2996-5101 (online) | ResearchBib (IF) = 10.81 IMPACT FACTOR
Volume-4| Issue-5| 2026 Published: |30-05-2026

INTERRELATIONSHIP BETWEEN MORPHOLOGICAL CHANGES IN THE LIVER AND BIOCHEMICAL INDICATORS OF BLOOD UNDER THE INFLUENCE OF GENETICALLY MODIFIED SOYA.

https://doi.org/10.5281/zenodo.20107893

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Annotation

When assessing the effect of genetically modified products on the body, it is not enough to analyze only morphological or only biochemical indicators separately. This study is aimed at determining the relationship between morphological changes in liver tissue and biochemical markers in the blood against the background of consuming genetically modified soybeans. The experiments were conducted on white outbred rats, and a comparative and correlation analysis of the histological state of the liver, the degree of dystrophy of hepatocytes, and the content of ALT and AST enzymes was carried out. The obtained results showed a direct correlation between the severity of morphological lesions and the increase in the level of liver enzymes.

Keywords

gen-modified soy, liver, morphology, ALT, AST, correlation, biochemical indicators.

Input

In modern toxicology and experimental morphology, a comprehensive approach to assessing organ and system damage is of great importance. In recent years, when studying the effects of genetically modified products on the body, along with morphological changes, the analysis of functional indicators has become a pressing issue [6,12,15].

The liver, as the central organ of the hepatobiliary system, plays a leading role in detoxification, protein, fat, and carbohydrate metabolism in the body[3,7,13,19]. Therefore, the effects of toxic or potentially dangerous substances are primarily manifested in the state of liver cells and the level of liver enzymes in the blood [2,11,17,21,25].

ALT and AST enzymes are the main biochemical markers of liver cell cytolysis, the increase of which is often accompanied by morphological damage[5,10,18,26]. However, the degree and features of this relationship under the influence of genetically modified products have not been sufficiently

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studied[1,8,14,22,23,24,28]. In this regard, determining the relationship between liver morphology and biochemical parameters against the background of consuming genetically modified soybeans is of scientific and practical importance[4,9,16,20,27,29].

Materials and methods

90 white outbred male rats weighing 160-180 g were involved in the study. The animals were divided into three groups:

- **Control group (n=30)** - fed a standard diet;
- **Experimental group I (n=30)** - gene-modified soybeans were added to the diet;
- **Experimental group II (n=30)** - genetically modified shade was given for a long time.

At the end of the experiment, the animals were decapitated in accordance with ethical norms. Liver tissue was taken for histological examination, and sections stained with hematoxylin-eosin were prepared.

Morphological assessment assessed the degree of edema of hepatocytes, vacuolization, fatty dystrophy, and microcirculatory disorders based on percentage indicators.

In the biochemical analysis, the levels of ALT and AST in the blood were determined, and the results were expressed as an average value ± standard deviation. The relationship between morphological and biochemical indicators was assessed using correlation analysis. Statistical significance was taken as $p<0.05$.

Results

Degree of morphological liver damage

In the control group, liver tissue had a normal histological structure, and dystrophic changes were noted to a minimal extent. In the experimental groups, diffuse dystrophic changes in the liver parenchyma prevailed.

According to the results of morphometric analysis, the proportion of dystrophically altered hepatocytes in the control group was 5.8±1.0%, while in the experimental group I it increased to 27.9±2.3%, and in the experimental group II to 43.2±3.6%.

Table 1. Degree of dystrophic changes in hepatocytes (%)

Group	Dystrophic hepatocytes
Control	5.8 ± 1.0
Experiment I	27.9 ± 2.3*
Experiment II	43.2 ± 3.6*

* $p<0.05$ - significant difference compared to the control group

Changes in biochemical parameters

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Analysis of liver enzymes in the blood showed significant changes in the experimental groups. The ALT level in the control group was 41.8±3.0 IU/l, while in the experimental group I it reached 67.2±4.1 IU/l, and in the experimental group II it reached 83.5±5.4 IU/l.

The AST indicator also showed similar dynamics, increasing from 38.6±2.7 IU/l to 59.4±3.8 IU/l and 74.1±4.9 IU/l, respectively.

Table 2. Blood ALT and AST levels (IU/l)

Group	ALT	AST
Control	41.8 ± 3.0	38.6 ± 2.7
Experiment I	67.2 ± 4.1*	59.4 ± 3.8*
Experiment II	83.5 ± 5.4*	74.1 ± 4.9*

* p<0.05 - significant difference compared to the control group

Correlation and diagrammatic analysis

The results of the correlation analysis revealed a strong positive correlation between the proportion of dystrophic changes in hepatocytes and the level of ALT (r=0.82), and with the level of AST (r=0.79).

Diagram analysis (Diagram 1) clearly showed a proportional increase in the level of liver enzymes with an increase in the degree of morphological damage. This confirms the morphological and functional harmony of liver cell damage.

Discussion

The obtained results show that genetically modified soybeans cause not only structural damage to liver cells, but also functional disorders. Increased fatty dystrophy and vacuolization in hepatocytes are explained by damage to cell membranes and the release of enzymes into the bloodstream.

An increase in the level of ALT and AST is a biochemical expression of liver cytolysis, and it has been established that the amount of these enzymes increases with the deepening of morphological changes. This relationship indicates the need for a comprehensive approach to assessing the hepatotoxic effect of genetically modified products.

Conclusion

The consumption of genetically modified soy leads to the development of diffuse dystrophic changes in the liver tissue of white outbred rats, and these changes are directly related to an increase in ALT and AST levels in the blood. A strong correlation between the degree of morphological damage and biochemical markers reliably confirms the hepatotoxic effect of genetically modified soybeans. The obtained results substantiate the importance of a joint analysis of liver

morphology and functional indicators when assessing the medical and biological safety of genetically modified products.

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