MORPHOLOGICAL EFFECTS OF GENETICALLY MODIFIED SHADE ON THE PANCREAS IN THE EXPERIMENT

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Annotation: *The widespread consumption of genetically modified products requires a thorough study of their effects on the digestive system, in particular on the pancreas. The purpose of this study is to identify morphological changes developing in the pancreas as a result of consuming genetically modified soybeans, to assess their degree, and to analyze their relationship with metabolic processes. The experiments were conducted on white outbred rats, and the macroscopic and histological structure of the pancreas, secretory activity, and pathological changes were quantitatively assessed. The obtained results showed that genetically modified soy leads to the development of hypertrophy, hyperplasia, secretory overload, and microcirculatory disorders in the pancreas.*

Keywords: *gen-modified shade, pancreas, pancreas, hypertrophy, hyperplasia, morphology.*

INPUT

The expansion of the use of genetically modified products in the modern food industry necessitates a comprehensive assessment of their long-term impact on the body [6,12,15]. Although most studies are devoted to the effects of genetically modified products on the liver and kidneys, the role of the pancreas in these processes has not been sufficiently covered [2,11,17,21].

The pancreas is a central organ in digestion and carbohydrate metabolism, and its exocrine and endocrine functions ensure the overall metabolic balance of the body [5,10,18]. Changes in diet composition, especially genetically modified products, can cause stress and adaptation reactions in gland function [1,8,14,22].

The protein and biologically active compounds contained in genetically modified soybeans are perceived by the body as a "new" substance, which increases the likelihood of increasing secretory activity in the pancreas and subsequently leading to structural changes [3,7,13,19]. Therefore, this study was aimed at an in-depth study of the morphological changes occurring in the pancreas on an experimental model [4,9,16,20].

Materials and methods

The study used 90 white outbred male rats with a body weight of 160-180 g. 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 for a short period of time;
- Experimental group II (n=30) - genetically modified shade was given for a long time.

At the end of the experiment, the animals were decapitated, observing ethical rules. The pancreas was macroscopically evaluated, and its size, color, consistency, and surface condition were recorded.

For histological examination, glandular tissue was fixed using the standard method, and sections stained with hematoxylin-eosin were prepared. Microscopic analysis assessed the state of acinar cells, the density of secretory granules, changes in the stroma, and the state of microcirculation.

The results of morphometric assessment were expressed in percentages, statistical significance was taken at the level of $p<0.05$.

Results

Macroscopic changes of pancreas

In the control group, the pancreas was of normal size and pale pink color, with a uniform consistency. In animals that consumed genetically modified soybeans, an increase in the size of the gland, a darker color, and in some cases, dilation of superficial blood vessels were observed.

The relative mass of the gland in experimental group I increased by an average of 18.4% compared to the control group, and in experimental group II by 29.7%.

Histological changes

Microscopic examinations revealed pronounced morphological changes in the pancreas. In the experimental groups, signs of enlargement of acinar cells, proliferation of secretory granules in the cytoplasm, and edema in the stroma of the gland were revealed.

In animals that received genetically modified soybeans for a long time, violations of the acinar structure, dilation of intercellular spaces, and zones of microhemorrhage were observed. In some areas, signs of hyperplasia were detected and assessed as a compensatory reaction of the glandular tissue.

Morphometric analysis

According to the results of quantitative assessment, signs of secretory overload (enlargement of acinar cells and granulation) in the control group amounted to 7.1±1.3%, while in the experimental group I it increased to 32.6±2.8%, and in the experimental group II to 46.9±3.5%.

Table 1. Signs of secretory tension in the pancreas (%)

Group	Secretory strain
Control	7.1 ± 1.3
Experiment I	32.6 ± 2.8*
Experiment II	46.9 ± 3.5*

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

Discussion

The obtained results show that genetically modified soybeans cause the development of functional, and then structural, changes in the pancreas. Hypertrophy and hyperplasia of the gland can develop as a compensatory adaptation mechanism and, with prolonged exposure, transition into a pathological process.

An increase in secretory granules indicates that the gland is working under excessive load. The appearance of microcirculatory disorders and hemorrhage zones reflects the advanced stage of metabolic stress. These changes are consistent with the experimental data presented in the literature and indicate the pancreatototoxic potential of genetically modified products.

Conclusion

The consumption of genetically modified soy leads to the development of significant morphological changes in the pancreas in white outbred rats. Glandular hypertrophy, hyperplasia, secretory strain, and microcirculatory disorders indicate the negative effect of genetically modified soybeans on the pancreas.

The degree of these changes increases with increasing consumption time and justifies the need to consider the condition of the pancreas as an important prognostic criterion in assessing the medical and biological safety of genetically modified products.

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