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FEATURES OF THE HISTOLOGICAL STRUCTURE OF THE WHITE PULP OF THE RAT
SPLEEN UNDER THE INFLUENCE OF A GENETICALLY MODIFIED PRODUCT

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✓ *Resume,*

In an experiment on 120 white mongrel male rats of three age periods (puberty, reproductive and pronounced senile changes), using histological and morphometric methods, followed by statistical analysis, it was found that the experimental introduction of a genetically modified product (GMP) causes morphological rearrangement of the spleen of animals, manifested in hypoplasia of the white pulp. The highest level of spleen reactivity in response to the introduction of genetically modified soy is observed in animals during puberty. Changes in the white pulp of the spleen of rats during the period of pronounced senile changes occur against the background of involutive processes.

Key words: rats, spleen, white pulp, genetically modified product.

ОСОБЕННОСТИ ГИСТОЛОГИЧЕСКОГО СТРОЕНИЯ БЕЛОЙ ПУЛЬПЫ
СЕЛЕЗЕНКИ КРЫС ПРИ ВВЕДЕНИИ ГЕННО-МОДИФИЦИРОВАННОГО ПРОДУКТА

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В эксперименте на 120 белых беспородных крысах-самцах трех возрастных периодов (полового созревания, репродуктивного и выраженных старческих изменений) с применением гистологических и морфометрических методов с последующим статистическим анализом установлено, что экспериментальное введение генно-модифицированного-продукта вызывает морфологическую перестройку селезенки животных, проявляющуюся в гипоплазии белой пульпы. Наиболее высокий уровень реактивности селезенки в ответ на введение генно-модифицированной сои наблюдается у животных периода полового созревания. Изменения белой пульпы селезенки крыс периода выраженных старческих изменений протекают на фоне инволютивных процессов.

Ключевые слова: крысы, селезенка, белая пульпа, генно-модифицированный продукт.

ГМО МАҲСУЛОТИ ТАЪСИРИДА КАЛАМУШ ТАЛОҒИ ОҚ ПУЛПАСИНИНГ
ГИСТОЛОГИК ТУЗИЛИШИ ХУСУСИЯТЛАРИ

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Тадқиқотда уч ёш даврлари (балогат, репродуктив ва қарилик) даги 120 оқ эркак каламуш гистологик ва морфометрик усуллар ёрдамида статистик таҳлил ўтказилиб, гени ўзгартирилган маҳсулот экспериментал ҳайвонлар талогидида морфологик ўзгаришлар кузатилиб, оқулна гипоплазиясига сабаб бўлади, деб топилди. гени ўзгартирилган маҳсулот киритилишига жавобан талоқ реактивлигининг энг юқори даражаси балогат давридаги ҳайвонларда кузатилди. Каламуш талогининг оқ пулпасида яққол сезиладиган ўзгаришлар қарилик даврида инволютив жараёнлар фонида рўй берди.

Калит сўзлар: каламуш, талоқ, оқ пулпа, гени ўзгартирилган маҳсулот.

Introduction

The influence of various pathogenic factors on human health leads to morphological changes in the tissues, disruption of the function of individual

organs, and in particularly severe cases, the entire body as a whole. The immune system of humans and animals is one of the most sensitive systems of

the body, which quickly reacts to external influences [1,9]. All this forces scientists to pay close attention to the organs of immunogenesis that provide the body's defense mechanisms. The spleen, in response to the effects of various pathogenic agents, forms a generalized immune response that ensures the maintenance of immune homeostasis and the necessary level of adaptive potential of the body [1, 3, 5].

Genetically modified products widely used in food products are associated with the development of complications associated with a damaging effect on various organs and tissues, in particular, on the organs of the immune system [2]. Despite the presence of numerous modern studies on the structure of the spleen under the influence of external factors [3, 5, 7, 13], the issues of morphofunctional changes in the lymphoid formations of the spleen in the age aspect remain insufficiently studied. The aim of the work was to study the features of the histological structure of the white pulp of the spleen of white mongrel male rats in different periods of postnatal ontogenesis when introducing a genetically modified product.

Materials and methods

The material for the study was 120 white mongrel male rats of three age periods: puberty (weighing 30-60 g), reproductive (120-160 g) and the period of pronounced senile changes (300-330 g), obtained from the vivarium of laboratory animals "Bukhara State Medical Institute". The experimental animals were included in the general-purpose diet of genetically modified soy, in a dosage of 20-30 mg/kg of body weight. Rats of different age periods were divided into 5 groups, depending on the duration of observation, with 6 individuals in each group. The animals were withdrawn from the experiment in the newborn, 6, 16, 30 and 60 days after the end of the drug administration. The control consisted of rats kept under normal vivarium conditions, which were injected with saline solution in equivalent volumes in accordance with the experimental scheme. The animals were kept and manipulated in accordance with the basic ethical principles in the field of bioethics and on the basis of the meeting of the Ethical Committee of the Ministry of Health of the Republic of Uzbekistan No. 4/17-1442 of

21.09.2020 [11]. Fragments of the spleen were fixed in Buena fluid, paraffin sections 4-6 microns thick were stained with hematoxylin-eosin and azur II-eosin.

Histological and morphometric studies were performed using an image analyzer with an eyepiece micrometer DN-107T / Model CM001 CYAN cope (Belgium) and a personal computer. At the same time, the relative area of the white pulp (in%), the diameters of the lymph nodes (in microns), the germinal centers (in microns), the width of the mantle zone (in microns), and the marginal zone (in microns) of the lymph nodes were determined on the frontal sections of the spleen made at the level of its gate. Statistical processing of the research data was carried out using a package of applied statistical programs directly from the general data matrix "Excel 7.0" using the capabilities of the program "STTGRAPH 5.1", the indicators of standard deviation and representativeness errors were determined. When organizing and conducting research, the principles of evidence-based medicine were observed. The significance of the differences in the mean values was determined by the Student-Fisher criterion at $p < 0.05$.

Results and discussion

The study of histological preparations of the spleen of rats of the control group allowed us to establish certain relationships between its structures - non-functional zones. The spleen of animals has a well-defined connective tissue capsule and trabeculae containing blood vessels. The organ parenchyma is represented by red and white pulp. The red pulp consists of sinusoid capillaries and splenic cords. The white pulp consists of numerous lymph nodes and periarterial lymphoid couplings. Morphometric parameters of the white pulp of the spleen of animals of the control group are presented in Table 1. The

data obtained on the main morphometric features of the red and white pulp of the spleen of rats of the control group correspond to and supplement the literature data on the structure of the organ in intact animals [4, 10].

Table 1-Morphometric parameters of the white pulp of the spleen of white mongrel male rats of the control group (M+m, n=20)

Indicators	Groups of animals according to age periods		
	Puberty	Reproductive	SenileChanges
Cross-sectional area of the white pulp of the spleen (%)	20,6±1,8	19,5±1,4	12,7±1,2
Diameter of the lymph nodes (in microns)	389,5±13,3	420,2±10,8	418,6±6,7

Diameter of the hermenative centers (in microns)	120,9 \pm 6,7	132,6 \pm 1,9	125,4 \pm 3,8
Width of the mantle zone (in microns)	42,7 \pm 2,5	43,6 \pm 1,8	40,2 \pm 1,4
Width of the marginal zone (in microns)	76,3 \pm 3,8	80,4 \pm 1,2	77,6 \pm 5,6
Width of the periarterial zone (in microns)	79,6 \pm 1,9	84,5 \pm 1,4	80,1 \pm 2,5

In puberty rats, after the introduction of genetically modified soy, the spleen retains its typical structure. The white pulp is represented by periarterial lymphoid couplings and rather large lymph nodes, occasionally containing germinative centers.

The introduction of genetically modified soy is accompanied by a decrease in the relative area occupied by white pulp, in the newborn and on the 6th day this indicator is 26.5% and 38.0% lower than the control one, in the further periods of observation the area of white pulp increases, but does not reach the control values (Fig.1). The diameters of the lymph nodes in the newborn and day 6 do not significantly differ from the control data, while at later follow-up periods (16, 30 and 60 days), the indicators become smaller than in

the control groups. Germinative centers of lymph nodes in the early follow-up period after the introduction of genetically modified soy are not determined. On days 16, 30, and 60, small germinal centers are visualized in the spleen only in single lymph nodes. Their diameter is smaller than in the corresponding age groups of control animals. The parameters of the width of the mantle and marginal zones of the lymph nodes are also reduced in comparison with the control (Fig. 1). The revealed structural changes in the spleen of animals during puberty indicate hypoplasia of the white pulp, which some authors associate with an increase in the incidence of apoptosis and a decrease in the level of cell proliferation in response to the influence of an unfavorable factor [5,12].

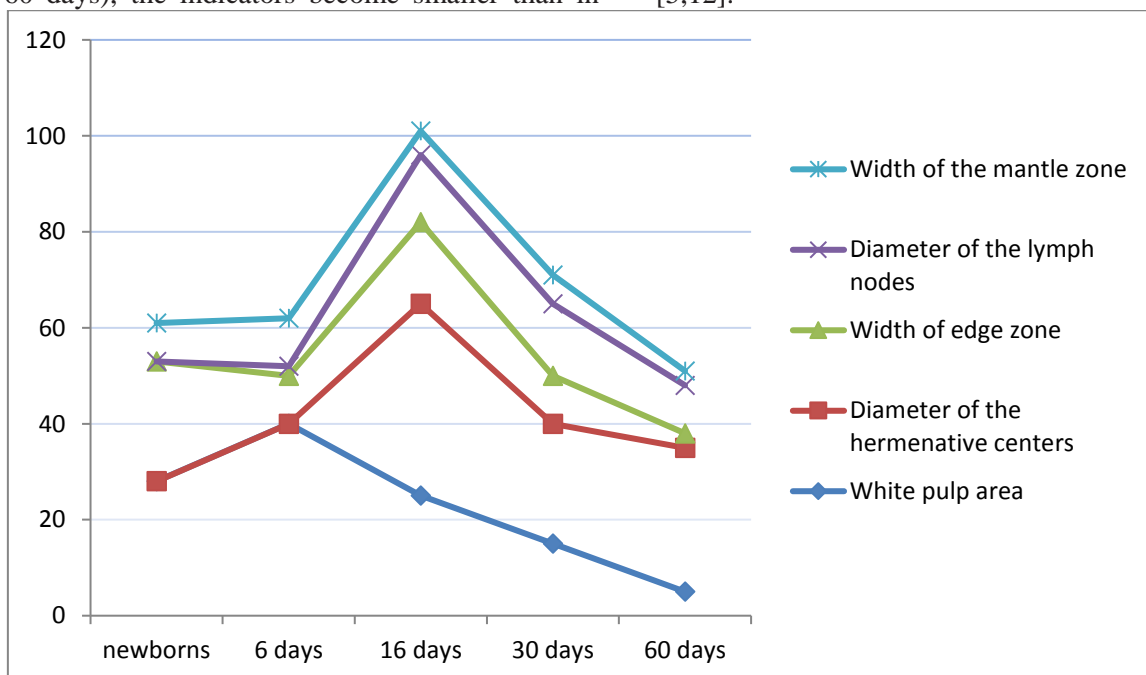


Figure 1-*Dynamics of morphometric parameters of the white pulp of the spleen of puberty rats at different follow-up periods after the introduction of genetically modified soy*

The histological structure of the spleen of animals of the reproductive period does not differ from that of control rats. On the preparations, the main structures of the white pulp are revealed: periarterial lymphoid couplings and lymph nodes. The border of the white and red pulp is clearly contoured. Germinative centers are detected in single lymph nodes 1 and 6 days after the

administration of the cytostatic agent, while they are detected much more often on the 16, 30 and 60 days. The relative area of the white pulp has the following dynamics: on days 1 and 6, this indicator is 18, 5% and 5.8% lower than the control one. No statistically significant differences were found in the subsequent follow-up periods (16, 30, and 60 days). The diameters of the lymph nodes are

smaller in comparison with the control group by 1.2% (1 day), 14.3% (6 days), 10.5% (16 days), 9.11% (30 days) and 3.7% (60 days). The germinal centers of the lymph nodes are not determined after 1 and 6 days of observation. On the 16th, 30th and 60th day, small germinal centers in the lymph nodes are detected in the spleen, their diameter does not exceed the control values. The parameters of the width of the mantle and marginal zones of the lymph nodes are reduced in comparison with

the control in all observation groups (Fig. 2). In rats of the period of pronounced senile changes, the spleen visually retains its typical structure, however, morphological signs appear that can be attributed to the category of involutive ones. Thus, there is a significant decrease in the relative area of the white pulp in comparison with the data of the control groups and animals of previous age periods.

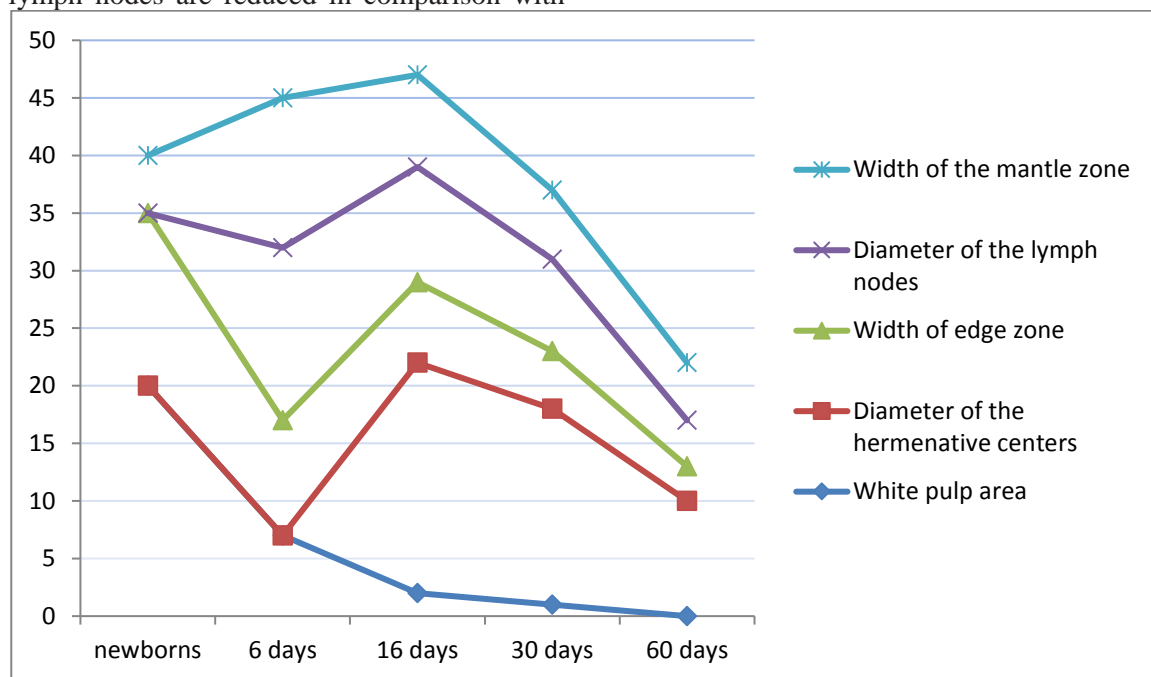


Figure 2-*Dynamics of morphometric parameters of the white pulp of the spleen of rats of the reproductive period in different periods of observation after the introduction of genetically modified soy*

The central arteries of the lymph nodes have thicker walls due to the development of sclerotic changes. Connective tissue trabeculae are well expressed, their thickness is increased, which corresponds to the age norm [6, 8]. In response to the administration of genetically modified soy to animals, there was a decrease in the diameters of lymph nodes by 10.07% (1 day), 11.75% (6 days) and 9.20% (16 days) relative to the control data (Fig.3). At the same time, in the subsequent periods of observation, the size of the lymph nodes exceeds the control parameters by 9.50% and

8.25% on the 30th and 60th days, respectively. Germinal centers of lymph nodes are detected in isolated cases. The width of the mantle and marginal zones of the lymph nodes in rats of the experimental groups of newborns, 6, and 16 days of observation is less than in the control groups by 6.93%, 7.11%, 5.71% and 19.7%, 11.83%, and 9.85%, respectively. At a later date after the introduction of genetically modified soy, no statistically significant differences from the control data are determined.

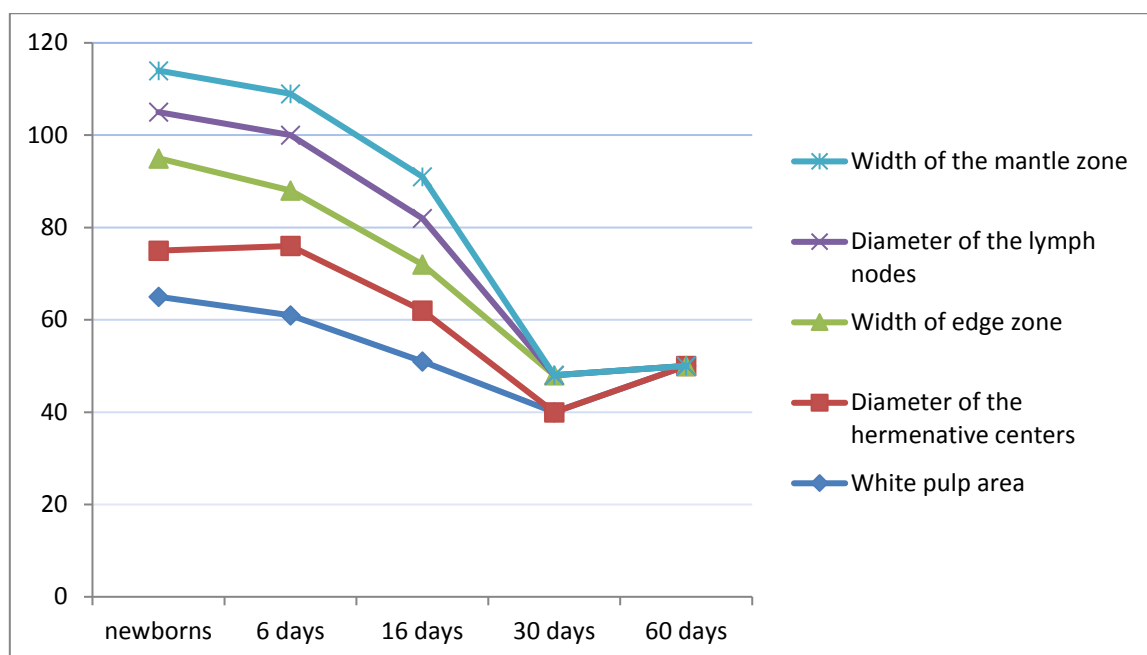


Figure 3-Dynamics of morphometric parameters of the white pulp of the spleen of rats during the period of pronounced senile changes in different periods of observation after the introduction of genetically modified soy

Conclusion

1. The white pulp of the spleen in animals of the control groups in different periods of postnatal ontogenesis is represented by well-defined lymph nodes and periarterial lymphoid couplings, in animals of the reproductive period, nodules with germinative centers predominate among the lymph nodes, in rats of the period of pronounced senile changes, involutive changes prevail.

2. The introduction of genetically modified soy leads to a change in the morphological characteristics of the spleen, manifested in hypoplasia of the white pulp in the early stages of observation.

3. The highest level of reactivity of the white pulp of the spleen in response to the introduction of a genetically modified product is observed in animals during puberty.

4. Significant changes in the structure of the white pulp of the spleen of rats during the period of pronounced senile changes occur against the background of involutive processes.

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