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Research Article

Correlation of the Cellular Composition of the Epithelial Layer and Its own Plastics of Muscular Shell of Body of the Stomach of Rabbits

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ABSTRACT –
This paper deals with the correlation of the cellular composition of the epithelial layer and its own plastics of the muscular shell of the body of the stomach of rabbits.
To determine the peculiarities of the tissue composition of the stomach walls, histochemical research methods were used. The study was conducted on 40 stomachs. Fixed in a solution of 5% formaldehyde, pieces of the stomach were embedded in paraffin according to the standard technique.
The nature of the correlation links between the indices of the cellular composition of the epithelial layer and the prosthetic plastics of the gastric mucosa of the rabbits of the control and experimental groups did not differ in both groups, the number of interepithelial lymphocytes positively correlated with the number of stromal lymphocytes ($r=0.62$, $p<0.05$, Spearman), the number of mast cells ($r=0.73$, $p<0.01$), fibrocytes ($r=0.58$, $p<0.05$), endothelial cells ($r=0.61$, $p<0.01$) and stromal neutrophils ($r=0.65$, $p<0.05$). The number of stromal lymphocytes was positively correlated with the number of stromal neutrophils ($r=0.71$, $p<0.01$), stroma macrophages ($r=0.52$, $p<0.05$), fibroblasts ($r=0.76$, $p<0.01$), eosinophils ($r=0.65$, $p<0.01$). The number of plasma cells positively correlated with the number of eosinophils ($r=0.67$, $p<0.01$) and fibroblasts ($r=0.53$, $p<0.05$). It was established that in both groups the quantitative ratios of different types of cells of the own plate of the gastric mucosa were closely related. This, as well as the direct results of the morphological study, indicates the absence of inflammatory changes in the gastric mucosa caused by the used food supplement.

Keywords: rabbits, mucous membrane, stomach, morphology, histology, correlation.

I. INTRODUCTION

The strategic goal of food security is the provision of safe agricultural products. Small husbandries, which produce more than 50% of all kinds of products, can provide the population of the country with environmentally safe products. However, small forms of management, including personal subsidiary farms, both in Russia in general and in Tyumen region in particular, face a huge number of problems constraining their further growth and development [2, 9].

Additional introduction of animal feed supplements to the diet contributes to better digestion and assimilation of essential nutrients in the gastrointestinal tract. Supplements stimulate the processes of digestion, metabolism, stimulates the functional reserves of the body, contributes to the formation of stable immunity [3,4,11,12]. The agroindustrial complex requires innovative development in all branches through the development, modernization of educational laboratory, research and experimental production base of the university itself. Consequently, it is necessary to radically change the process of training specialists at the university by strengthening its practical component [1,5,6].

Achieving food independence is only one of the key elements necessary to ensure the country's food security. In this regard, all possible ways to improve the systems of feeding animals to increase productivity, taking into account the preservation of the quality of their products [7,8, 10,12,13,14,15], remain topical issues. The successful development of rabbit breeding needs to know the biological characteristics of rabbits, the physiological processes of their nutrition, that is, the assimilation and use of their dietary nutrients, which will help the breeders to find a rational way to use feed and reduce their costs in raising animals.

Objective. Objective of the research is to find out the histological features of the stomach of Californian rabbits in normal state and upon the application of Bio-Mos feed supplement.

Task. The research task was to study the structure of the wall of different parts of the stomach in rabbits in normal state and upon the application of Bio-Mos feed supplement.

II. MATERIALS AND METHODS

The research material was carcasses of clinically healthy male rabbits (slaughtered at the age of 4 months). The animals of the control group were on an experimental diet, which consisted of granulated feed, the formula was developed at the farm and made at the Tyumen flour mill.

The rabbits of the experimental group, in addition to the basic diet, received the Alltech Bio-Mos feed supplement designed to increase the overall resistance, productivity and safety of rabbits at a dose of 2 g per kg of granulated feed, starting from 2 months of age.

To determine the peculiarities of the tissue composition of the stomach walls, histochemical research methods were used. The study was conducted on 40 stomachs. Fixed in a solution of 5% formaldehyde, pieces of the stomach were embedded in paraffin according to the standard technique.

III. RESULTS AND DISCUSSION

Rabbits are animals with a single-chambered stomach, horseshoe-shaped, about 200 cm3 in volume, vegetable feeders. A morphometric study of the gastric superficial-foveolar epithelium revealed no statistically significant differences in the bottom and the body, while the depth, width of the gastric pit and the height of epithelium cells in the pyloric part in animals of the experimental group exceeded the same parameters of the control group by 6.1, 4.6 and 6.8%, respectively. The differences are not large, but they are statistically significant, and are presented in Table 1. Therefore, we can conclude about the effect of the food supplement on the structural and functional state of the gastric superficial-foveolar epithelium.

Table 1 - Morphometric parameters of the gastric superficial-foveolar epithelium of rabbits, M±*s*

Parameter	Control group	Experimental group
Gastric bottom and body		
Gastric pit depth, µm Gastric pit width, µm	100.4±12.7 32.4±2.8	106.5±10.2 29.8±5.4
Epithelial cell height, µm	22.1±1.8	23.4±2.5
Epithelial cell width, µm	7.2±0.9	7.4±0.8
Total numerical density of epithelial cells, 1 mm	131±15	127±17
Pyloric part		
Gastric pit depth, µm Gastric pit width, µm	126.1±11.8* 19.6±2.1*	131.3±12.6* 20.5±4.3*
Epithelial cell height, µm	16.1±1.2*	17.2±2.1*
Epithelial cell width, µm	7.3±0.8	7.5±0.9
Total numerical density of epithelial cells, 1 mm	128±16	125±18

Note. * – Statistically significant differences between sections of the stomach at $p<0.05$. M±*s*– mean ± standard deviation (sigma).

A morphometric study of the glands of the gastric mucosa in animals of the control and experimental groups revealed statistically significant differences in the bulk density of the glands, in the number of main and mucous cells in the gland; the results are presented in Table 2.

Table 2 – Morphometric parameters of the glands of the mucous membrane of the gastric bottom and body of rabbits, M±*s*

Parameter	Control group	Experimental group
Bulk density of glands, %	56.2±5.3	62.8±4.1*
Outer diameter of glands, μm	39.3±3.6	41.9±4.7
Amount of main cells in the glands, %	51.2±4.8	60.9±3.7*
Amount of parietal cells in the glands, %	28.2±2.2	23.1±2.9
Amount of mucous cells in the glands, %	13.7±1.6	9.9±2.7*
Other cell types (endocrinocytes)	6.9±1.6	6.2±0.8
Cross-sectional area of the main cell nucleus (μm^2)	9.4±0.2	9.2±0.5
Cross-sectional area of the main cell cytoplasm (μm^2)	38.5±5.4	36.2±7.1
Nuclear cytoplasmic relation (NCR)	0.24±0.01	0.25±0.02
Cross-sectional area of the parietal cell nucleus (μm^2)	16.5±1.0	17.2±1.9
Cross-sectional area of the parietal cell cytoplasm (μm^2)	124.5±9.9	121.1±10.5
NCR	0.13±0.01	0.14±0.02
Cross-sectional area of the mucous cell nucleus (μm^2)	12.5±0.6	13.4±0.7
Cross-sectional area of the mucous cell cytoplasm (μm^2)	25.5±2.0	26.4±2.1
NCR	0.49±0.04	0.51±0.04

Note. * – statistically significant differences between sections of the stomach at $p<0.05$. M±*s*– mean ± standard deviation (sigma).

Animals of the experimental group had the bulk density of the glands higher by 11.7% than in animals of the control group. Animals of the experimental group had a greater number of main cells by 18.9% and less mucous cells by 27.7%, which is presented in Table 2. This also indicates the influence of the food supplement on the structural and functional state of the epithelium of the glands of the gastric mucosa. A slight increase in the number of main cells in the gland can help increase the number of specific enzymes and improve digestion.

Thus, the histological pattern of the stomach walls of rabbits of the experimental group shows the following features: the mucous membrane occupies ¾ of the stomach wall, the muscular layer is thicker in the pyloric region, as it forms the pyloric sphincter, also a well-developed connective tissue-vascular environment; cells of the mucous membrane of the stomach of rabbits of the experimental group have a pronounced mitosis, which indicates good regeneration of the membranes of the stomach of rabbits.

On the basis of the data obtained, it is possible to conclude that the Bio-Mos feed supplement changes the histological pattern of the stomachs of rabbits: rabbits of the experimental group have an increase in their cross-sectional area of the mucous and muscular membranes, as well as in the number of glands in the field of view of the gastric mucous membranes. Karyokinesis (mitosis) is better manifested in the cells of the gastric mucosa of the rabbits of the experimental group; it promotes self-reproduction of cells, that is, generation of young cells. The number of cells increases upon division so that the body grows, dead cells are replaced and damaged organs are restored.

In order to assess the cellular components of the stroma and the possible reaction of the mucous to nutritional supplements, a morphometric analysis of our own plastics of the mucous membrane of the gastric body in animals of the compared groups was carried out; the results are presented in Table 3.

Table 3 – Morphometric parameters of the cellular composition of the epithelial layer and its own plastics of the muscular shell of the body of the stomach of rabbits, M±*s*

Parameter	Native plastics level			Friedman's ANOVA (df = 2,)
	Pit	Cervix	Gland	
Interepithelial lymphocytes, %				
Control group	10.4±2.2	6.2±1.2	3.7±0.8	$\chi2$=12.3, p<0.01*
Experimental group	11.3±3.1	5.8±1.1	3.3±0.7	$\chi2$=10.1, p<0.01*
Interepithelial neutrophils, %				
Control group	0.9±0.2	0.3±0.3	0.05±0.03	$\chi2$=9.4, p<0.05*
Experimental group	0.8±0.1	0.4±0.2	0.06±0.02	$\chi2$=8.2, p<0.05*
Interepithelial eosinophils, %				
Continuation of Table 10				
Parameter	Native plastics level			Friedman's ANOVA (df = 2,)
	Pit	Cervix	Gland	
Control group	0.1±0.05	0.07±0.04	0±0	$\chi2$=4.3, p>0.08
Experimental group	0.14±0.04	0.08±0.02	0±0	$\chi2$=5.1, p>0.07
Total numerical density of the cells of the native mucosal plastic, per 1 mm^2				
Control group	4681±920	4327±899	4124±888	$\chi2$=4.8, p>0.1
Experimental group	4699±860	4422±787	4282±564	$\chi2$=3.6, p>0.1
Lymphocytes of the native mucosal plastic, per 1 mm^2				
Control group	469±97	365±75	305±64	$\chi2$=9.8, p<0.01*
Experimental group	443±56	338±66	313±79	$\chi2$=7.8, p<0.05*
Neutrophilic leukocytes of the native mucosal plastic, per 1 mm^2				
Control group	135±37	124±26	129±28	$\chi2$=3.2, p>0.1
Experimental group	143±45	131±31	118±59	$\chi2$=2.7, p>0.1
Eosinophilic leukocytes of the native mucosal plastic, per 1 mm^2				
Control group	84±22	79±15	81±17	$\chi2$=2.5 , p>0.1
Experimental group	89±17	76±12	87±19	$\chi2$=2.3 , p>0.1
Plasma cells of the native mucosal plastic, per 1 mm^2				
Control group	342±98	298±79	279±67	$\chi2$=3.7, p>0.05
Experimental group	331±87	254±42	294±88	$\chi2$=3.1, p>0.05
Mast cells of the native mucosal plastic, per 1 mm^2				
Control group	183±48	212±59	202±91	$\chi2$=4.2, p>0.05
Experimental group	178±55	205±48	211±50	$\chi2$=3.9, p>0.05
Macrophages of the native mucosal plastic, per 1 mm^2				
Control group	88±12	64±11	58±9	$\chi2$=7.8, p<0.05*
Experimental group	85±17	71±13	62±11	$\chi2$=6.9, p<0.05*
Fibroblasts of the native mucosal plastic, per 1 mm^2				
Control group	1412±198	1255±205	1126±220	$\chi2$=2.8, p>0.05
Experimental group	1488±221	1300±222	1188±198	$\chi2$=3.2, p>0.05
Fibroblasts of the native mucosal plastic, per 1 mm^2				
Control group	778±115	802±115	819±200	$\chi2$=2.4, p>0.05
Experimental group	743±122	831±127	825±188	$\chi2$=2.2, p>0.05
Vascular endothelial cells of the native mucosal plastic, per 1 mm^2				
Control group	1190±115	1128±132	1125±120	$\chi2$=0.9, p>0.05
Experimental group	1111±223	1099±162	1127±215	$\chi2$=0.9, p>0.05

Note. * – statistically significant differences between sections of the stomach at p<0.05. M±*s*– mean ± standard deviation (sigma).

We established statistically significant differences in the cellular composition of the epithelial layer and the native plastics of the gastric mucosa at the level of the pit, cervix and gland body. At the level of the pit there are more interepithelial lymphocytes and neutrophils. More lymphocytes and macrophages are in the lamina propria at the pit level. The remaining morphometric parameters of the cellular composition of the epithelial layer and of the native plastics of the mucous membrane of the body of the stomach did not differ significantly. There were no statistically significant differences between all the studied indicators of the control and experimental groups revealed.

The nature of the correlation links between the indices of the cellular composition of the

epithelial layer and the prosthetic plastics of the gastric mucosa of the rabbits of the control and experimental groups did not differ in both groups, the number of interepithelial lymphocytes positively correlated with the number of stromal lymphocytes ($r=0.62$, $p<0.05$, Spearman), the number of mast cells ($r=0.73$, $p<0.01$), fibrocytes ($r=0.58$, $p<0.05$), endothelial cells ($r=0.61$, $p<0.01$) and stromal neutrophils ($r=0.65$, $p<0.05$). The number of stromal lymphocytes was positively correlated with the number of stromal neutrophils ($r=0.71$, $p<0.01$), stroma macrophages ($r=0.52$, $p<0.05$), fibroblasts ($r=0.76$, $p<0.01$), eosinophils ($r=0.65$, $p<0.01$). The number of plasma cells positively correlated with the number of eosinophils ($r=0.67$, $p<0.01$) and fibroblasts ($r=0.53$, $p<0.05$).

CONCLUSION

Thus, in both groups the quantitative ratios of different types of cells of the own plate of the gastric mucosa were closely related. This, as well as the direct results of the morphological study, indicates the absence of inflammatory changes in the gastric mucosa caused by the used food supplement.

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