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Comparative characteristics of the morphological and morphometric parameters of the stomach in chronic radiation sickness and correction of the ASD-2 fraction in postnatal ontogenesis

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ABSTRACT

Background: This research delves into the morphometric parameters of the gastric wall in white rats, aiming to unravel the dynamic changes in thickness throughout their lifespan. The focus arises from the prevailing gastric diseases affecting 35% of the population, with limited comprehensive knowledge of the fine structure of stomach walls.

Methods: The study involved 166 white outbred male rats across various age categories, from newborn to 12 months. Rats were divided into groups, with the control group receiving distilled water daily for 20 days. Morphological and morphometric analyses were conducted on the excised stomachs, fixed in Bouin's solution, and processed for histological examination.

Results: The intact group displayed uneven thickness increases throughout life. Newborns exhibited a threefold increase in total stomach wall thickness in the cardiac region and a 1.3-fold increase in the pyloric region. The control group showed the most significant increases at 3 and 6 months, with 55.4% and 52.7% in the cardiac region and 52.7% and 44.9% in the pyloric region, respectively. Growth rates decreased at 9 and 12 months,

indicating a maturation phase, with reductions of 31.9% and 19.9% in the cardiac region and 28.9% and 20.4% in the pyloric region, respectively.

Conclusion: The study provides crucial insights into the dynamic and age-dependent changes in gastric wall thickness. Understanding these morphometric variations contributes to our knowledge of stomach development and lays the groundwork for potential therapeutic interventions in gastrointestinal health. Further research should explore the underlying mechanisms guiding these changes to understand physiological and pathological processes comprehensively.

KEYWORDS: *stomach, stomach wall, mucous membrane, lymph, tissue*

INTRODUCTION

Data on the ontogenesis of the digestive system in general and the stomach in particular [3] is of particular interest. Despite the relevance of this problem, the ontogenesis of the stomach is studied in terms of determining the timing of formation and stages of changes in the structural and microscopic organization of the mucous membrane [10]. Of significant interest is the elucidation of the relationship between morphological and cytological changes in organs and the content of lymphoid tissue cells since it is known that the latter are involved not only in immune processes but can also influence the formation of organs and their structures. The following concept has been formulated - "lymphocyte - morphogenesis factor" [2].

The effect of viral infections, namely the influenza virus, on gastric morphogenesis remains poorly understood. Regarding frequency and number of cases, such a nosological form as influenza ranks first, accounting for 95% of all infectious diseases. Influenza epidemics occur annually, affecting up to 15% of the world's population, significantly increasing mortality in high-risk groups, which include pregnant women. Influenza suffered during pregnancy can lead to disturbances in homeostasis in the mother-placenta-fetus system, which in the future can cause hormonal dyspeptic disorders and food allergies, abnormalities in the development of the stomach in young children, and chronic gastroduodenitis. Therefore, studying the influence of the influenza virus and the consequences of

administering the influenza vaccine on the morphogenesis of the stomach is reasoned and necessary in a tense epidemiological situation [7].

In the gastrointestinal tract, immunocompetent lymphoid tissue protects against them. It makes up about 25% of its entire mucous membrane, and the total volume is approximately half the volume of the spleen. The digestive system contains 75% of immunocompetent cells [12].

Lymphoid tissue, located in the walls of the organs of the digestive system, is an important protective barrier in the body from foreign influences [14]. Lymphoid tissue is scattered throughout the gastrointestinal tract; however, only in the upper respiratory tract and ileum is it organized in structures similar to those in other secondary lymphoid organs such as the spleen and lymph nodes. Waldeyer's ring in the oropharynx is composed of this tissue, as are Peyer's patches in the terminal ileum. Under normal conditions, they are rarely found in the esophagus or stomach. lymphoid follicles[13].

The presence of lymphoid structures in the esophagus or stomach is unnecessary because intestinal transit is rapid, and the environment is hostile to microorganisms. In the presence of inflammation, infection, or tumors, a persistent antigenic stimulus may promote the development of lymphoid tissue organized to resemble mucosal-associated tissue elsewhere [14]. Under normal conditions, this lymphoid tissue can also be observed in the appendix [6].

In animals exposed to antigenic influence in utero, an increase in the percentage of lymphoid cells is noted in the gastric mucosa. The formation of lymphoid structures in the stomach in rats occurs through the migration of lymphocytes from blood vessels. In the lymphoid structures, the distribution of lymphocytes in the experimental group exceeds the control indicators. In the cell population of lymphoid structures, the highest content of small lymphocytes was revealed in comparison with other classes of lymphocytes [10].

The stomach wall contains many ganglion elements, nerve bundles and fibers, and sensitive nerve formations, which are closely interconnected, forming a single intramural nervous apparatus. At the same time, there is a tendency for the number and volume of nerve ganglia to increase in the direction of the pylorus [4.14].

Notably, there is a close functional and morphological relationship between the nerve structures innervating the capillary network of the stomach, the muscular layer, and the glandular apparatus. The problem of the structural and functional organization of extra- and intramural nerve plexuses of the stomach of mammals continues to be actively developed [1] primarily due to the important role of extra- and intramural innervation in the mechanisms of unified regulation of the activity of the stomach and other parts of the digestive tract.

The radiation problem is considered the most complex, with radiobiological and social significance. The immune system is the first to respond to various influences. Therefore, research is constantly being carried out on the reaction of lymphoid organs to external stimuli. This also applies to radiation exposures, the frequency of which has decreased, but they remain relevant today.

A comprehensive study of the influence of experimental influences and environmental factors on the morpho-functional characteristics of the stomach wall of mammals remains one of the pressing problems of modern biology and medicine, the solution of which makes it possible to study the pathogenesis of diseases and identify specific patterns in changes in the layers of the stomach, its vascularization and innervation apparatus. At the same time, the degree of severity of morphological changes in the structures of the muscular lining of the stomach after various experimental influences (peritonitis, hypokinesia, ischemia, etc.) is directly proportional to the duration of exposure, has certain dynamics and is characterized by polymorphic changes [9].

Research by the scientist academician V.P. Filatov and his colleagues discovered a new group of natural biologically active substances called "biogenic stimulants." These funds have found their application in various areas of modern clinical medicine in the form of plant, animal, and mixed-origin preparations.[eleven].

Biogenic stimulants and adaptogens increase the body's resistance to physical and emotional stress. A rich spectrum of biologically active compounds (BACs) contained in the raw materials of many plants provides a general healing (organoprotective) effect on the body along with a specific pharmacological effect[4].

The following was revealed after a comparative analysis of adaptation reactions and the corresponding indicators of the health status of high school students before and after activation prophylaxis with a phytoadaptogen. The number of high school students with adaptive reactions corresponding to a good and satisfactory state of health increased significantly (+30.1%) after activation therapy with Eleutherococcus extract [5].

Tissue medicinal product ASD - Dorogov's antiseptic stimulant - is an original drug manufactured using a unique technique developed by Candidate of Veterinary Sciences A.V. Dorogov (VIEV) in 1948. The ASD drug is a product of thermal decomposition (dry distillation) of animal tissues (meat and bone meal, meat and bone waste from slaughterhouses of biological plants, as well as various organs and tissues of animals). ASD is produced by biofactories in the form of two fractions: ASD F-2 (for internal and external use) and ASD F-3 (for external use). ASD fraction 2 is a drug from the group of immunomodulators [1].

Among the existing means of tissue therapy, the drug ASD occupies a special place. It is a powerful stimulant for the body's vital functions, both when administered orally and parenterally. When applied topically, it also has an antiseptic effect in addition to being a stimulant.[9].

ASD-2 stimulates biochemical processes associated with the biological function of active sulfhydryl groups and can intensify the metabolism of carbohydrates, lipids, and proteins [4].

Speaking about ASD fraction two and its immunomodulatory properties, we can say that the experimental studies on this drug are insufficient.

At the present stage in morphology and clinical medicine, increasing importance is attached to critical periods in the development of the body, as well as correction with the help of various biostimulants.

Experimental studies regarding ASD fraction two and its immunomodulatory properties are insufficient. Therefore, further, more in-depth study of the chemical structure of the ASD drug, isolation of active substances in pure form, and study of the biochemical mechanism of the pharmacological action of this drug will allow us to develop more rational recommendations for the use of a biostimulant in medicine[12,13].

The degree of influence of preliminary correction of chronic radiation sickness with the Dorogov antiseptic stimulant of the second fraction is unknown. The relevance and need to study these problems are undeniable since the disclosure of the mechanisms and morphological basis of adaptation of the gastrointestinal tract will make it possible to clarify essential points - morphological and functional features at different age periods, interorgan and intertissue relationships in physiological and pathological conditions after chronic irradiation.

The aim of the study is To study the morphometric parameters of the stomach of white rats with chronic radiation sickness and correction with the biostimulator ASD-2 in postnatal ontogenesis.

MATERIALS AND METHODS

For the study, 166 were tested white outbred male rats in the following age categories - newborn age and at the age of 3, 6, 9, and 12 months, kept under normal vivarium conditions. To determine the morphometric indicators of the structure of the stomach in postnatal ontogenesis, The test mammals in the age category were divided into four groups

For those animals that made up the control group, distilled water in a volume of 0.5 ml was administered through a metal probe into the stomach for 20 days.

In order to carry out morphological and morphometric studies, and the removed stomach was fixed in Bouin's solution, and after the appropriate wiring,

the material was poured into paraffin according to generally accepted rules. Next, histological cross sections with a thickness of 6 - 7 μm were prepared from the cardiac and pyloric parts of the stomach, followed by clearing them in alcohols of increasing concentrations. The sections were stained with hematoxylin-eosin and the Van Gieson method after deparaffinization. Morphometric studies and measurements of stomach tissues were carried out under an NLCD-307B microscope.

RESULTS

The study found that the thickness of the gastric wall of the intact group increases unevenly throughout life. The most pronounced rate of increase in the thickness of the organ under study in the control group of animals is observed at the ages of 3 and 6 months, while in the cardiac region, it is 55.4% and 52.7%, in the pyloric region 52.7% and 44.9 %, respectively, a decrease in the growth rate occurs at 9 and 12 months of age and is 31.9% and 19.9% in the cardiac region, 28.9% and 20.4% in the pyloric region, respectively.

When comparing the parameters of the total thickness of the stomach wall of laboratory animals of the control groups and those exposed to chronic radiation sickness, its most significant increase in the cardiac region was noted at the age of 6 months and was equal to 52.7%; in the pyloric region, the greatest increase in this indicator is also observed in 6-month-old animals and amounts to 32.9%. The smallest increase in the above indicator in both parts of the stomach occurs in animals at 12 months of age, amounting to 16.1% and 14.5%, respectively.

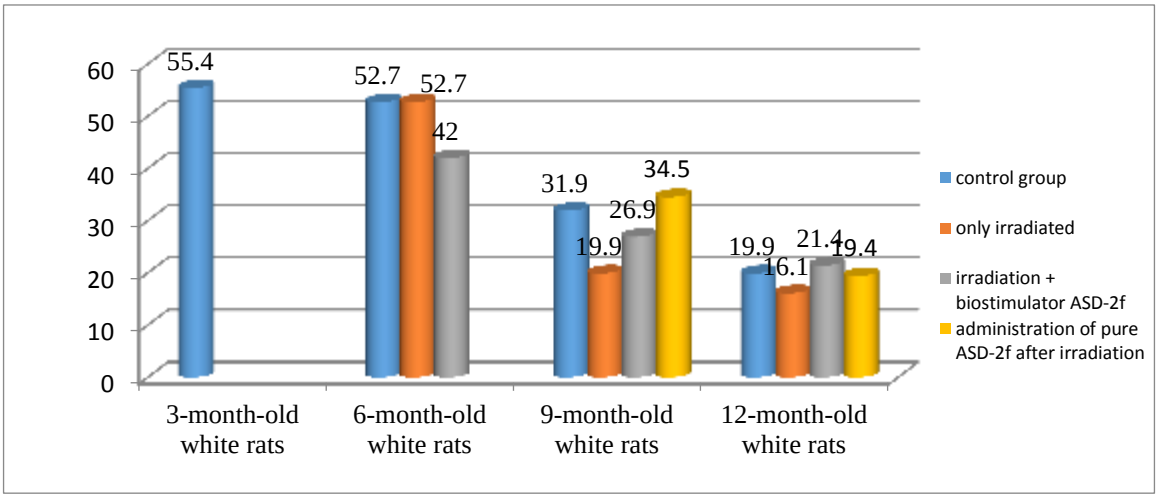

Fig. No. 1. Comparative characteristics of the rate of increase in cardiac wall thickness stomach in normal conditions, with chronic radiation sickness and with various corrections with ASD-2f

It was found that the maximum growth ratethickness of the gastric wall in both the cardiac and pyloric regions in the group of rats taking ASD - 2 fractions at a dose of 0.1 ml against the background of irradiation, observed at the age of 6 months 42.0% and 44.8% respectively. The lowest growth rate of this morphometric parameter in both parts of the stomach compared to the control group was observed in 12-month-old rats, respectively equal to 21.4% and 23.2%.

In the group of animals that took ASD - 2 fractions at a dose of 0.1 ml after irradiation, the greatest increase in the wall thickness of the organ under study in the cardiac and pyloric regions was recorded at nine months of age and equal to 34.5% and 29.5% respectively. The smallest increase in this indicator in both parts of the stomach is observed in rats 12 months of age, amounting to 19.4% and 22.6%, respectively.

According to our study, the highest rate of increase in the thickness of the mucous membrane in the cardiac part of the organ of rats of the intact group, determined at three months of age and equal to 57.3%; in the pyloric region, this figure is highest in 6-month-old animals and amounts to 43.4%. The lowest rate of increase in the thickness of the mucous membrane in the cardiac and pyloric sections was established at the age of 12 months and amounting to 20.5% and 19.7%, respectively.

In a group of rats with chronic irradiation, the rate of increase in the thickness of the mucous membrane in the cardiac and pyloric parts of the stomach is the greatest at six months of age. It is equal to 58.0% and 31.0%, respectively. This indicator is the lowest in irradiated animals 12 months of age, amounting to 14.3% and 13.9% in both parts of the organ, respectively.

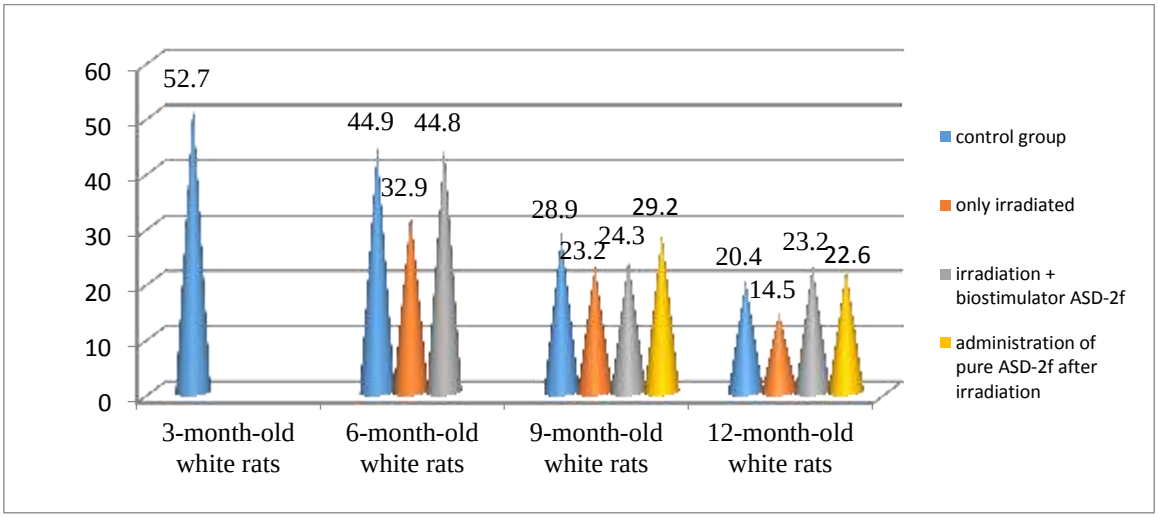

Fig. No. 2. Comparative characteristics of the growth rate of the wall thickness of the pyloric region stomach in normal conditions, with chronic radiation sickness and with various corrections with a biostimulator

In animals of the third group, which received ASD - 2 fractions at a dose of 0.1 ml in parallel with irradiation, greatest increase in mucosal thickness in the cardiac and pyloric parts of the stomach, was registered at six months of age, amounting to 38.8% and 40.1%, respectively. The smallest increase in this morphometric indicator in both parts of the organ was noted at nine months of age and was equal to 20.9% and 19.2%, respectively.

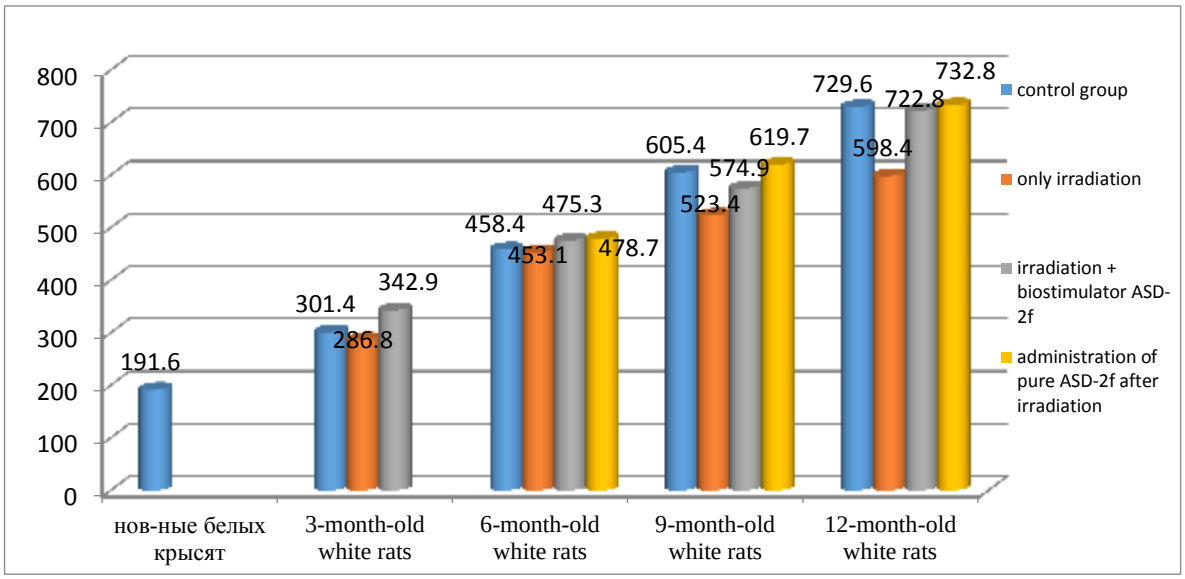

Fig. No. 3. Comparative characteristics of the thickness of the mucous membrane of the cardiac part of the stomach of white rats in normal conditions, with chronic radiation sickness and when corrected with a biostimulator

The highest rate of increase in the thickness of the mucous membrane in the cardiac part of the organ of rats that took ASD – 2 fractions at a dose of 0.1 ml after irradiation, noted at the age of 9 months and equal to 29.5%; in the pyloric section of the stomach this figure is highest at the age of 12 months and amounts to 34.0%.

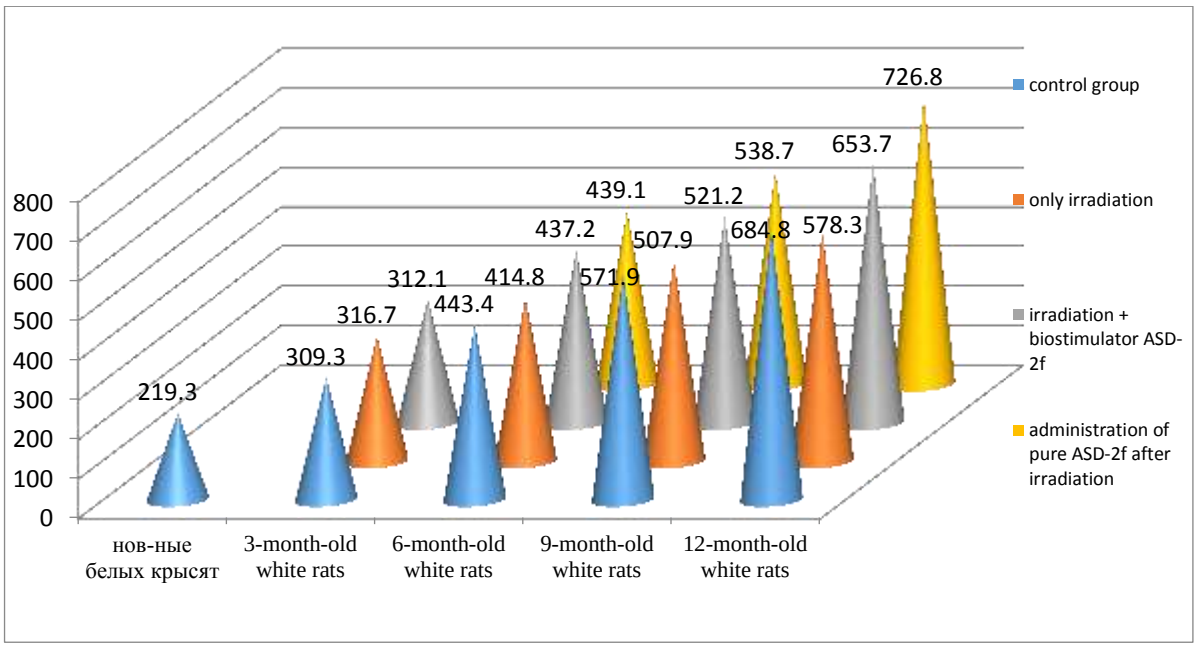

Fig. No. 4. Comparative characteristics of the thickness of the mucous membrane of the pyloric part of the stomach of white rats in normal conditions, with chronic radiation sickness and when corrected with a biostimulator

This indicator in the cardiac section is the lowest in 12-month-old rats - 18.3%, in the pyloric section - at 9 months of age, amounting to 22.5%.

The increase in the height of the folds of the mucous membrane in animals of the control group in both parts of the stomach was greatest in animals at the age of 3 months and amounted to 62.7% and 49.1%, respectively. The smallest increase in this morphometric parameter in both the cardiac and pyloric regions was detected in 12-month-old animals and amounted to 17.9% and 15.7%, respectively.

A comparative analysis showed that in the group of rat pups with chronic irradiation the highest growth rate The height of the folds of the mucous membrane in both parts of the stomach is noted at 6 months of age and is equal to 63.2% and 34.6%, respectively. The growth rate of the above indicator in the studied parts of the stomach is the lowest in rats aged 12 months and is 14.0% and 17.3%, respectively.

The research results show the greatest increasethe height of the folds of the mucous membrane in both parts of the stomach in the group of rats receiving ASD - 2 fractions at a dose of 0.1 ml simultaneously with irradiation, at 6 months of age, amounting to 59.0% and 44.6%, respectively. The smallest increase in this parameter in both the cardiac and pyloric regions is observed in 9-month-old animals, equal to 21.6% and 19.7%, respectively.

In the group of laboratory animals that took ASD - 2 fractions at a dose of 0.1 ml after irradiation, the highest growth rate the height of the folds of the mucous membrane in the cardiac part of the stomach is noted at the age of 9 months and is equal to 34.0%; in the pyloric region this figure is highest in 12-month-old rats and amounts to 33.6%. The lowest rate of increase in the height of the folds of the mucous membrane in the cardiac part of the stomach is observed in rats aged 12 months, amounting to 19.2%; in the pyloric region in 9-month-old animals and is equal to 22.1%.

Regarding this morphometric parameter, likeheight of the glands of the mucous membrane, it was found that in rats of the intact group inboth departments organ, the greatest increase in this indicator is observed at 3 months of age, equal to 56.7% and 70.9%respectively. The smallest increase in the height of the glandular apparatus in the studied parts of the stomach was found in 12-month-old animals and amounted to 17.0% and 23.1%, respectively.

When modeling chronic radiation sickness in the process of performing work, the highest growth rateheight of mucosal glands Vin both parts of the stomach was detected in animals 6 months of age, amounting to 46.8% and 38.4%, respectively. The growth rate of this indicator in the cardiac and pyloric parts of the organ was the lowest in rats 12 months of age and equaled 18.7% and 18.5%, respectively.

CONCLUSION

The study found that the thickness of the gastric wall of white rats of the intact group increases unevenly throughout life. In newborns, there was an increase in the total thickness of the stomach wall in the cardiac region by 3 times and in the pyloric region by only 1.3 times. The most pronounced rate of increase in the thickness of the organ under study in the control group of animals was observed at the ages of 3 and 6 months, amounting to 55.4% and 52.7% in the cardiac region; in the pyloric region 52.7% and 44.9%, respectively. A decrease in the growth rate occurs at 9 and 12 months of age and is 31.9% and 19.9% in the cardiac region, 28.9% and 20.4% in the pyloric region, respectively.

REFERENCES:

1. Abdrakhmanov VI, Dorogova OA, Kiryutkin GV, Krasnov VL. Comparison of quality indicators of the drug ASD-2F produced by Areal-Medical LLC and FSUE Armavir Biofactory. Zooindustry. 2005;(1):5.

2. Voloshin NA, Grigorieva EA, Kushch OG, et al. Intrauterine administration of antigens - a model for studying the role of lymphocytes in the processes of morphogenesis of internal organs. Constipation. honey. magazine. 2005;3:13.

3. Guseinova ST, Guseinov TS. Anatomical and morphometric characteristics of lymphoid formations of the stomach in white rats under normal conditions. Collection of scientific works Current problems of biology. Tomsk. 2004;Z(1):127-128.

4. Isupova NV. Extra- and intraorgan innervation of the stomach wall of chickens in ontogenesis: dis. Ph.D. veterinarian, science. Izhevsk; 2006. 136 p.

5. Kurkin VA, Akimova NL, Avdeeva EV, Ezhkov VN, Petrukhina IK. Immune system and immunocorrectors. Samara; 2010. 132 p.

6. Mikhailichenko KYu, Nazarov VA, Chizhov AYa. Activation therapy of schoolchildren with a biostimulant as a way to increase the resistance of the children's population. Health and education in the 21st century. 2011;13:352-354.

7. Mikhaleva LM, Smirnova ED, Kunizheva MA. Comparative morphological characteristics of the small intestine at different periods of modeling acute strangulation intestinal obstruction. Abstracts of the V All-Russian Congress of Anatomists, Histologists and Embryologists. Morphological Gazette. 2004;1-2:111.

8. Nefedova NB, Gordeeva MS, Zuev VA. The influence of maternal virus-specific T-lymphocytes on the formation of pathology of pregnancy and fetuses during experimental congenital influenza infection. Questions of Virology. 1990;36(6):456-458.

9. Rybakov AG, Ivanov NM. Intramural innervation of the stomach in peptic ulcer. Scientific notes of UlSU. Series "Biology". Ulyanovsk: UlGU; 2006. Issue 16:83-86.

10. Samuilenko AYa, Evglevsky DA, Sokolovsky SI, Smirnov II, Timkova PA. Increasing the biocidal and medicinal properties of Dorogov's antiseptic stimulant ASD-2F "Aisidivit" with colloidal silver ions. Current problems of society, science, and education: current state and development prospects. 2016:485-488.

11. Svetlitsky AO. Lymphoepithelial relationships in the epithelium of the mucous membrane of the ileocecal angle structures in rats under normal conditions and after antigen administration. Constipation. honey. magazine. 2010;12(1).

12. Syrtsov VK, Evtushenko VM, Kovalev SP, Koigushskaya GP. Patterns of variability of lymphoid structures of the peripheral immune system. Vyunik problems of medicine. 2003;3:87-88.

13. Teshaev ShZh, Khasanova DA. Comparative characteristics of the morphological parameters of the lymphoid structures of the small intestine of rats before and after exposure to the antiseptic Dorogov stimulant fraction 2 against the background of chronic radiation sickness. Operative surgery and clinical anatomy (Pirogov scientific journal). 2019;3(2):19-24.

14. Teshaev ShZh, Khudoiberdiev DK, Teshaeva DSh. Impact of exogenous and endogenous factors on the stomach wall. Problems of biology and medicine. 2018;4(104):212-214.

15. Khudoiberdiev DK, Teshaeva DSh. Bir oilik ok kalamush oshkozon topography, oshkozon devorining macro microscope tuzilishi. Biology va tibbiyot muammolari. 2020;3(119):165-168.