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Topography, Anatomy, Histology and Morphometry of The Stomach in Experimental Rats Depending on Age

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Abstract: Based on our scientific research, comparative morphological and morphometric analysis of the structure of the mucous, submucosal, muscular and serous layers of the stomach wall of rats fed palm oil, comparative analysis of the density of the mucous glands, and evaluation and comparison of their morpho-functional changes under experimental conditions using laboratory analyses allow us to develop statistical analysis indicators of the stomach wall layers.

Keywords: Rats, stomach, mucosa, submucosa, stomach length, stomach width, stomach weight, morpho-functional, organometry.

Introduction: To measure the macroscopic dimensions of the stomach, Ivan Pavlov used the organometry method to study the anatomical dimensions of the stomach of rats. After the stomach was removed from the abdominal cavity, its length, height, width, and weight were measured [1, 2, 3, 4, 5, 6]. Organometry of organs, due to the possibility of statistical analysis, complements morphological data, increases the level of reliability, and demonstrates objectivity. This method is of great importance in assessing the concepts of the normal state and pathological changes of organs. A

caliper was used to measure these dimensions of the stomach. The shape of the stomach was determined visually [8,10,11,13,15,19].

For microscopic examination, the stomach was excised from the abdominal cavity and fixed in a 10% neutral solution of formalin for 72 hours, then washed in running water, dehydrated in increasing concentrations of alcohol, and paraffin-embedded blocks were prepared. Sections 5–8 µm thick were prepared from them, and the general histological structure was studied with hematoxylin-eosin stain, and the connective tissue fibers in the gastric stroma were stained with the Van Gieson method. Histological preparations were photographed using a CX40 model with an OD400 camera.

Research objective

In our scientific work, we aimed to study the topography, anatomy, histology, and morphometry of the rat stomach depending on age.

METHODS

For the study, the stomachs of 150 white male rats, 2 groups, with a body weight of 48 grams to 220 grams, of different ages: 21, 60, 90, 120, 150, 180 days, were taken. The experimental animals were kept under normal laboratory diet conditions. These rats were divided into two groups. The control group continued to be fed a daily constant diet. The diet of the second experimental group of white rats was restructured so that it consisted of red palm oil. For 30 days, 1.7 Palm oil from g/kg During daytime feeding, rats were given a special diet in the laboratory, in addition to oral through probe using an additional dose was administered into the stomach.

The general morphology of the structural structures of the stomach of experimental animals was studied by histological sections of the stomach prepared on a microtome, stained with hematoxylin eosin and Van Gizon. To measure the macroscopic dimensions of the stomach, the organometry method was used to study the anatomical dimensions of the stomach of Ivan Pavlov's rats. After the stomach was removed from the abdominal cavity, its length, height, width and weight were measured. Organometry of organs, since it is possible to perform statistical analysis, complements morphological data, increases the level of reliability, and shows objectivity. This method is of great importance in assessing the concepts of the normal state and pathological changes of organs. A caliper was used to measure these dimensions of the stomach. The shape of the stomach was determined visually.

RESULTS AND DISCUSSION

The following data were obtained regarding the structural components of the stomach wall of the white male laboratory rats under study. The gastric mucosa of the rats in the control group is covered with a stratified epithelium. The epithelial layer consists of three rows of basal, round and oval cells.

Basal cells are small, densely packed, and characterized by a central nucleus. The cells of the middle and upper rows are oval in shape, larger in size, with off-center nuclei. The apical part of the cells contains granules indicating secretory properties. The cells of the proximal row of the covering epithelial tissue of the rat stomach are covered with a cuticle.

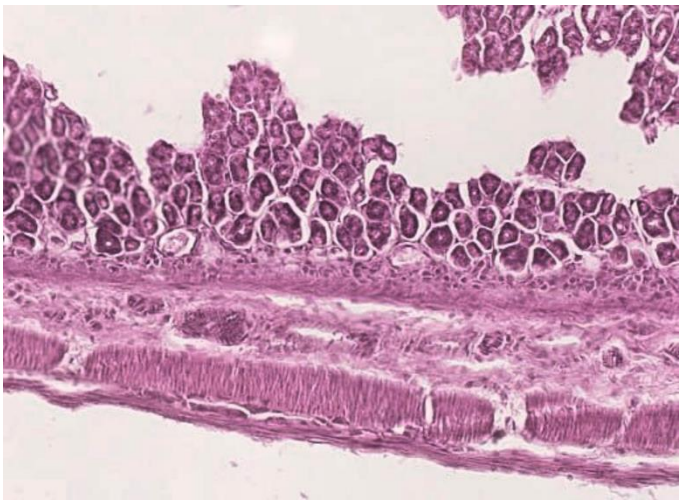

Figure 1. Gastric wall layers in the 21-day control group.

Staining: hematoxylin-eosin. X: 10x40.

The muscularis mucosa of the stomach of white male rats is composed of smooth muscle fibers with an internal longitudinal and external circular orientation, and is composed of muscle layers. The outer serous

membrane of the rat stomach has a mesothelial lining with sparse fibrous connective tissue.

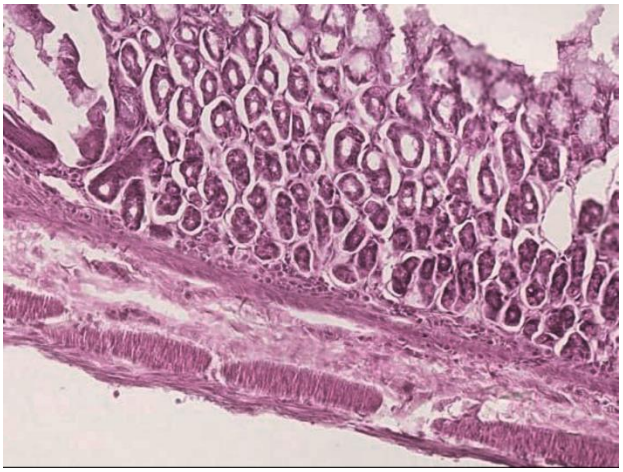

Figure 2. The sparse fibrous connective tissue of the stomach wall of the control group rat is irregularly arranged. Staining: hematoxylin-eosin. X: 10x40.

and Van Gieson methods to study the general morphology of the gastric structures.

The following data were obtained as a result of studying the morpho-functional changes in the stomachs of control group rats. A sharp increase in the mucoid layer is detected on the surface of the gastric mucosa. There were almost no lesions on the mucosal surface.

The sparse fibrous connective tissue of the gastric submucosa of rats remained unchanged (Figure 3).

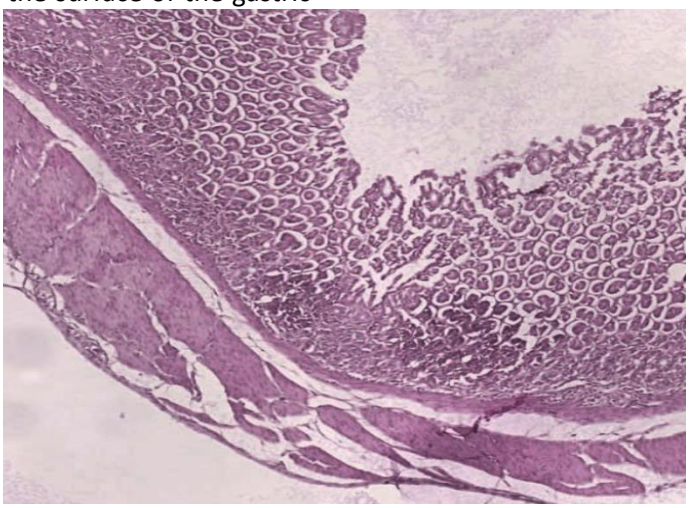

Figure 3. Microscopic view of a sharp increase in mucoid coating on the surface of the gastric wall of the experimental group rat. Staining: hematoxylin-eosin. X: 10x40.

During the study of morpho-functional changes in the stomach of experimental rats at 21, 60, 90, 120, 150, and 180 days, an increase in the number of mucous glands in the layers of the gastric wall, a fullness of small blood vessels in the submucosa, and lymphocyte infiltration were detected (Figure 4).

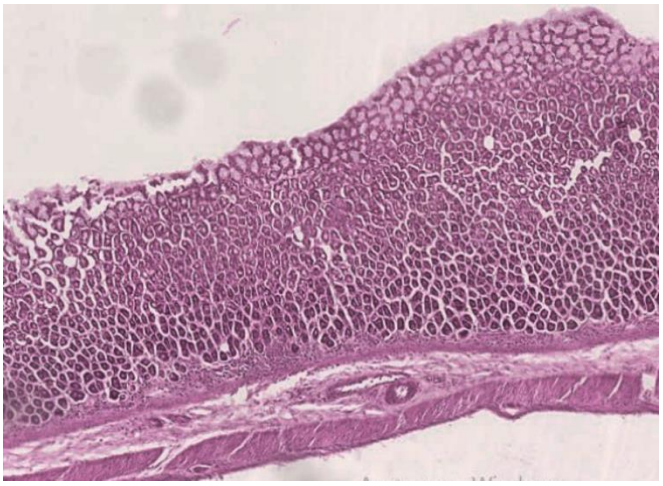

Figure 4. Microscopic view of the increase in mucous glands of the gastric wall layers of the experimental group rats. Staining: Van-Gieson. X: 10x40.

The following data were obtained as a result of studying the morpho-functional changes in the stomach of rats of the experimental group 21, 60, 90, 120, 150, 180 days old. The structural elements of the gastric mucosa of rats are sparse connective tissue fibers, as well as sparse fibrous connective tissue of the submucosa, smooth muscle fibers of the muscularis mucosa, and thickening of the small blood vessels of the gastric wall mucosa and submucosa (Fig. 5).

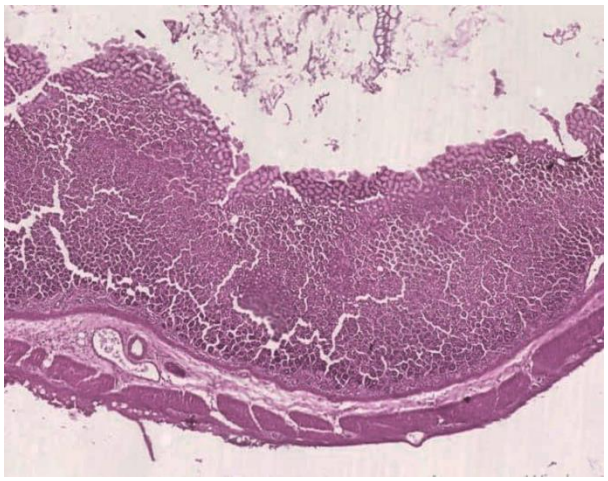

Figure 5. Microscopic view of thickening of small blood vessels in the mucosa and submucosa of the stomach wall of the experimental group rat. Staining: Van-Gieson. X: 10x40.

The mucous, muscular, and outer layers of the stomach wall of white male laboratory rats are supplied with blood by blood vessels. The lymphoid structures of the submucosa consist of several rows of chains of lymphocytes.

The following data were obtained regarding the anatomical structural components of the rat stomach wall.

The stomach of a rat is a crescent-shaped sac that weighs between 3.9 and 9.5 grams. The stomach tissue of a rat makes up about 2.2 % of its total body weight.

During postnatal ontogenesis Changes in the structure of the stomach with age The following data were obtained for the dynamics.

The body weight of 21-day-old male rats ranged from 48 to 55 grams, with an average of 51.5±0.14 grams, and the stomach weight ranged from 1.06 to 1.21

grams, with an average of 1.13±0.5 grams. It was found that the shape of the rat stomach at this age gradually changes from tubular to hook-shaped. The length of the stomach is 1.8 cm to 2.0 cm, with an average of 1.9±0.2 cm, and the width is 0.4 cm to 0.8 cm, with an average of 0.6±0.4 cm.

60 -day-old male rats ranged from 70 to 82 grams, with

an average of 75.6±2.08 grams, and the stomach weight ranged from 1.54 to 1.80 grams, with an average of 1.67±1.8 grams. It was found that the shape of the rat stomach at this age gradually changes from a hook-shaped to a stocking-shaped shape. The length of the stomach is 2.4 to 2.8 cm, with an average of 2.6±0.5 cm, and the width is 0.7 to 1.4 cm, with an average of 1.05±0.2 cm.

The body weight of 90-day-old male rats ranged from 100 to 120 grams, with an average of 110.2±3.08 grams, and the stomach weight ranged from 2.2 to 2.6 grams, with an average of 2.4±0.6 grams. It was found that the shape of the rat stomach at this age gradually changes from a stocking-shaped to a crescent-shaped shape. The length of the stomach is 3.0 to 3.5 cm, with an average of 3.25±0.3 cm, and the width is 1.2 to 1.8 cm, with an average of 1.5±0.1 cm.

The body weight of 120-day-old male rats ranged from 130 to 150 grams, with an average of 141.6±2.23 grams, and the stomach weight ranged from 2.9 to 3.3 grams, with an average of 3.1±0.8 grams. It was found that the shape of the rat stomach at this age gradually changes from crescent-shaped to horseshoe-shaped. The length of the stomach is 3.5 to 3.8 cm, with an average of 3.65±0.2 cm, and the width is 1.5 to 2.2 cm, with an average of 1.85±0.7 cm.

The body weight of 150-day-old male rats ranged from 165 to 186 grams, with an average of 175.5±4.34 grams, and the stomach weight ranged from 3.6 to 4.1 grams, with an average of 3.85±2.6 grams. It was found that the shape of the rat stomach at this age gradually changes from crescent-shaped to sac-shaped. The length of the stomach is 4.0 to 4.2 cm, with an average of 4.1±0.2 cm, and the width is 2.0 to 2.6 cm, with an average of 2.3±0.8 cm.

The body weight of 180-day-old male rats ranged from 200 to 220 grams, with an average of 211.6 ± 3.54 grams, and the stomach weight ranged from 4.4 to 4.8 grams, with an average of 4.6 ± 1.75 mg. The shape of the rat stomach at this age was found to be crescent-shaped. The length of the stomach ranged from 4.2 to 4.6 cm, with an average of 4.4 ± 0.5 cm, and the width ranged from 2.2 to 2.7 cm, with an average of 2.45 ± 0.1 cm.

Table 1

Age-related changes in the anatomical parameters of the stomach of rats in the control group

Rats age (days) on account of)	Rats body weight, gr	Rats stomach weight, gr	Length of the stomach cm	Stomach width cm
21	51.5±0.14	1.13±0.5	1.9±0.2	0.6±0.4
60	75.6±2.08	1.67±1.8	2.6±0.5	1.05±0.2
90	110.2±3.08	2.4±0.6	3.25±0.3	1.5±0.1
120	141.6±2.23	3.1±0.8	3.65±0.2	1.85±0.7
150	175.5±4.34	3.85±2.6	4.1±0.2	2.3±0.8
180	211.6±3.54	4.6±1.8	4.4±0.5	2.45±0.1

The morphometric parameters of the stomach wall layers in rats in the experimental group at 21, 60, 90, 120, 150, and 180 days of age are as follows:

The following data were obtained when the 21-day control group rats were studied. The weight of the 21-day control group rats was 48-55 g, with an average of 51.5 ± 0.14 g.

The thickness of the gastric mucosa of 21-day-old male white rats in the control group was 270.81±23.5 µm, the thickness of the submucosa was 135.65±23.4 µm, the thickness of the muscularis and serosa layers was 202.0±15.5 µm, and the total thickness of the gastric wall was 0.61 ±0.06 mm . The average distribution of the density of the mucous glands was 6.20 ±0.36 mm2 (Table 3).

The weight of 60-day-old male white rats in the control group ranged from 70 g to 82 g, with an average of 75.6 ± 2.08 g. The thickness of the gastric mucosa of 60-day-old rats in the control group was 542.30 ± 50.2 µm, the thickness of the submucosa was 280.64 ± 50.0 µm, the

average thickness of the muscular and serous layers was 275.0 ± 28.0 µm, and the total thickness of the gastric wall was 1.10 ± 0.13 µm. mm. The average distribution of the density of the mucous glands was 10.0 ± 0.60 mm 2 (Table 3).

The weight of 90-day-old male white rats in the control group ranged from 100 g to 120 g, with an average of 110.2 ± 3.08 g. The thickness of the gastric mucosa of 90-day-old rats in the control group was 701.81 ± 15.0 µm, the thickness of the submucosa was 416.71 ± 43.5 µm, the average thickness of the muscular and serous layers was 280.2 ± 12.1 µm, and the total thickness of the gastric wall was 1.40 ± 0.07 µm. mm. The average distribution of the density of the mucous glands was 13.8 ± 0.32 mm 2 (Table 3).

The weight of 120-day-old male white rats in the control group ranged from 130 g to 150 g, with an average of 141.6 ± 2.23 g. The thickness of the gastric mucosa of the 120-day-old rats in the control group was 782.22 ± 23.1 µm, the thickness of the submucosa was 440.66 ± 50.0 µm, the average thickness of the muscular and serous layers was 306.5 ± 30.0 µm, and the total thickness of the gastric wall was 1.53 ± 0.10 µm. mm. The average distribution of the density of the mucous glands was 15.4 ± 0.21 mm 2 (Table 3).

The weight of 150-day-old male white rats in the control group ranged from 165 g to 186 g, with an average of 175.5 ± 4.34 g. The thickness of the gastric mucosa of 150-day-old rats in the control group was 810.41 ± 64.0 µm, the thickness of the submucosa was 461.20 ± 35.2 µm, the average thickness of the muscular and serous layers was 328.3 ± 61.0 µm, and the total thickness of the gastric wall was 1.60 ± 0.16 µm. mm. The average density distribution of the mucous glands was 16.5 ± 0.15 mm 2 (Table 3).

The weight of 180-day-old male white rats in the control group ranged from 200 g to 220 g, with an average of 211.6 ± 3.54 g. The thickness of the gastric mucosa of the 180-day-old rats in the control group was 835.72 ± 75.0 µm, the thickness of the submucosa was 478.20 ± 24.1 µm, the average thickness of the muscular and serous layers was 344.1 ± 80.3 µm, and the total thickness of the gastric wall was 1.66 ± 0.18 µm. mm. The average distribution of the density of the mucous glands was 17.1 ± 0.12 mm 2 (Table 3).

Stomach wall of control group rats of different ages of the layers (M±m);

Table 3

Rat age	Mucous membrane (micrometer)	Submucosal floor (micrometer)	Muscle and Serous layers (micrometer)	Stomach wall general thickness	Glands density mm ^{2}
21 days	270.81±23.5	135.65±23.4	202.0 ± 15.5	*0.6 1 ± 0.0 6*	*6.20 ± 0.36*
60 days	542.30 ± 50,2	280 , 64 ±50.0	275.0 ±28.0	*1.10 ± 0.13*	*10.0 ± 0.60*
90 days	701.81 ± 15.0	416.71 ± 43.5	280.2 ± 12.1	*1.40 ± 0.07*	*13.8 ± 0.32*
120 days	782 , 22 ± 23,1	440 , 66 ±50,0	306.5 ± 30.0	*1.53 ± 0.10*	*15.4 ± 0.21*
150 days	810.41 ± 64.0	461 , 2 0± 35,2	328.3 ± 61.0	*1.60 ± 0.16*	*16.5 ± 0.15*
180 days	835.72 ± 75.0	478 , 2 0± 24,1	344.1 ± 80.3	*1.66 ± 0.18*	*17.1 ± 0.12*

CONCLUSION

Thus, it was found that the body weight, stomach length, width and stomach weight of white male rats were greater in the experimental group than in the control group. The relative weight of the body and stomach weight of rats at 21, 60, 90, 120, 150, 180 days of age changed depending on age. The anatomical dimensions of the stomach increased at a rate from 21 days to 180 days . Gradually, due to the faster growth of the length of the stomach, the shape of the stomach changed from a tubular shape to a crescent-shaped sac-like shape.

REFERENCES

Teshaev SZ et al. Morphological and morphometric changes of the stomach layer of one monthly white rats //Journal For Innovative Development in Pharmaceutical and Technical Science (JIDPTS). - 2021. - T. 4. – no. 5. - S. 15.

Green W. G. Morfofunktsionalnoe sostoyanie jeludka i slepoy kishki belyx krys posle kursovogo priema claritromitsina //Actualní problemi suchasnoï meditsini: V isnik ukrainskoï medichnoï stomatologíchnoï akademiï. - 2020. - T. 20. – no. 1 (69). - S. 134-140.

Sultanov G. N., Yusupova D. T. Morfofunktsionalnye

izmeneniya sudov mikrokriskulyatornogo rusla jeludka na rannix etapax postnatalnogo ontogenez na fone sakharnogo diabeta //Biologiya i integrativnaya meditsina. – 2017. – no. 4. – S. 33-40.

Potekhin P. P. i dr. Osobennosti slizistoy obolochki antralnogo otdela jeludka pri kronicheskom antralnom gastritis s keshechnoy metaplasiai pri ispolzovanii krasnogo palmovogo masla //Meditsinsky almanakh. – 2011. – no. 2. - S. 115-118.

Raja K. et al. Histological and Histochemical Studies on the Stomach of Guinea Pig (Cavia porcellus). - 2022.

Abd AL-Rhman SA Morphological and histological study of the stomach in local rodent species (guinea pig) Cavia porcellus //Journal of Biology, Agriculture and Healthcare. - 2016. - T. 6. – no. 6. - S. 74-86.

Di Natale MR et al. Organization of the musculature of the rat stomach //Journal of anatomy. - 2022. - T. 240. - no. 4. – S. 711-723.

Gayvoronskaya, Yu. V. Strukturno-funktsionalnoe sostoyanie nadpochechnyx zhelet u belyx krys razlichnogo vozrasta pri izbytochnom upotreblenii palmovogo masla / Yu. V. Gayvoronskaya // Bulletin of the medical internet conference . - 2018. - T. 8. – No. 7. – S. 274-276.

Kamoldinova, R. A. Osobennosti formirovaniya slizistoy obolochki jeludka krys v postnatalnom ontogeneze / R. A. Kamoldinova, R. R. Rakhmanov, Kh. Z. Ibragimova // Re-health Journal. – 2020. – No. 2(6). - S. 65-71.

Mirzoyan E., Chekunkov V.V., Davidenko V.N., Markvo L.I. Histological manifestation of early differentiation of smooth muscle cells in the embryonic tube of the rat in the prenatal period and postnatal histogenesis in the stomach of the rat//Mejdunarodnyi studencheskiy nauchnyi vestnik. - 2015. - No. 2-2. - S. 144.

Petrenko V.M. Form and topography of the stomach of white mice // Uspekhi sovremennogo estestvoznaniya. – 2012. – No. 4. – S. 27-29.

Cheraneva M.V. Morphological parameters of the mucous membrane of the stomach of a sterile white rat, used in experiments//Uchenye zapiski Kazanskoy gosudarstvennoy akademii veterinarnoy meditsiny im. N.E. Baumana. - 2011. - T. 208, No. 4. - S. 407-412.

Yuldashev A. Yu. Morfologicheskie osobennosti formirovaniya slizistoy obolochki fundalnogo otdela zhudka krys v postnatalnom ontogeneze / A. Yu. Yuldashev, S. Z. Yuldasheva, M. X. Rakhmatova [i dr.] // Medical biology of Sv i t. - 2014. - T. 10. – No. 4-2(47). - S. 214-219.

Bittar NM, Zulian JG, Ogias D, Gama P. Ghrelin and GHS-R in the rat gastric mucosa: Are they involved in regulation of growth during early weaning? Nutrition. 2016 Jan ;32 (1):101-7.

Nickel VV, Efremova VP. Age changes in connective tissue structures of the stomach. // Adv Gerontol. 2017 ;30 (5):665-670. Russian. PMID: 29322731.

Matsukura N., Shirota A., Asano G. Anatomy, histology, ultrastructure, stomach, rat //Digestive system. - Berlin, Heidelberg: Springer Berlin Heidelberg, 1985. - S. 281 - 288.

Zhu L., Wang JL Sexual dimorphism in histological structure of normal rat stomach //Int. J. Morphol., Temuco. - 2016. - T. 34. – no. 4. - S. 1461-1464.