

HISTOLOGICAL STRUCTURE OF THE GREY WOLF (*CANIS LUPUS*) STOMACH

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ABSTRACT

The aim of the current study was to investigate the microscopic anatomy structure of the grey wolf stomach wall and to compare it with another carnivorous as dog, fox, jackal, cat and tiger, respectively which were surveyed previously. The stomach of 2 male grey wolves obtained after unplanned hunting, were investigated microscopically. The observation and morphometry was done by using „Olympus“ microscopic computer system.

The mucous membrane of the grey wolf stomach wall contains the typical tubular glands in different anatomical regions of the stomach and a chief, parietal and mucous exocrinocytic cells are presented. But no signs of the layer stratum compactum belt-like collagen formation was observed in wolf stomach mucosa. In layer tela submucosa well developed network of myotypical arterial and venous blood vessels are observed. The muscle layer of the wall is proportionally developed from three-positional situated smooth muscle cells bundles and an autonomic intramural myenteric nervous plexus is found between. The most outer layer serosa is morphologically presented and it enveloped the organ.

Dismissing the layer stratum compactum in grey wolf stomachs is similar fact as another canine animal species like dog, fox and jackal but it differs in cat and tiger where it was demonstrated. This fact supports the hypothesis that the mucosal layer stratum compactum may not to be presented in animals belonging to Canidae family carnivores but usually exists in Felidae animals.

Key words: carnivorous, stomach, histology, stratum compactum.

Introduction

The carnivorous animals have a simple stomach with a classic four layered structure. In histological literature the authors as Bacha W. Jr. and L. M. Wood, 1990, Krystev H. and S. Vitanov, 1993, are described the presence of specific lamina subglandularis into the most inner mucous layer of carnivorous stomach wall. As a wild animal it feeds on meat together with bones, but also supplemented the diet with fruits and vegetables which is supposition for specific structure of the stomach. The information about its designation and composition shows a certain amount of discrepancies. Its presence and double-layered structure in lamina propria mucosae underneath the bases of the stomach glands has also been noted by Smollich A., 1972, who however named it as stratum subglandulare. According to him, as well as Stinson A. W. and M. Lois Calhoun, 1993, the first layer which is situated closer to the bases of the glands and it is designated as stratum granulosum due to the fact that it is rich of connective tissue cells and their nuclei give impression for granulation. The other deeper layer which is positioned just to the lamina muscularis mucosae and has denser collagen structure is designated as stratum compactum. According to other authors only a single-layer dense fibrous acellular membrane, which protects the stomach wall from perforations in carnivorous stomach propria exists. In Nomina Histologica nomenclature, 1992, as Frappier B.L., 2006, it is noted that only one additional layer of the stomach mucosa in carnivores exists and it is called as stratum compactum.

The major aim of the current study was to examine the histological structure of the grey wolf stomach wall and the next one was to compare results with another stomachs from carnivorous

animals as dog, fox, jackal belonging to Family *Canidae*, and also cat and tiger from Family *Felidae*, respectively which were surveyed previously in another studies.

Materials and methods

The stomachs of 2 male grey wolves obtained after unplanned hunting in Balkan range, were examined microscopically. The samples taken for histological investigation were fractionally fixed in 10% buffered formalin after the gastrotomy. Histological slides for microscopic investigation were conventionally prepared. The tissue samples were embedded in paraffin wax and sections 7 µm thick were stained with hematoxylin and eosin. An observation and morphometry of prepared samples by using „Olympus“ (Olympus Co Ltd., Tokyo, Japan) microscopic computer system was done.

All investigated methods are done in accordance with the Bulgarian law for protection and human attitude with animals and were under observation of institutional ethics committee of FVM.

Results and discussion

As we expected the wall of wolf's stomach showed a typical layered structure (Fig. 1.). The fourth main layers, as glandular mucosa followed by tela submucosa, then musculature and after that serosa were histologically presented. In stomach glands the excretory epithelial cells as mucous cells – mucocytes cervicales, chief cells – exocrinocytes principales, and parietal cells – exocrinocytes parietals, were shown. Cervical mucocytes included vacuoles and their cytoplasm was transparent, chief cells which included pepsinogen were stained basophilic and parietal cells included respectively chlorides were eosinophilic. Between glandular tubules an individual smooth muscle cells were observed. They theoretically belong to the most inner layer of mucosal muscle laminae. No sign of the layer stratum compactum as belt-like collagen formation was observed in the wolf stomach mucosa just under the tubular glandular bottoms and before mucosal muscular lamina. Furthermore, stratum compactum was not established, neither in small intestine or in large intestine mucosal layer, in our additional research of the wolf intestinal duct.

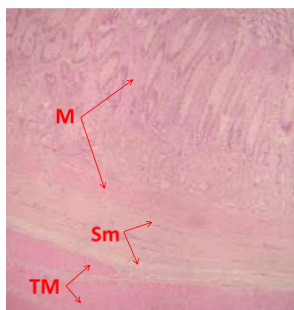


Figure 1: Wolf stomach wall. M – mucosa, Sm – submucosa, TM – tunica muscularis.

Adequately to these facts in another investigated stomachs belonging to animals of Family *Canidae* the mucosal layer stratum compactum also dismisses, as for example in fox, jackal and dog species Zahariev, P. et al, 2010, 2014. This distinctive feature is only comment by Bacha W. J. and Wood L. M., 1990, who reports that the cat stomach has layer stratum compactum, but the later one may be absent in dog's stomach. In comparison to this characteristic, in another investigated

stomachs of animals belonging to Family *Felidae*, the mucosal layer stratum compactum was presented, as for example in domestic and wild cat and tiger. The final one mucosal lamina muscularis is well-developed as three layer organization and thick smooth musculature bundles interrupted by thin connective tissue streaks were established. The existence of smooth muscle cells between the glandular tubules conforms the data of Frappier, B. L., 2006, who also present three layered structure of this lamina in another animal's stomachs. In submucosal layer a branched network of arterial and venous blood vessels was observed. These vascular frames were formed by vessels of muscular type of construction and triple-layered vessel wall was clear demonstrated. The smallest arterioles, venules and capillaries as well as lymphatic vessels were also visible. The muscle layer – tunica muscularis, of the wall is proportionally developed from three-positional situated bundles of smooth muscle cells which are better presented in cardiac and pyloric regions. An autonomic intramural myenteric nervous plexus containing multipolar neurons was found between muscular fascicles. The most outer denser serous layer was morphologically presented and it's composition of fibrous layer and superficial mesothelium, consisting of squamous epitheliocytes, was observed.

Conclusion

Dismissing of the layer stratum compactum in grey wolf stomachs is a similar fact as in another canine animal species like dog, fox and jackal but it differs in cats and tiger where it was demonstrated. This fact supports the hypothesis that the mucosal layer stratum compactum probably is not presented in all animals belonging to Family Canidae but usually permanently exists in animals of Family Felidae, nevertheless that these both families belong to the Order *Carnivora* animals.

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