Institute of Experimental Morphology, Pathology and Anthropology with Museum
Bulgarian Anatomical Society

Acta morphologica et anthropologica, 26 (3-4)
Sofia ● 2019

Histological Gastric Structure of Badger (Meles meles)

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The aim of this study was to investigate histologically the stomach of a male badger (Meles meles) which was found on the road after car accident and to compare it with another carnivorous animals as dog, fox, wolf, jackal, bear, cat and tiger. In carnivores, for comparison aspect as nomenclature prescription, the mucosal layer of the stomach has a collagen like membrane layer - *stratum compactum mucosae,* just under the funduses of the glands. Previously it was called - *lamina subglandularis,* and its thickness in mature animals varies between 15-40 μm. Actually the layer in badger stomach was not presented in observed slides although the animal belongs to carnivorous order. It is similar situation as in animals of canine family unlike of animals from feline family which usually have layer - *stratum compactum mucosae*, between bottom of the glands and muscular mucosal lamina.

Key words: histology, carnivorous, badger, stomach

Introduction

The badger (*Meles meles*) belongs to Class Mammalia, Order Carnivora of the family Mustelidae. It is distributed in mountain areas that are less urbanized, and although it avoids contact with people, it is subject to taming. The badger is the only animal that allows in their labyrinthine hollow "renters", nevertheless they are other animal species.

As a wild animal it has been recorded consuming the greatest variety of foods, but also supplemented the diet with fruits, small vertebrates, various invertebrates (worms, molluscan and others).

The badger has been subjected to various genetic and ecological studies on its origin, structure distribution and behaviour. In our country there are little scientific reports that are related to badgers' investigations and treatment and they are concentrated generally on similar wild animals [1, 4, 5, 6]. Furthermore, there are small morphological investigations focusing on specific comparative morphofunctional explanation of badger organism or in comparison [4]. The animal is the object of hunting because of his precious skin and some subproducts of it. Stuffed specimens serve not only for ornamentation, but also for beautiful accessories, souvenirs and even clothes.

According manner of eating carnivorous must bite and rip their food off and probably because their teeth are brachidont, as herbivores chew side to side and their teeth are hypsodont [7, 9]. Unlike humans, their saliva does not contain digestive enzymes. Carnivores have a shorter digestive tract. This is because their meat is rich of nutrients and they can extract them easier. The actual size of a carnivorous stomach is significantly larger than herbivores. Their stomachs encompass roughly 60 to 70% of their digestive tracts. Within their stomach they have powerful digestive enzymes. They have roughly 10 times more the excretion of hydrochloric acid in their stomach than humans or herbivores. Their caecum, however is much smaller in comparison of other animals.

Anatomically, the stomach of the carnivores resembles a lot of human, both in shape and in a device where the entire mucosal surface is glandular, unlike that of the horse and the pig, in which animals about 1/3 of the surface has an aglandular cutaneus mucosa. Furthermore, ruminants have specific aglandular forstomach with three parts, respectively rumen, reticulum, omasum, and then follow a glandular abomasum, corresponding to ventriculus [7, 13, 14].

In histological literature there are data for specific lamina subglandularis in carnivorous stomach wall which presences into the propria of mucous layer. Some other histologists demonstrate double-layered structure of this lamina subglandularis, which is underneath the bases of the stomach glands. According to them the first layer which is situated closer to the bottoms 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 second layer they call *stratum fibrosum*, consisting of thick collagen fibers and which actually is typical *stratum compactum mucosae* [2, 3, 8]. According to other authors and by Nomina Histologica only a single collagenous acellular layer *stratum compactum mucosae* exists in carnivorous stomach mucosa, which hypothetically protects the wall of perforations [10].

The aims of this study are investigation of the histological structure of the badger stomach wall and comparing it with other carnivorous animals as dog, fox, jackal, wolf, bear, cats and tiger, respectively which were surveyed previously and to comment this specific fact on the physiological reason for this.

Materials and Methods

The stomach of a male badger which was found on the road after car accident was investigated. After laparotomy the stomach was removed and pieces from the wall were cut. The histological slides were prepared by conventional method and after paraffin impregnation, the sections 7 μm thin were cut by microtome and stained with Hematoxylin and Eosin. Then the samples were examined microscopically and morphometry was done as well. For observation, measurement and picture documentation a microscope with computer system „Olympus“ (Japan) was used.

Results and Discussion

Almost 1/3 of the wall thickness of badger stomach is covered by mucosa (**Fig. 1**). Superficial mucosal epithelium has columnar form in one layer and weak eosinophily was demonstrated. Glandular tubules have transversal diameter around 25 μm and into the thin space between tubules in loose connective tissue of the propria an individual smooth muscle cells exist that are arisen by three layered structure of *lamina muscularis*

mucosae as it was described for another animals [3]. In stomach glandulocytes are shown, respectively basophilic chief cells (*exocrinocytes principales*) and eosinophilic parietal cells (*exocrinocytes parietales*) but less mucocytes are observed. Furthermore, as in many other investigated by us carnivorous species belonging to canine family the subglandular mucosal layer – *stratum compactum mucosae*, was not established [11, 12, 13, 16, 17].

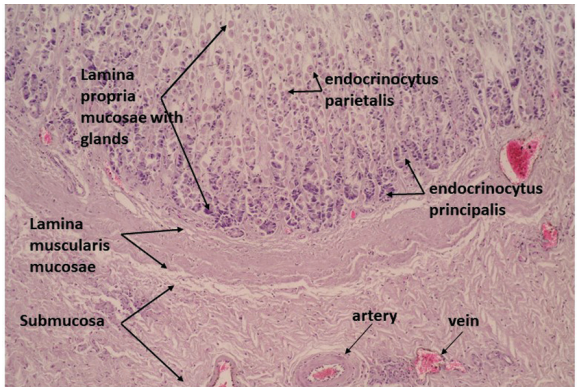

Fig. 1. Mucosal and submucosal layers of badger stomach (magn. × 100).

Opposite to this fact in felines species stomach the layer *stratum compactum mucosae* was always presented (**Table 1**). This distinctive feature is only commented by some authors [2], who report that the cat stomach has layer *stratum compactum mucosae*, but the latter may be absent in dog's stomach.

Submucosa is quite thicker in comparison of other large animals [7, 13, 14] and varies almost 500 μm. It includes between tissue composition well developed myotypical blood vessel plexus and masses of diffusely distributed lymphocytes. Submucosal autonomic nervous plexus – Meisneri, is very well presented in sites rich in white adipose tissue.

Table 1. Stratum compactum existence layer in stomach mucosa of investigated animals.

Family of Order Carnivores	Species	Total (n)	Male (n)	Female (n)	*Stratum compactum mucosae* (μm)
Canidae	Dog *(Canis familiaris)*	15	9	6	-
	Fox *(Vulpes vulpes)*	1	-	1	-
	Jackal *(Canis aureus)*	2	2	-	-
	Grey Wolf *(Canis lupus)*	2	2	-	-
Ursidae	Brown Bear *(Ursus arctus)*	1	-	1	-
Felidae	Domestic Cat *(Felis domestica)*	8	3	5	32.5 – 37.5
	Wild Cat *(Felis silvestris)*	2	1	1	15 – 25
	Tiger *(Panthera tigris)*	2	1	1	40 – 42.5
Mustelidae	Badger *(Meles meles)*	1	1	-	-

Thickness of muscular wall layer varies 200-300 μm and bundles are surrounded by delicate perimysium. Longitudinally cut smooth muscle cells have a worm-like nuclei as a result of suddenly cause death. The autonomic intramural myenteric nervous plexus containing multipolar neurons is found between muscular fascicles (**Fig. 2**).

The peritoneum has common compound [3, 7, 10] and its proper layer consists of dense irregular connective tissue covered outside with mesothelium.

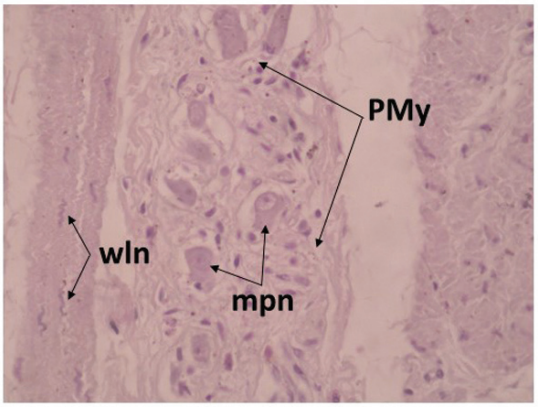

Fig. 2. Part of the muscular layer from badger stomach. PMy – *plexus nervous myentericus*, wln – worm-like nuclei, mpn - multipolar neurons (magn. × 400).

Conclusion

Dismissing of the layer *stratum compactum mucosae* in a badger stomach is a similar fact as in another canine carnivorous species like dog, fox, jackal, wolf and bear, but it differs in feline animals – cats (wild and domestic) and tiger, where it was demonstrated. This fact supports the hypothesis that the mucosal layer *stratum compactum mucosae* permanently exists in *Felidae family* animals, but it is not usually presented in animals belonging to *Canidae, Ursidae* and *Mustelidae family*, nevertheless that these three families belong to animals of *Order Carnivorae*.

Acknowledgements: The financial support by the National Program of Ministry of Education and Science for Young Scientists and Postdoctoral investigators 2018-2020 is acknowledged.

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