Bulletin UASVM Animal Science and Biotechnologies 70(2)/2013, 383-384
Print ISSN 1843-5262; Electronic ISSN 1843-536X

Anatomical and Histological Comparative Study of the Esophagus and Stomach in Rainbow Trout, from Different Growth Systems

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Abstract. Due to modernization of growth technologies and the increasing of growth trout densities, were highlighted differences in terms of the final products obtained quality. Therefore, we aimed to identify the possible morphological and histological changes of the digestive system of rainbow trout, by adequate investigation on some specimens from two different farming systems, one classical and the other superintensive-recirculating. Respecting the working protocols, were slaughtered trout from each system, being prelevated samples and segments of the esophagus and stomach. The results did not reveal morphological and histological differences, except for some lipids deposits.

Keywords: rainbow trout, esophagus, stomach, anatomy, histology

Introduction: One of the most intensively exploited fish species, both nationally and throughout the world, is rainbow trout (*Oncorhynchus mykiss*). Even if they have done anatomical and histological studies of the digestive tract (Geyikoğlu *et al*., 2004; Khojasteh, 2012), we believe they are insufficient, this being the reason we want to bring our contribution at the completion of the literature.

Aims and Objectives. From the perspective of diversification of rearing technologies and replacing animal protein ingredients with plant constituents in the forage structures (economical reason), we intend to investigate the changes that occur in the digestive tract, both anatomically and histologically.

Materials and Methods. Experiments were conducted in 2012, being slaughtered 10 rainbow trout from each group. The origin of the biological material was common, from the same population (Fiad trout nursery, Bistrița-Năsăud County). The collected samples were fixed in 10% formalin and then, were included in paraffin, passing then through all stages of hydration, re-hydration and the microtome sectioning. Coloration protocols were hematoxylin-eosin and goldners'trichrome. Anatomical observations were made macroscopically.

Results and Discussions. At the esophageal mucosa level, respectively esophageal lumen, are present parallel longitudinal folds. In terms of coloring, they have a pale tinge in the first third (in close proximity to pharyngo-esophageal junction), gradually becoming pale pink in the middle third, and later, the hue of pink to become more evident in the last third, sometimes with reddish tints. The role of these prominences is to enable esophagus to dilate, when the catch is large prey. On the back part of the first third of the esophagus, are present the pneumatic duct that connects the esophagus and air bladder. Precisely for this reason, rainbow trout is fall within pfizostoumos fish category, less evolved. Highly evolved fish (as fish belonging to the *Cyprinidae* family), no have this duct. Boundary demarcation between the esophagus and stomach is evident, and is resembles at the eso-gastric junction with a pseudo-sphincter.

From the histological point of view, it is also in both groups noted, that the esophagus has a poor keratinized mucosa, followed by a dense lamina propria, composed of connective tissue. In lamina propria are present glands that is opened in the esophageal lumen (Ciuhandu *et al*., 2012), probably acting as lubricant, facilitating the transfer of food from the oral cavity, to pharynx and stomach (Arellano *et al*., 2001). It is known that in fish, the chemical digestive processes are starting at the stomach level (in fish that have stomach), or in the first third of the intestine (in fish without stomach -herbivores) (Horn *et al*., 2006). Collagen fibers are also present in the lamina propria of the histological structure of esophagus. Under the lamina propria is found the muscular tissue, composed of smooth muscle fiber. Histologically, there are no differences in the esophagus between the two studied groups, except some adipose deposits, due to the more pronounced voluntary ingestion of trout from recirculation system (Al Abdulhadi, 2005). In general, the fish stomach is like a dilatation of digestive tube, more or less pronounced, depending on the species and specific nutritional spectrum. Rainbow trout stomach takes the shape of the letter V, presenting two branches: one first descending branch, which make the junction with the esophagus, and the second branch, ascending, that connects the stomach with medium intestine. Morphological and anatomical differences have not been reported between stomachs of trout in the two studied groups. Relationship between the muscular wall and mucosa is 4:1 for both groups, and longitudinal folds, highlighted on the esophagus are also present on the stomach, but they are less pronounced. The stomach muscle layer is protected by a very thin covering epithelium and the cells from this area have a oval shape. They role is secretory. The mucosa of lamina propria is densely, at this level being very good represented collagens fibers. In the mucosa thickness are many simple or branched tubular and acini glands, acting as secretion of substances necessary for the digestive processes. The mucosa is similar to most animals (including mammalians), showing deep crypts and numerous glands.

Conclusion. The anatomical and histological investigation of the rainbow trout esophagus and stomach, from the different rearing systems, did not reveal major structural differences. Therefore, we conclude that growth technology, regardless of intensive or super-intensive criteria, it doesn't lead to anatomical and histological differences in esophagus and stomach of rainbow trout.

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