Short Communication

Anatomical study of urinary organs and accessory glands in javelin grunter, Pomadasys kaakan (Cuvier, 1830) from the Persian Gulf (Teleostei: Haemulidae)

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Abstract: Pomadasys is a genus of Haemulidae family, order Perciformes, inhabits in the Persian Gulf. The members of Pomadasys are known as Grunters (Sangsarmahian). The aim of this study was focusing on javelin grunter, Pomadasys kaakan (Cuvier, 1830) from anatomical points of view to provide some basic knowledge to facilitate subsequent decision makings for marine culture, resources preservation, health keeping and disease diagnosis of this marine fish. Eleven javelin grunter (total length: 32.5±5.83SD) were caught in Hormuzgan fishing harbours, then an incision was made on the abdomen to penetrate the fixative (formalin solution 10%) and transported to aquatic laboratory of veterinary faculty for anatomic investigations of liver, spleen, pancreas and urinary system. The position, adjacencies and characteristics of any of the mentioned organs were expressed. The liver is divided into two right and left portions (pedicles) which left one is bigger and are connected to each other making an uncommon loop shape. The spleen of grunter fish is a long and dark organ located inside the intestinal meso and under the right pedicle of liver. The pancreas is located between two parts of intestine and after the second intestinal curve in the form of disseminated and pink tissue. The two kidneys are located as lobulated twain organs on the top of swim bladder and in the ceiling of abdominal cavity anteriorly began from the side of the esophagus (where right and left pedicles of liver are connected) and finally ends to the ureter.

Keywords: Pomadasys, Liver, Spleen, Pancreas, Kidney.


Introduction

Identification and morphoanatomical evaluations of the Persian Gulf fish species are the primary steps of the possibility assessments for culture, propagation and mass cultivation of these species and preventing the importation and culture of invasive and non-native species in Iranian waters and safekeeping and preserving the local valuable species. Stocking density, dens nutrition and infectious agents in marine culture systems may induce some displacements and gross injuries in kidney and accessory glands like nephrocalcinosis and cystic, tumoral and paranchimatous injuries with various causes which their accurate diagnosis and control require the prior studies and basic knowledge about the normal anatomic situations of the organs and

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tissues (Mokhayyer 2003).

Haemulidae is a family of fishes in the order Perciformes commonly known as grunters. There are about 135 species in two subfamilies (Haemulininae and Plectorhinchinae) (Eschmeyer & Fong 2016). These fish are found in tropical fresh, brackish, and salt waters around the world in the Atlantic, Indian, and Pacific oceans (Nelson et al. 2016). They are bottom-feeding predators, and named for their ability to produce sound by grinding their teeth. Three genera of Haemulidae family (with the local name of Sangsar), including Diagrama, Plectorhynchus (each one with one species) and Pomadasys with five species exist in the Persian Gulf. The fish with different sizes are observed in coastal shallow waters of coral reef regions and in muddy waters. Their nutrition is mainly based on benthic invertebrates and these are generally omnivorous (Sadeghi 2001). Since these fish are desirable trade species and worthy of investment for culture and maintaining the reserves in future, this article tries to investigate the anatomic characteristics of urinary organs and accessory glands of digestive system (liver, pancreas and spleen) in Pomadasys kaakan (Cuvier, 1830).

Material and Methods

Eleven grunter fish were caught from Hormoz catching station of Hormuzgan Province (Iran), then an incision was made on the abdominal mid line for better fixative penetration in formalin solution of 10% and the specimens were then transported to Kerman University Aquatic Laboratory of Veterinary Faculty for anatomical investigations. The macroscopic studies were performed on accessory digestive glands (liver, pancreas and spleen) and urinary organs using stereomicroscope (Nikon SMZ Japan) and weight and length measurements were made on the studied organs using a digital scale.

Results

Liver: This organ is one of the accessory glands of digestive system which is observed after unfolding the abdominal cavity (Fig. 1A, B, C). The liver is divided into two right and left portions (pedicles) which the left one is bigger than the other and are connected to each other at the abdominal and dorsal sides of the esophagus making a hepatic loop around the esophagus. The right pedicle continues on the swim bladder and the left pedicle continues on the stomach and is located next to the swim bladder and genital glands (Fig. 1A, B, C). The two pedicles are located on the digestive system. No gall bladder was observed in javelin grunter fish in this study. The mean weight of liver was 3.64g and its mean length of left and right pedicles were 6.21 and 4.92 cm, respectively. The liver had allocated the 21.37% of weight of whole digestive organs.

Spleen: It is a long and red dark organ located inside the intestinal meso and under the right pedicle of liver and is to some extent at the mid line of the body (Fig. 1D, E). The spleen of grunter is 4.66cm long and 0.29g (mean).

Pancreas: This organ is located in the intestinal mesoes between two parts of intestine and after the second intestinal curve in the form of a disseminated and pink tissue (Fig. 1F).

Kidney: The two kidneys are located as lobulated twain organs on the top of swim bladder and in the ceiling of abdominal cavity (Fig. 1G, H). Each kidney anteriorly begins from the side of the esophagus (where right and left pedicles of liver are connected) and finally ends to the ureter. In male grunter fish, the ducts coming out from the testicles connected to each other and beside the ureter they reach to the urinary sinus to shed their contents to the urogenital orifice. The urogenital orifice is located behind the anus (Fig. 2A, B). The mean length of the kidneys in this species is 10.48cm and this is 32.24% of body length.

Discussion

In some species such as sharks and rays, liver is a big organ and especially in some of the pelagic sharks, it is about 20% of fish body weight. It is comprised of two lobes in sharks while in salmon it has one part
Fig. 1. Organs in the abdominal cavity of Pomadasys kaakan. (A) 1-liver, 2-muscular wall of abdominal cavity, (B) 1-hepatic loop around the esophagus, 2-right pedicle of liver (RP), 3-stomach, 4-left pedicle of liver (LP), 5-intestine, 6-spleen, (C) 1-RP of liver, 2-LP of liver (ventral view), (D) 1-LP of liver, 2-RP of liver, 3-stomach, 4-first curvature of intestine, 5-second curvature of intestine, 6-spleen, 7-last curvature of intestine, (E) 1-spleen, 2-liver (ventral view), (F) 1-pancreas, 2-intestine (ventral view), (G) 1-kidney and 2-swim bladder (right flank view) and (H) 1, 2-kidney, 3-part of swim bladder.
and in makerel (Scombridae) it has three lobes (Sattari 2006). In the current study, the liver of grunter appropriated 21.38% of the body weight. In grass carp, Ctenopharyngodon idella and common carp, Cyprinus carpio (Cyprinidae) liver has two lobes (right and left) and the right one is bigger (Zehtabvar et al. 2011a, b) while in grunter the left lobe was visibly bigger than right lobe. In this fish, the right lobe is located on the swim bladder and left lobe had laid on the stomach and was located beside the swim bladder and gonads. In brown grouper, Epinephelus chlorostigma (Serranidae), the liver is noticed as a brown gland located at the center of the peritoneal cavity on the ventral side of the esophagus (Hassan 2013). In the current study, the liver is also located on the ventral side of the esophagus and makes a loop around it. The liver of hagfishes (Myxini) has two separate parts connecting to gall bladder via two separated ducts. The adult lampreys (Petromyzontiformes) have no bile duct or gall bladder but many of other fish have gall bladder (Sidon & Youson 1983). The javelin grunter had no gall bladder.

The hagfish has a small pancreas with numerous ducts which drain the excretions to the bile ducts. Lampreys have the pancreatic tissue (only endocrine gland) which is diffused throughout the liver and intestinal wall. In bony fish, especially the species with thorn rays in fins, the pancreas tissue is diffused inside or around the liver. In sharks and rays, the pancreas is noticed as a compressed organ and has two portions (Pieler & Chen 2006). In brown spotted grouper, the pancreas is scattered throughout the mesenteric peritoneal cavity and more focused on gastric and hepato intestinal mesenteries (Hassan 2013). In grass carp, the pancreas is observed as a coalescent gland at the beginning of the intestine (Zehtabvar et al. 2011a). In our study, the pancreas is located inside the intestinal mesoes and is scattered between two parts of intestine and mainly after the second curve in pink color.

Spleen is a red dark organ and is usually in pyramidal shape. This organ is laid on or on the back of the stomach (Sattari 2006). In common and grass carp, the spleen is being on the left side of the abdominal cavity and its initial part is in contact with the left lobe of the liver (Zehtabvar et al. 2011a, b). Lamprey and hagfish do not have a compressed and integrated spleen but some spleen like tissues are diffused along the intestine. Also there is no spleen in lungfishes (Sattari 2006). The spleen in javelin grunter is an oblong and dark organ placed in the intestinal mesoes under the right pedicle of liver and is nearly under the midline of the body.

In sturgeons and paddle fish a pair of long kidneys have been observed along the abdominal cavity which are separated and narrower at the anterior and fused to each other at the posterior side (Georgi & Beedle 1978; Gambaryan 1988; Sattari 2006). The grunter fish of our study had a pair of long
and dark kidneys on top of the swim bladder embedded in the ceiling of body cavity which are similarly separated at the anterior and connected at the posterior part and their length is 32.24% of total body length. In many of male fish, there is connection between kidneys and genital system and the anterior kidney receives numerous efferent ducts from the testis and at the posterior the nephric tubules of each kidney join to each other (from both sides) in to a dilated sac like structure. In Polypterus the posterior kidney is related to testis but except for the urogenital sinus no connection exists between ductus deferens and archinephric tubule (Wake 1986; Sattari 2006).

In the current study, the nephric and deferens ducts are separated but both are connected into a space. Because the urogenital and digestive contents effuse separately through anus and urogenital orifice, the authors prefer to name that space as urogenital sinus (instead of cloaca or bladder) which opens into urogenital orifice at the end.

The positioning of the urinary organs and accessory glands of P. kaakan are in accordance with the usual pattern of these organs in many of the bony fishes. The presence of accessory glands beside a big liver with its uncommon loop shape probably provides and keep the needed amount of glucose and iron for swimming muscles and movements and helps the fish to metabolize the substantial portion of the protein in fish feed and to store noticeable amount of blood and immune cells and to excrete the additional metabolites and helping the fish for better osmoregulation in variable osmolarity of different settlements of the Persian Gulf by means of long kidneys and its ducts.

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References
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مطالعه تشريحی اندام‌های ادراری و غدد ضیمه در ماهی سنگسر معمولی (Pomadasys kaakan (Cuvier, 1830))

خلاصه

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کلیدی: سنگسر، کبد، طحال، پانکراس، کلیه.