

Macro Anatomic Investigations on Digestive System of Marmara Region Sea Gulls

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Abstract: In this study, 5 sea gulls brought for fracture treatment and died at the Istanbul University Veterinary Faculty Wild Life Research and Protection Club (VASAK) were used. The digestive systems were dissected after keeping the gulls in 10% formaldehyde solution. Crop and Meckel's diverticulum (Diverticulum vitelli) were not observed at dissection. Ceca averaged 0.7 cm as a pair at both sides of the ileum. Gallbladder was present as a 2.2 cm long pouch between the liver lobes. The aim of this study was determination of macroscopical differences in the digestive system of sea gulls and establishes a data to compare anatomical characteristics with other avian species.

Key words: Sea gull, avian, birds, digestive system, gastrointestinal track, anatomy, Turkey

INTRODUCTION

Sea gull is a common name for sea birds belonging to Laridae familia of Charadriiformes order (King and Mclelland, 1984). Most of the species are gathered in the Larus genus (Kiziroglu, 1989). There are 11 sea gull (*Larus* sp.) species living in Turkey. Their colour is generally white having some black and grey colorings on the back and upper wings (Kiziroglu, 1989; Demirsoy, 1992). Their length varies between 21-52 cm (Kiziroglu, 1989). They feed on fish, garbage, small mammals and baby birds (Kiziroglu, 1989; Demirsoy, 1992).

Adaptations for reducing body weight on birds which adapted to fly has also acquired in digestive system (Whittow, 2000). Lips, teeth, soft palate and jaw muscles are not present (King and Mclelland, 1984; Dursun, 2002; Whittow, 2000). Beak that used for holding, catching, carrying and rupturing the nutrients (Dursun, 2002) is very light structured (Whittow, 2000). Sharp sides of the beak called tomia are performs the duty of lips and teeth (King and Mclelland, 1984).

The soft palate is absent in birds therefore the pharynx is not divided into nasal and oral parts and have a single cavity called oropharynx. Choana is a median fissure in the upper palate that connects oropharynx to the nasal cavity (King and Mclelland, 1984; Dursun, 2002). Infundibular cleft is placed behind the choana and shaped as tiny fissure that opens to the right and left pharyngothympanic tubes (King and Mclelland, 1984). Birds tongue is differentiated according to shape of

collecting, processing and swallowing of nutrients (King and Mclelland, 1984; Dursun, 2002; Whittow, 2000). Beak has great influence on different appearance of tongue (Dursun, 2002). By the help of papillae on it and rostrocaudal movements of the tongue, received nutrients moved to oesophagus and crop. The avian oesophagus is thin-walled (Whittow, 2000) and has a property to expand much more than mammals (King and Mclelland, 1984; Dursun, 2002). In many species crop was formed by dilatation of the oesophagus at the entrance of thoracic cavity (King and Mclelland, 1984; Dursun, 2002). Crop is an organ that nutrients are stored, initial digestion started and in pigeon milk like fluid is excreted (Dursun, 2002).

Birds have a capability of digesting their nutrient without chewing and have a very short digestive track. The stomach is generally placed at left dorsal and left ventral parts of the thoracoabdominal cavity in birds (King and Mclelland, 1984). In mammals, the stomach consists of a single chamber however in birds, the stomach consists of two chambers, proventriculus (pars glandularis) and the gizzard (pars muscularis) (King and Mclelland, 1984; Dursun, 2002; Bahadir *et al.*, 1992b; Whittow, 2000; Nickel *et al.*, 1977). The proventriculus placed in front of the gizzard. It is a fusiform shaped organ with different size and shape among species. It is a small in granivorous species while large and distensible structured in aquatic carnivores. In the *Carnivorous* and *Piscivorous* species; stomach is adapted for storage nutrients. Muscular stomach contains two pairs of opposing circular muscle that one is thin and the other is

thick (Whittow, 2000). The small intestine is divided to parts as duodenum, jejunum and ileum. Diverticulum vitellinum (Yolk stalk, Meckel's diverticulum) is used to determinate the border of jejunum and ileum (Whittow, 2000). Intestinal lengths show variations between avian species. Cecum reaches to merge point of ileum and rectum (colon). In some bird species ceca is absent or rudimentary. In other species they are paired and placed on both sides of ileum which is different from mammals. Rectum is sometimes called colon and relatively short in aves.

The cloaca and rectum have an important role in water reabsorption. Cloaca has a duty as being joint track for urinary and reproductive systems and excreting of digestive system wastes from body. It is formed from three parts as coprodeum, urodeum and proctodeum. Pankreas and liver are auxiliary organs of the digestive system (Whittow, 2000).

Considering these morphological traits, it aimed to determine the macroscopic differences of the digestive tract of sea gulls and have a data to compare with anatomical characteristics of other aves.

MATERIALS AND METHODS

Five dead sea gulls (*Larus* sp.) were used which were brought to the I.U. Veterinary Faculty Wild Life Research and Protection Club (VASAK) to be treated and died. The gulls were kept in 10% formaldehyde solution for 48 h. According to Calislar (1977) dissection technique, the materials digestive tracts were dissected from the beak and photographed by a Nikon Coolpix 5100 digital camera.

Nomina Anatomica Avium was referred for terminology (Baumel *et al.*, 1993). This study has been approved by Istanbul University Animal Researches Local Ethical Commission with serial number 89 on 23rd of July 2009.

RESULTS AND DISCUSSION

Beaks were even firm and sharp. The upper beak extended to the lower like a hook and was longer. Measurements are shown in Table 1. Palatum was made up of two parts as pars rostralis and pars caudalis. About 5-7 papillas medially located on the pars rostralis of palatum were observed.

These papilla increased in size from cranial to caudal and the last one was divided into two (fork like). At the pars caudalis of palatum at both sides of choana, a groove (sulcus palatina laterale) started with a V shaped nicked blister getting shallower and narrower towards cranial were witnessed. On the medial sides of both grooves (left

Table 1: Length measurements of upper beak, lower beak, tongue, esophagus, glandular and muscular stomach, duodenum, jejunum, ileum, right-left ceca and colon of sea gulls

Gulls lenght measurements (mm)	Sea gull 1	Sea gull 2	Sea gull 3	Sea gull 4	Sea gull 5
Upper beak	45.81	51.71	53.85	76.33	77.46
Lower beak	43.11	51.06	52.02	72.60	75.29
Tongue	30.26	33.25	32.49	45.21	45.50
Esophagus	54.60	57.98	101.65	166.51	140.31
Glandular stomach	17.80	18.20	19.80	23.41	22.53
Muscular stomach	23.64	30.20	26.31	34.74	32.60
Duodenum	78.96	142.27	111.07	116.88	114.65
Jejunum	160.18	180.28	310.90	290.10	275.08
Ileum	57.92	48.05	32.85	38.80	42.12
Right Ceca	8.44	8.01	7.39	7.11	4.60
Left Ceca	8.51	8.04	8.64	7.57	5.09
Colon	35.52	37.87	36.84	38.93	45.52

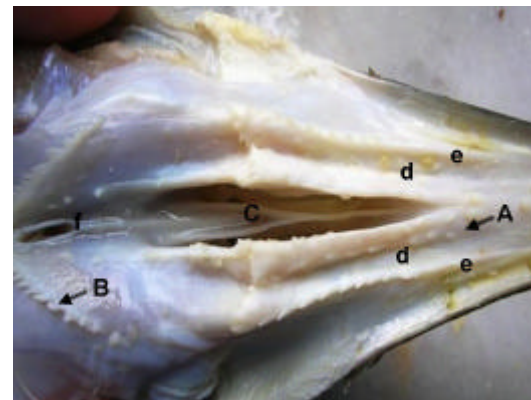


Fig. 1: View of palate. A: Papilla palatina, B: Papilla pharyngealis, C: Choanal cleft, d: Sulcus palatina laterale, e: Rugae palatina laterale and f: Infundibular cleft

and right) 10-12 Papilla palatina located close to each other from cranial to caudal are shown in Fig. 1. These papilla have combined at the cranial edge. On the lateral side of the above groove (rugae palatina laterale), 8 hard, sharp saw-teeth like protrusions were observed.

Choana and infundibular cleft just behind were observed to be adjacent. There was a sharp side of 1.5 cm long on the attachment border above. There were 10-12 V shaped pharyngeal papilla pointing to caudal direction and located backwards from the infundibular cleft (Fig. 1).

The tongue observed on lower jaw was a sharp triangle shape towards cranial and apex lingua was V shaped. Conical shaped 20-25 Lingual papillae were observed at caudal tongue (Fig. 2). Lingual frenulum was observed as a single cord. Tongue length measurements are shown in Table 1.

Esophagus extending from pharynx to the glandular stomach was comprised of a long neck (Pars cervicalis) and shorter thorax (Pars thoracalis) regions. The cervical



Fig. 2: View of the Lingual papilla

region was observed to travel first at dorsal of trachea and then at the right side of the neck. No crop was witnessed along the length of the esophagus of the examined gulls. The stomach was observed to be comprised of two sections, glandular and muscular. The glandular stomach was attached to vertebral column at the entrance of thorax by connective tissue, vessels and a thin pleura fold. The glandular and muscular stomach was observed to be at the left side of the median line and muscular stomach to resemble a biconvex lens. Length measurements of esophagus, glandular and muscular stomach are shown in Table 1.

It was determined that duodenum was U shaped emerging from the pylorus region of stomach with a groove at the middle for pancreas to place. Jejunum was spiral shaped between duodenum and ileum. No Diverticulum vitelli was observed in ansa jejunalis which were not spiraled so much. Length measurements of intestines are shown in Table 1.

Ceca, the initial region of the large intestine were rudiment at both sides of ileum measuring 0.7 cm (Fig. 3). Colon (Rectum) was average 3.9 cm long in sea gulls opening to the coprodeum. The left lobe of liver was larger than the right having an average 10.5 g weight in gulls. The bile duct was average 2.2 cm long on the right lobe of liver.

In accordance with Nickel *et al.* (1977) explanations in the fowl and pigeon, the beak of the sea gull was extremely hard and the upper beak made a hook over the lower beak. Whittow (2000) mentioned that birds from Charadriiformes order have totally soft beaks. However, it observed that seagulls from Charadriiformes order have very hard beaks. It concluded that this can be an adaptation sourced from seagulls feeding style. Transversal papillae reported in front at both sides and next to the choana (Getty, 1975) were determined also in this study. The findings were parallel to the results of

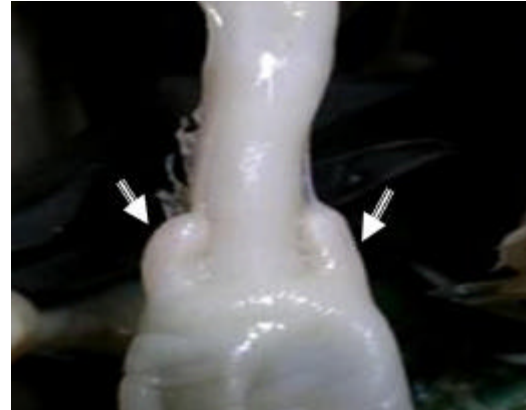


Fig. 3: View of ceca (right and left)

Getty (1975) who has stated this number as 10-12 transversal rows. Nickel *et al.* (1977) stated that the tongue of aves had variations in shape depending on the shape of the lower beak. This information has been approved in the present study and the V shape of the tongue tip was also observed as reported by Calislar (1977).

Whittow (2000) specify that the tongue in *Piscivorous* species are nonprotruding and covered with stiff, sharp, caudally directed papilla. Transversal lingual papilla at caudal part of the tongue (Nickel *et al.*, 1977; Dursun, 2002; Getty, 1975; Bahadir *et al.*, 1992a; Whittow, 2000) and especially in ducks and geese horny papillae were reported (Nickel *et al.*, 1977; Dursun, 2002; Bahadir *et al.*, 1992a) at sides of the tongue. However, in spite the lingual papillae were present no horny papillae were observed in sea gulls. Getty (1975) stated number of transversal Lingual papillas approximately 30 and we observed number of transversal lingual papillas 20-25 in sea gulls. Most researchers have determined crop at the entrance of chest in aves (King and Mclelland, 1984; Nickel *et al.*, 1977; Calislar, 1977; Getty, 1975; Bahadir *et al.*, 1992b; Whittow, 2000). In this study, no crop was seen in sea gulls like penguins (King and Mclelland, 1984; Dursun, 2002) and ostriches (Whittow, 2000). Although, 2 ceca of 17-18 cm long with lumens wider than that of the ileum in aves (Calislar, 1977), 0.4-0.5 cm in long legged buzzard (Haligur, 2008) and 0.3-0.7 cm in pigeons (Nickel *et al.*, 1977) were reported, ceca were rudimented protrusions having average 0.7 cm length in sea gulls. Ceca were quite small in sea gulls like in pigeons (Nickel *et al.*, 1977) and in long legged buzzard (Haligur, 2008).

The mean length of jejunum was informed 105 cm in ducks and 60 cm in pigeons (Nickel *et al.*, 1977). This length was measured 24 cm mean in sea gulls. It was

stated that Meckel's diverticulum was present in 60% of chicken and pigeons (Calislar, 1977; Dursun, 2002) and in 80-90% of ducks and geese (Dursun, 2002). Nickel *et al.* (1977) reported this trace to disappear sooner in other species than ducks and geese. This trace was not encountered at the outer surface of jejunum in sea gulls.

It was reported that the liver was longitudinally placed at the ventral of the body cavity (Calislar, 1977; Dursun, 2002). Pigeons (King and Mclelland, 1984; Nickel *et al.*, 1977; Calislar, 1977; Dursun, 2002), parrots (King and Mclelland, 1984; Dursun, 2002), ostriches (King and Mclelland, 1984; Dursun, 2002) and budgerigars (Calislar, 1977; Dursun, 2002) did not have gallbladder. In this study the gallbladder was determined as a 2.2 cm long pouch like organ. Other findings were in accordance with the literature. The weight of the liver was reported 35-51 g in fowl, 58-113 g in ducks, 85-171 g in geese, 8-10 g in pigeons (Nickel *et al.*, 1977) and determined 9-12 g in the sea gulls.

CONCLUSION

It was determined that number and shapes of the papilla's were different in sea gull's oropharynx than the other avian species, Crop and Meckel's diverticulum were not observed and ceca were rudiment on both sides of ileum. It concluded that this study will be a reference data for future avian investigations.

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