

## HISTOMORPHOLOGY AND HISTOMETRY OF OESOPHAGUS IN CASPIAN GULL

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### ABSTRACT

The aim of this study was to describe the histomorphology and histometry of oesophagus in Caspian Gull. Five adult male and five adult females from Persian Gulfcoast in south of Iran, were used in this study. After measurement of the entire alimentary tract as the cervical and thoracic part of oesophagus, routine procedures of preparation of tissues were followed and the paraffin blocks were cut at 6 microns, stained with H&E and PAS and studied under light microscope. Neither crop nor esophageal enlargement was observed in the both sexes of the birds. Macroscopic observation indicated that the oesophagus was lined with non cratinized stratified squamous epithelium with glands and longitudinal folds were symmetrically arranged in the mucosa. The lamina propria was seen as a loose connective tissue containing nodular lymphatic. The muscularis mucosa was present as a thick layer of smooth muscle fibres. The tunica submucosa was seen as a loose connective tissue containing vessels and nerves. The tunica muscularis consisted of smooth muscle and was surrounded by the tunica adventitia at the cervical part of the oesophagus and by the tunica serosa at the thoracic part. There was some difference in histometric examination in both sexes in level of 0.05% confidence that reported. The structure of Caspian Gull's oesophagus was similar to that of other avian species with minor differences.

**Keywords:** *Histomorphology, Histometric, Oesophagus, Caspian Gull*

### INTRODUCTION

Studies showed that these birds are scavengers (Malling and Larsson, 2003; Small, 2000) and predators with a very different diet (Eaton *et al.*, 2009). They almost feed fish trashes (Collinson *et al.*, 2008; Heubeck *et al.*, 2009) but in breeding season they often eat rodents such as ground squirrels, flying some distance into the steppes to find them (Klaus and Hans, 2004). There are many studies about anatomy of the alimentary tract of many other birds but, a few papers have been published about the alimentary tract of sea gull. Understanding of the anatomy of the alimentary tract as oesophagus of this bird was been important, because it is known that anatomical differences can cause significant variation in food absorption from the oral cavity in animals (Ivey and Edger, 2005). It is observed that the avian oesophagus is on the right side of neck and it is placed between the pharynx and glandular stomach portion. It is thin with dilatable walls with a diameter relatively larger than of the mammals (Neubauer *et al.*, 2009; Krautwald and Maria, 2010). Such studies provide useful information in relation to medical, surgical, propagation and nutritional management of these birds in the best mode of procedure. As per the literature surveyed by the authors, there is no published report describing the normal anatomy and histology of the oesophagus in Caspian Gull. That's why present study was undertaken to investigate the histomorphology and histometric study of the oesophagus in Caspian Gull.

### MATERIALS AND METHODS

Five adult male and five adult females were brought from Persian Gulf coast in south of Iran. After examining their health clinically, birds were deeply anesthetized by excess ether inhalation. For anatomical studies, birds were slaughter. The length of the entire of alimentary tract was defined as the cervical and thoracic part of oesophagus (Figure 4). The oesophagus was washed with distilled water and dissected throughout the region of cervical and thoracic part and were measured by ruler. Specimens were then kept in 10% buffered formalin for 48 hours for histological examination. These samples were washed in 70%, ethanol putting them into alcohol

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series for dehydration and clearing and then were embedded in paraffin for histological studies. 5 to 6  $\mu\text{m}$  thick serial sections were cut off with LEICA microtome (RM2245, Germany). Some sections were stained with haematoxylin- eosin and periodic acid Schiff and histological examination was carried out according to the method by Crole and Soley (2010). Oesophagus measurements for males and females were described separately and the data were analysed by Student's *t* test (2-tailed test assuming equal variance) using Microsoft Excel (Microsoft Corporation, USA) to assess sex differences.

**RESULTS AND DISCUSSION****Results**

Comparative measurements of the Mean $\pm$ SEM length of the total alimentary tract for each sex are presented (600.80 $\pm$ 1.24) for male and (606.20 $\pm$ 3.07) for female. Results of examination showed the oesophagus in Caspian Gull was a mobile long, muscular, longitudinally folded tube and usually lay to the right of the midline of the neck and composed of two cervical and thoracic parts. The oesophagus connected the pharynx to the gastric region, and consisted of a proximal pars cervicalis and a distal pars thoracica. The cervical part was longer than thoracic part, and extend from the pharynx to proventriculer, while there was no crop along of oesophagus. The histological results of two part in transvers section of oesophagus showed mucosa, submucosa, muscular and serosa layers. The mucosa layer constituted with no keratinized stratified squamous epithelium and few mucous gland, nodular lymphatic tissue were promined within the Connective tissue of lamina propria. The lamina propria of the oesophagus consisted of a loose connective tissue. This layer contained mucosal glands in some although the number, type and location of glands varied. The submucosa was made up of fibrous tissue. The muscular tunica consists of two layers' smooth muscles, an inner circular and outer longitudinal (Figure 1). In the cervical part of the oesophagus, the tunica muscularis was surrounded by the tunica adventitia, a loose connective tissue. The thoracic part of the oesophagus was covered by a tunica serosa (Figure 2). There was no sex difference between the histological structure of the oesophagus in birds. The mean and SEM of length in cervical part and thoracic part was recorded respectively (Figure 3). The length of the oesophagus of the male Caspian Gull was not significantly greater than that of the female. According to the table1 in both sexes, the mean measurements of Cervical part was significantly greater as compared to thoracic part ( $p<0.05$ ) (Table 1). In both sexes, the mean number of mucos glands in oesophagus of Cervical part was significantly lesser as compared to thoracic part ( $p<0.05$ ) (Table 2). In both sexes, the mean micrometric measurements of oesophagial histometric parameter in Cervical part as epithelium, lamina propria, muscularis mucosa and tunica submucosa was significantly greater as compared to thoracic part( $p<0.05$ ). But for tunica muscularis, circular and longitudinal layer, in thoracic part was significantly greater as compared to cervical part ( $p<0.05$ ) (Table 3).

**Table 1: Average of Oesophagus Measurements (mm) in Different Parts in Caspian Gull (Mean $\pm$ SEM)**

Gender Region	Male	Female
Cervical part	55.68 $\pm$ 0.60	51.00 $\pm$ 0.57
Thoracic part	31.33 $\pm$ 0.88	29.33 $\pm$ 0.88

**Table 2: Average number of mucosa glands in oesophagus different parts in Caspian Gull (Mean±SEM)**

Gender Region	Male	Female
Cervical part	6.00±0.70	7.60±0.50
Thoracic part	8.80±0.37	10.00±0.31

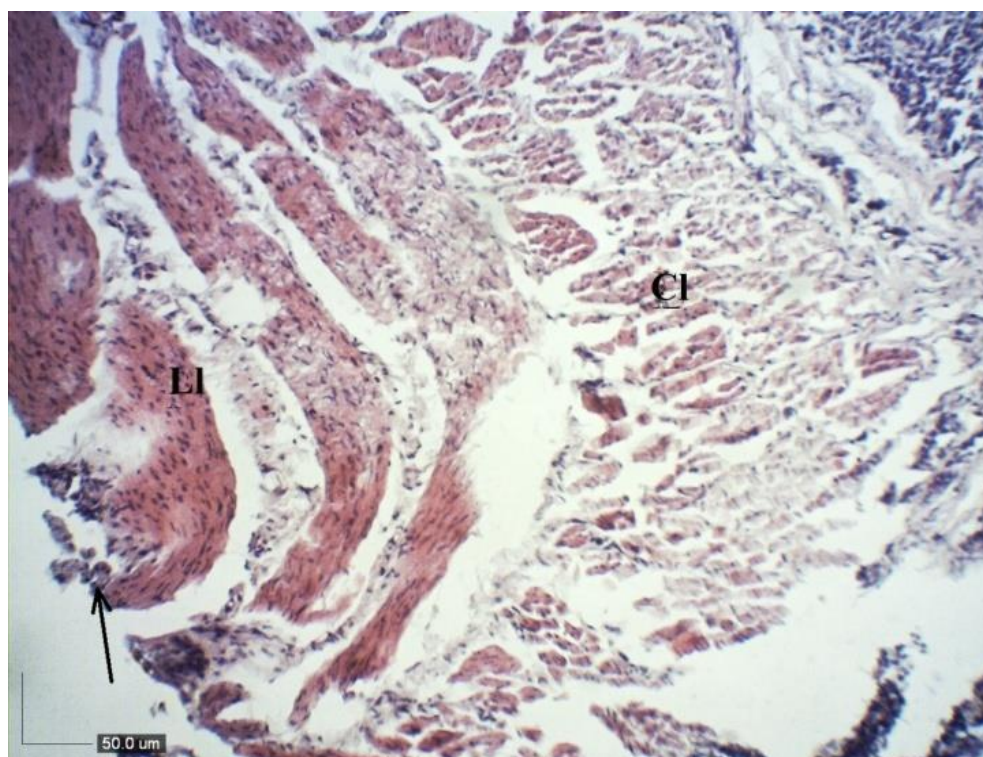
**Table 3: Average micrometric measurements (um) of oesophagus in Caspian Gull (Mean±SEM)**

Region	Gender	Epithelium	Lamina propria	Muscularis mucosa	T. submucosa	T. muscularis (circular layer)	T. muscularis (longitudinal layer)
Cervical part	Male	141.79±0.6	61.49±0.49	39.93±0.12	66.58±0.6	75.73±0.97	148.90±0.54
	Female	0	62.15±0.65	38.32±0.43	7	76.12±0.62	146.62±0.21
		141.83±0.5 2			65.77±0.8 5		
Thoracic part	Male	69.45±0.51	29.49±0.39	35.93±0.31	26.08±0.8	170.73±0.27	208.71±0.43
	Female	68.11±0.42	30.19±0.41	36.99±0.74	7	173.12±0.66	216.91±0.11
					21.77±0.0 9		

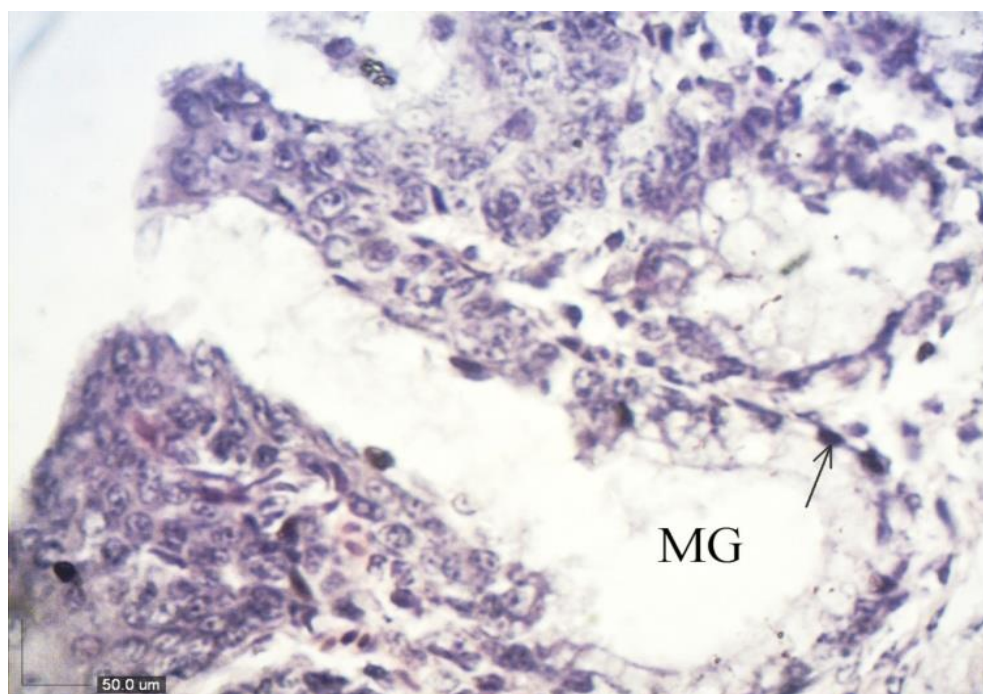


**Figure 1: Histological Structure of the Cervical Part of the Oesophagus of Male Caspian Gull : E, Epithelium; Mg, Tubulo Acinar Oesophageal Gland; Lp, Lamina Propria; Mm, Muscularis Mucosa; M, Tunica Muscularis; NL, Nodular Lymphatic (H&E)**

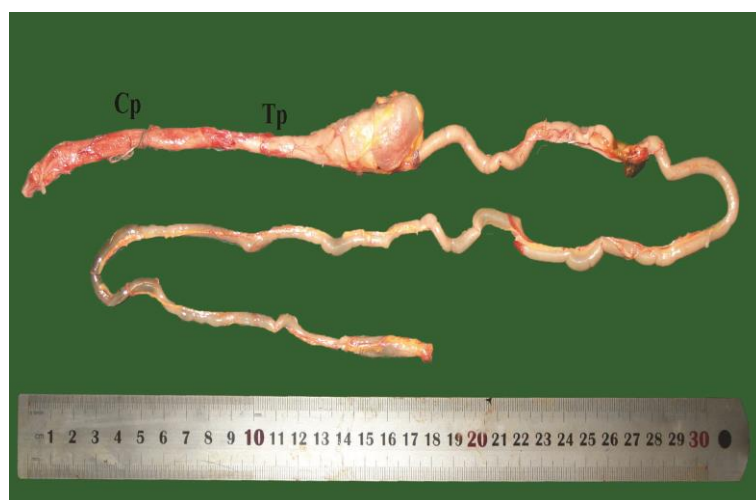




**Figure 2: Microphotograph Showing the Tunica Muscularis Thoracic Part of Oesophagus of Male Caspian Gull: Cl, Circular Layer; Ll, Longitudinal Layer and Serosa, Arrow (H&E)**



**Figure 3: Microphotograph Showing a Tubulo Acinar Oesophageal Gland with Secretions (Mg); Nucleus, Arrow (H&E)**



**Figure 4: Alimentary Tract of an Adult Caspian Gull in Macroscopic View. Cp, Cervical Part; Tp, Thoracic Part**

### Discussion

This study referred the oesophagus in Caspian Gull as an organ that is located at the right side of the neck and located between the pharynx and glandular stomach. The result agrees with Batah, (2009). It is relatively straight muscular tube, through which food passes from the pharynx to the stomach. The esophagus can contract or expand to allow for the passage of food (Nagy *et al.*, 2005). It was composed of two parts, cervical and thoraces part. Cervical part was longer than thoraces, as it was reported by Crole and Soley (2010). The morphology of the oesophagus and contribution of each region were similar in all species of marind birds. Caspian Gull has a rather long neck and possess no crop. That may explain the longer oesophagus, while the longer proventriculus and ventriculus are adapted for the storage of food compared with other species. It is reported that, the simplest form of crop is a spindle-shaped enlargement of the cranial, middle or caudal region of the oesophagus. Krautwald and Maria (2010) reported that some bustards belonging to the genus *otis* had such an enlargement. In many birds, for example, an expanded region of the esophagus anterior to the stomach forms a thin-walled crop, which is the bird's principal organ for the temporary storage of food. Some birds use the crop to carry food to their young. Neither a crop nor an oesophageal enlargement was observed in the present study. To meet their metabolic needs while remaining as light as possible (to be efficient flyers), the digestive system of birds has to be both as light as possible and as efficient as possible. Weight has been minimized by the loss of teeth in many birds, limited jaw musculature and accessory organ for example crop in oesophagus in seagull (Tivane, 2008). Although food may be stored through a long oesophagus of avian species which have no crop (Samuelson, 2007). Result of length and weight measurements of each component of the oesophagus showed no sexual dimorphism in female and male birds. The histological results of cervical and thoracic portion of oesophagus of Caspian Gull showed four layers, mucosa, submucosa, muscular and serosal layer. The mucosa constituted non keratinized stratified squamous epithelium with mucous glands, and nodular lymphatic tissue within the connective tissue of lamina propria. This results are similar with researchers who studied the esophagus of other species (Figueiredo *et al.*, 2006; Monteiro *et al.*, 2009). There was no evidence of submucosa but contain the fibrous tissue, this description is similar to the study done in chicken esophagus. But the muscular Struma consisted of two layers, an inner which was circular and an outer longitudinal. It was similar to those reported by other researches, but also disagreed with Rossiet *al.*, (2006) Rossiet *al.*, (2006) studied the cervical part and reported to contain a medial circular layer between outer and longitudinal layers. The serosa of the studied birds composed of loose connective tissue with collagen and elastic fibers that agreed with other studies done by Crole and Soley, (2010; Illanes *et al.*, (2006 ). According to the observations of this

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study, the structure and histological study of oesophagus in other species of birds including sea birds would be very informative.

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