

Review Article

HISTOMORPHOLOGICAL STUDY OF MUSCULAR STOMACH (GIZZARD) IN QUAIL (*Coturnix coturnix*)

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Abstract

The present study was designed to focus the light on the gizzard in quail (*Coturnix coturnix*) birds. For this purpose, 10 samples of quail birds were collected from Al-Amiriyah market in Baghdad city, Iraq. The quail were sacrificed and the specimens were fixed in 10 %. Neutral buffered formalin solution. Routine histological techniques were carried out and stained with Hematoxyline and Eosin (H&E), Periodic acid Schiff (PAS) for the staining. The morphological results demonstrated that the gizzard of quail has a ball shape and location connected between proventriculus from upper part and duodenum from lower part. The muscular stomach (gizzard) is surrounded by adipose tissue and yellowish layer is called cuticle in internal surface of gizzard. The histological results of the gizzard of quail showed that the four tunics (mucosa, submucosa, muscularis and serosa). The present study showed cuticle layer during histological sections of gizzard, where it's located upper parts of epithelium. The tunica mucosa was included epithelium, lamina propria and muscularis. The lamina propria is represented by loose connective tissues. The sub-mucosa is thin layer during gizzard of quail bird. The tunica muscularis were included outer layer of smooth muscles have longitudinal orientation while the inner layer of smooth muscles will be circular orientation. The last layer of histological tunics was called serosa, which have loose connective tissue with cover mesothelium represented by simple squamous epithelium.

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1. Introduction

There are about 8600 species of birds spread around the world, from them about 130 species from quail bird (King and Mclelland, 1975; Gloria *et al.*, 2019). The quail (*Coturnix coturnix*), or European quail, is a small ground nesting game bird (heavy bodied ground feeding birds and their skill is running rather than flying), from the pheasant family it is migratory birds, breeding in the Western and Wintering in Africa and southern India. It is widespread in Europe and North Africa

(Carl Linnaeus, 1758). The digestive tract is mainly functioning the ingestion of the food so that utilized the energy (Hilton *et al.*, 1999). The alimentary canal of birds transfer food to the stomach this system comprises the crop which is an expansion of the esophagus located in the lower part of the neck. The stomach in birds is formed from glandular stomach (proventriculus), the muscular stomach (gizzard), and intestine (Hassouna *et al.*, 2001). Gizzard is an organ found in the digestive tract between proventriculus and duodenum. This specialized stomach constricted

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of thick muscular walls consists of smooth muscles is used for grinding up food often aided by particles of stone or grit (Klassing, 1999). Gizzard is a spheroid organ. It lies in the left dorsal and ventral areas of the thoraco-abdominal coelomic cavity. The gizzard wall also has the four layers; mucosa, submucosa, muscular layer and serosa. The mucous membrane presents low folds, which are lined by columnar epithelial cells. The sub-mucosa composed of abundant connective tissue containing blood vessels and nerves. The muscular bundles are interspersed with bands of connective tissue. The serosa was constituted by connective tissue lined by mesothelium (Zaher *et al.*, 2012).

2. Materials and Methods

Experimental design

We brought 10 birds of quail from Al-Amiriyah market in Baghdad and kept them at home for short period for studying of histology and morphology of muscular stomach, the weights of birds were approximately the same. We use a surgical set, formalin 37 % for keep samples, blades and handle with scissors for the dissection. Starting to dissect the bird by killing the animal through anesthetization, it gently and we placed the bird on his back, pull the legs to the side and the back. Cut the skin between the legs and abdomen on each side, Hold the legs from near the hip and then lift it to the top so inseparable, Raise the skin over the thigh and chest. Complete raise the skin from the director and even the beak, Cut the abdomen gently in a cross-sectional area at the end of the sternum, in order to gain access to internal organs (viscera), Cut the ribs on the right side and the left until it reaches the shoulder, Raise the chest at this stage, lift the gizzard carefully and remove all adipose tissue that surrounds the gizzard, proventriculus and liver, to appears spleen and intestines then take the duodenum, cut the area between the proventriculus and esophagus then take the crop out, put each of gizzard in containers that contain diluted formalin 10%, then send the samples to get dissected histologically in the histology lab. The stains were used through

slides hematoxilin and Eosin (H and E) and Peroidic Acid schift (PAS) (Luna, 1968).

3. Results and Discussion

Gizzard is an organ of the digestive system located between the proventricular and duodenum inside the abdomen and was covered by adipose tissue as in Figure - 1 and Figure - 2. These results were differed with AL-Taai and Hasan (2020) which whom said that adipose tissue no cover of the gizzard in starling birds. Also, it was located in the cranio-ventral part of the abdomen between the proventriculus caudally and duodenum, gizzard has spherical in shape and its highly muscular organ, its wall contains small round stones that help in food digestion. The anatomical results were accepted with showed (Hodge, 1974; Melelland, 1975; Nickel *et al.*, 1977) which whom said that in ostrich the muscles of the gizzard were divided into 4 muscles. The present study showed the internal surface of gizzard included the yellow layer was covered the internal surface of gizzards called Cuticle layer (Figure - 3). These results were accepted with said by in Kramer (1976) and Lima and Sasso (1985) in Columba livia, the gizzard through various kinds of birds the folds of the mucosa were represented as longitudinal. In the Eurasian Hobby, the folds of gizzard in form of low fold without special shape. Klem *et al.* (1983) described the mucous membrane of the gizzard of passer domestics. The thickness of the cuticle was highly related with food consumed, thick in granivorous thin in frugivorous and nectarivorous and it was often green brown or yellow in color agree with the result of Gionfriddo and Best (1996) but the inner aspect of the gizzard of partridge was coated by a fine cuticle gastrica with yellowish color (Taylor, 2000). Gizzard in the ostrich appeared with disc or biconvex lens shape coated with thick yellowish green tissue (koilin) taking the irregular pleated pattern of longitudinal folds and grooves however in the other birds like barn owl gizzard was soft elongated spindle to pear shape lined with very poor yellowish koilin layer took the fan shape with vertical and longitudinal pattern of the inner folds the variation between stomach of under

investigation birds probably due to the feeding habits identified by King (1984), Kardong (1998) and Kent (2001). The gizzard wall in quail was represented by mucosa containing branched tubular glands, sub-mucosa, muscular layer and serosa. The surface mucosa showed clear ridges and depressions (crypts) (Figure - 4, 5 and 6). The mucosa was covered with a thick keratinized laminated layer formed by the secretion of the glandular tubules, tubular glands was located in the lamina propria and opened in the mucosal crypts by short neck. The lumina of the tubular glands were narrow and filled with homogenous lightly stained acidophilic materials with H&E stain. The muscular layer was well developed forming the main bulk of the gizzard wall and represented by smooth muscle fibers arranged mostly in a circular and longitudinal arrangement. Beneath the muscular layer, there was a tendinous layer of collagen bundles arranged parallel to each other (Figure - 5). These results were corresponding with said that by (AL-Taai and Hasan, 2020). The gizzard has four layers (tunics) and the cover the surface of epithelium by cuticle layer in starling birds. In ostrich the wall of the gizzard was coated by layer of serrated cuticle called koilin these finding same observation of Hodge (1974) in fowl. The current study was accepted with Rossi *et al.* (2005). The cuticle layer was thick in kinds that has well-developed muscular stomach. The study confirmed that ostrich gizzard coated by thick layer of cuticle but the cuticle layer was formed from 2 layers in hoopoe (Gartrell, 2000). The secretion of the glands of the mucous membranes is solid on the surface and forms the cuticle agree with the results of Swart (1993). Recognized in combined AB-PAS stain vertical koilin and horizontal koilin was positive. The last layer of tunics was represented by serosa (Figure -7).



Figure - 1: Morphological picture of Quail bird shows Proventricular (PR), Gizzard (black arrow) and Adipose tissue (AD)



Figure - 2: Morphological picture of Quail bird showed Proventricular (A), Ventricular (B) and Adipose tissue (AD)



Figure - 3: Ventral surface of gizzard shows Ventricular muscles (mv), Ventriculopyloric orifice (OD), Cuticle layer (CG), Saccus cranialis (SC) and Cranial sac (SR)

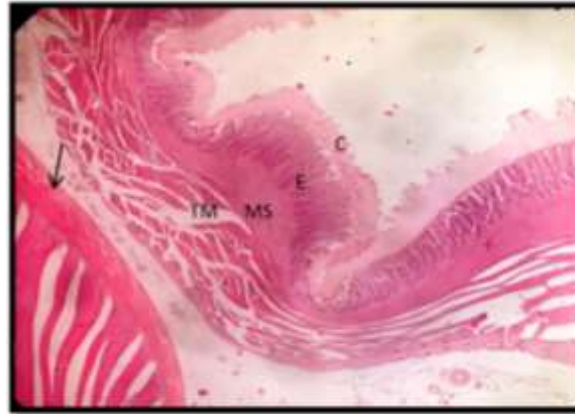


Figure - 4: Cross section of gizzard's wall shows Cuticle layer (C), Epithelia OF Tunica mucosa (E), Muscularis mucosa (MS) and Tunica muscularis (small arrow) H&E stain 40x

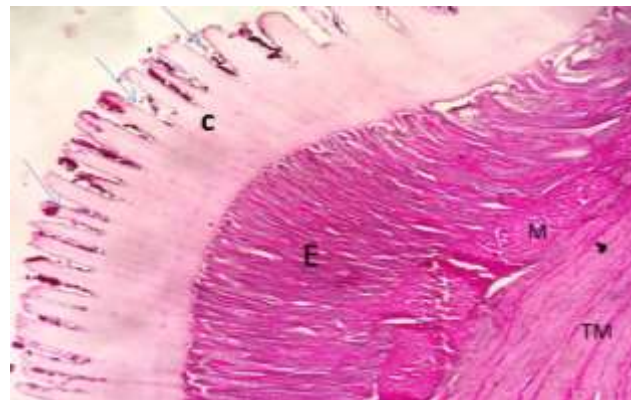


Figure - 5: Cross section of gizzard's wall shows Cuticle layer (C), Gastric pits (small blue arrows), Epithelia (E), Muscularis layer (M), and Tunica muscularis (TM), PAS stain 100x



Figure - 6: Cross section of gizzard's wall shows Cuticle layer (C), Epithelia (E), Muscularis layer (M), and Tunica muscularis (blue long arrows), PAS stain 100x

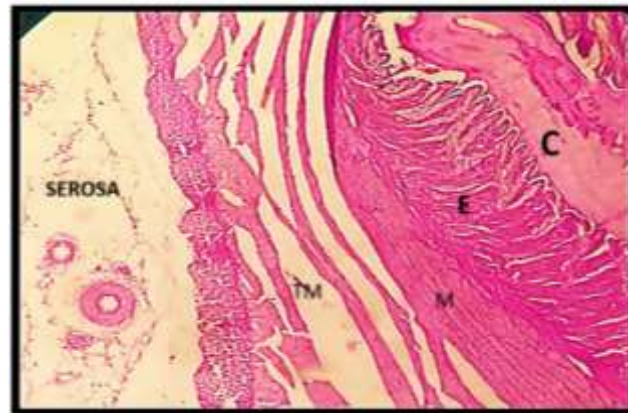


Figure - 7: Cross section of gizzard's wall shows Cuticle layer (C), Epithelia (E), Muscularis layer (M), and Tunica muscularis (TM), PAS stain 100x

4. Conclusion

Gizzard characterized by presence of strong muscular masses so it is called Muscular stomach. Also its lumen lined by thick layers called cuticle which yellowish color, the external feature revealed the presence of dorsal and ventral sac. The gizzard lined by mucous membrane covered by koilin. Microscopically, the gizzard is lined by simple columnar epithelium

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