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Morphological and Histological study of colon in swan goose (*Anser Cygnoides*)

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Abstract

The current study aimed to observe the morphological,and histological features of the colon in adult males and female swan geese. The study was carried out on 10 adult geese, with ages ranging from(one - two)years. These birds were used for anatomical and histological study. The coleomic cavity was dissected and photographed to identify the colon was grossly described and measured (weight, relative weight, length, relative length, and diameter and volume) . Colon the short, straight part of the large intestine, pale pink color, it was the caudal part of large intestine continuous with the ileum. Its situated ventral to the synsacrum and pelvic bone. It was extending from the end of the small intestine till it opens into cloaca, its related dorsally with the jejunum . Colon showed a velvet appearance with short finger-like projections. The histological study showed that the large intestine (colon) was characterized by folded mucosa and submucosa, the lining epithelium was simple columnar epithelium, while the isthmus was lined with stratified squamous epithelium, The mucosal glands different in size and shape occupied most of the lamina propria, The goblet cells showed high density toward the end of the intestine. The villi appeared different in size and shape, The submucosa appeared poorly developed layer. The layer of muscular mucosa was constructed of two layers of smooth muscle fibers. The serosa composed of connective tissue covered by a layer of mesothelium lined the wall of all the organs occupied with blood vessels, lymphatic vessels, and nerve plexus.

Keywords: Colon, Swan goose, Morphological features, Histological features

Introduction

The feed necessities of the bird are principally strong-minded by the anatomy and competencies of its alimentary tract (1). The swan goose (*Anser cygnoides*) is a large geese with a breeding range in Mongolia, northern China, and the Russian far east (Swan geese are native to eastern Asia). The digestive system of birds is important in converting the food eating into the nutrients its body needs for growth, maintenance, and production (such as egg production). An animal's body breaks down food through both mechanical and chemical means. In many animals, mechanical action involves chewing; however, because birds do not have teeth, their bodies use other mechanical action. Chemical action includes the release of digestive enzymes and fluids from various parts of the digestive system. After being released from food during digestion, nutrients are absorbed and distributed throughout the animal's body(26). The colon where the last of the water reabsorption occurs(26). Avian digestive system consisting of the mouth, esophagus, crop, and stomach (proventriculus and ventriculus) small intestine, large intestine and cloaca. It's pretty short compared to those of mammals (2). Most of this relative reduction

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is in the bird's intestines, which proposes that birds have less space for digestion and absorption than mammals. This makes the feedstuffs vacation in the gut for less time and makes it stiffer to get the nutrients from the feedstuffs(2). The large intestine consists of cecae followed by a straight segment of the intestine that is homologous to the mammalian rectum called colon (3). Histologically, the large intestine does not differ from the other parts of the small intestine, it is composed of four layers: mucosa, submucosa, muscular externa, and serosa (4).

Material and Method

Ten apparently healthy adult males and females swan goose were divided into two equal groups. Each group used for morphological study, while the second group was used for histological studies. These birds were purchased from the local suppliers in common markets in aldwiynia province from(September2021 - March 2022). All studied birds were weighed, then euthanized by injected ketamine and xylazin in pectoral muscle (5). Each bird was dissected by fixing it on a suitable dissecting board to view the coelomic viscera including colon. A mid-line incision in the coelomic wall was made, after that, the colon was identified and photographed in situ using a digital camera. The location and shape of colon of the studied birds was well described. Samples were extirpated and washed with normal saline to remove adhered debris and blood, then the cleaned again by normal saline. Then, the weights of studied organs were measured in grams by using a sensitive digital scale .The macroscopic measurements (length and diameters) of the collected segments were conducted in centimeter and millimeters by using the electronic Vernier caliber, while the volume was measured by water displacement method. Histologically the bird was used. colon removal, they were washed using normal saline solution, then fixed with 10% neutral buffer formalin for 48h, then proceed with the routine histological technique for histological study.

Ethical approval: The researchers obtained ethical approval from the research Ethical Approval Committee of the College of Veterinary Medicine, University of Al-Qadisiyah.

Results

The lager intestine consists of two long right and left cecum and short straight colon and, which connected with the colon and the distal part of the ileum. colon the short, straight part of the large intestine, pale pink color, it was the caudal part of large intestine continuous with the ileum. Its situated ventral to the synsacrum and pelvic bone. It was extending from the end of the small intestine till opens into cloaca, its related dorsally with the jejunum (Fig.1). The mean colon weight 6.83 ± 0.12 g, the length of the colon 10 .73± 0.15 cm, and diameter was 8.29± 0.69 mm and the volume of the colon was 8.85 ± 0.16 ml (Table1)

Table 1: Anatomical Measurements of duodenum, ileum and colon of goose N = 10

Anatomical Measurements	Duodenum Mean+ SE	Ileum Mean+ SE	Colon Mean+ SE
Weight(g)	10.88± 0.14	5.8 ± 0.85	6.83 ± 0.12
Length (mm)	18.69 ± 0.24	5.2 ± 0.23	10 .73± 0.15
Diameter(mm)	7.35 ±0 .70	5.6 ±0 .61	8.29± 0.69
Volume(ml)	8.88 ± 0.18	7.85 ± 0.14	8.85 ± 0.16

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Histologically, the wall of the colon of a modern bird is composed of four layers: the mucosa, the submucosa, the muscularis, and the serosa. At the cranial section of the colon , the mucous membrane is arranged as numerous valvar folds that protrude toward the rectal lumen (Fig.3). However, it becomes shorter and extends less toward the caudal region of the rectum until it reaches the cloaca (Fig.3). All of the mucosal folds that formed the different sized and shaped villi were bordered by a simple columnar epithelium that had a brush border and abundant goblet cells with transparent cytoplasm that were dispersed amongst the columnar cells (Fig.3,4). The lamina propria is made up of areolar connective tissue, which contains bundles of muscle fibers and simple tubular glands that appear to be lined with the same rectal mucosa and its extends toward the core of each fold of mucosa, and the muscularis mucosa shows a layer of longitudinally arranged smooth muscle fibers (Fig.3). The Submucosa composes from connective tissue layer as with collagen fibers and nerve plexus and blood vessels (Fig4). The muscularis externa is composed of two distinct layers of smooth muscle fibers (Fig.3), an inner layer that is thick and circular and an outer layer that is thinner and longitudinal. Between these layers there is bundle of a connective tissue that abundant with collagen fibers and has a large mynteric plexus and blood vessels (Fig.5). The serosa presents as a comparatively thin layer of connective tissue that is abundant in collagen fibers and is enclosed by the mesothelium (Fig.5).

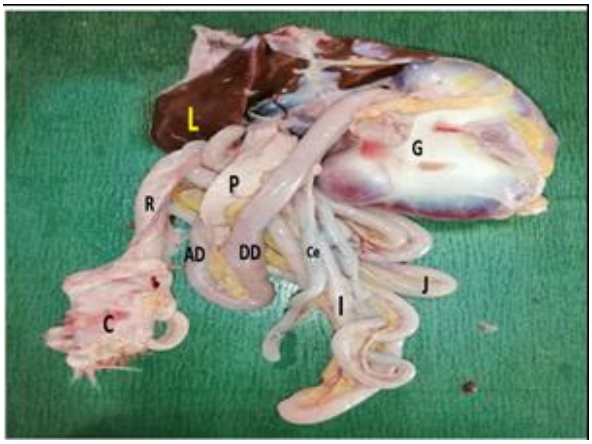

Fig.(1):Photograph illustrate anatomical showing of duodenum in the coelomic cavity of male goose showed: Descending &Ascending Duodenal Limbs (D-D & A-D), pancreas (P), liver, Gizzard(G), jejunum (J), ileum (I), cecum (Ce), Rectum (R) and cloaca (C).

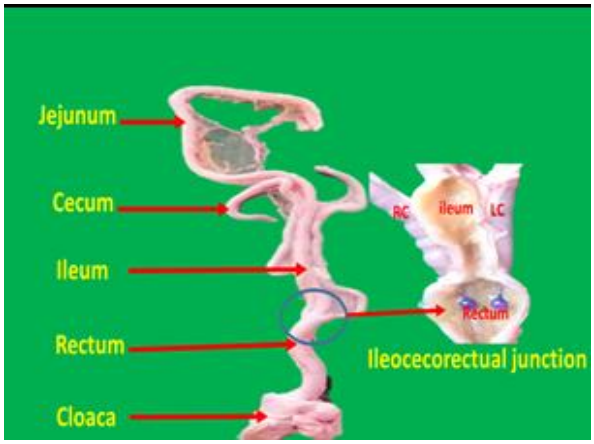

Fig.(2):Groose anatomy show location and relationship of colon with anther parts of intestine and ileocecorectal junction.

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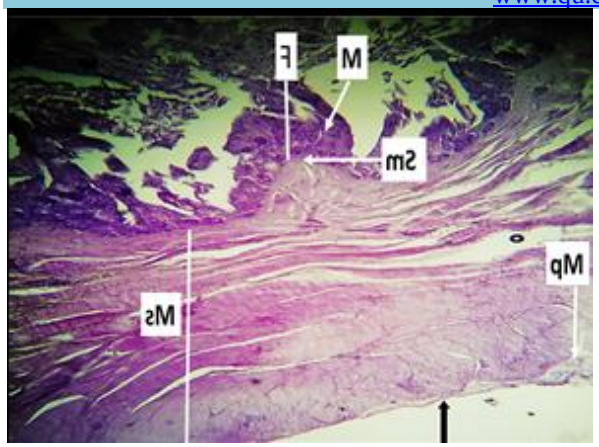

Fig. (3): Histological Section of the colon in goose shows: fold (F), mucosa (M), Submucosa (Sm) Muscularis internal and external (Ms), Serosa (black arrow) H&E stain 200X.

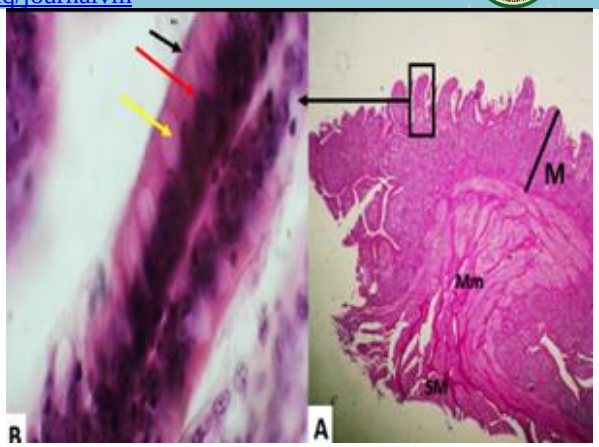

Fig. (4): Histological Section of the Colon in swan goose shows : A Mucosa (M), Submucosa (Sm), Muscularis (Mm), B Villa,brush border (black arrow), epithelia columnar cells (red arrow), goblet cells (yellow arrow) H&E Stain, A.40X.B.800X.

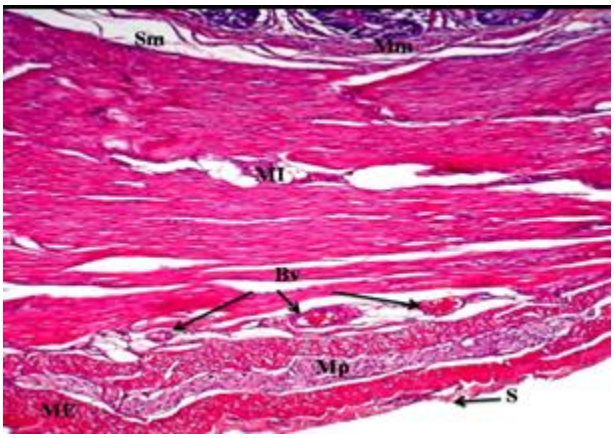

Fig.(5): Histological Section of the Colon in Goose shows Muscularis mucosa (Mm), Submucosa (Sm), Muscularis (MI, ME), Blood vessels (BV), Myenteric plexus (MP), Serosa (S), H&E Stain, X 200.

Discussion

In the current study the colon of goose represented the end of the digestive tract, as omnivorous were in line with (6) in chickens whom referred that colon is the terminal part of the large intestine is relatively short extended to the cloaca, its role functionally is water re-absorption and retrieve nutrients remaining in the digesta from the ileum, prior to eventual expulsion from the digestive tract (7). The colon in goose clearly distinguished from the small intestine and cloaca and this disagrees with (8,9) Hotzin , canary (*Serinus canaries*) respectively the colon is relatively short and there is no clear transit with small intestine and cloaca. According to the results, the internal surface of the colon in goose revealed as smooth, thin, velvety, and pale pink to white in that similar to that findings of (10) in common kestrel *(Falco tinnunculus*) and white eared bulbul (*pycnonotus leucotis*).The colon appear as a straight structures, pale pink to white in color, uncoiled, the mucous membrane of colon was smooth and velvety whereas in herbivores the ostrich colon poses sacculations

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along its length for microbial fermentation (11,12). The morphometric data revealed that weight of colon of goose more than of common kestrel *(Falco tinnunculus*) and white eared bulbul (*pycnonotus leucotis*) (10), Length of colon of goose is shorter than that of ostrich which had very long colon about 11-12 cm, partly sacculated and looped, unlike that of almost all other birds(13). The diameter of colon showed slightly close to common kestrel bird (10), but less than in Turkey diameter which was 6.9033 mm (13), these findings may be due to different bird species and feeding habits. According to the findings of the current research, the colon is histologically comparable to the majority of avian species. The wall of the colon is composed of four layers: the mucosa, the submucosa, the muscularis, and the serosa. This finding was in agreement with what (14) and (2) discovered in the colon of chickens, white-eared bulbuls, and common kestrels. Mucosa displayed a large number of valvular folds that were projected toward the colon lumen. These folds, which had high villi and huge numbers of goblet cells, increased the surface area of the colon, which was consistent with the findings of (16) in Falco sparverius. These findings have also been documented by (17) Columba liviadomestica, (10) common kestrel, and white-eared bulbul. The rectal mucosa showed the same epithelium as other digestive organs, which was covered by simple columnar epithelium with a brush border and abundant goblet cells. The purpose of increasing the number of goblet cells at the end of the intestine is to assist in lubricating and protecting the mucosa from abrasion caused by feces (18). The lamina propria is composed of areolar connective tissue, and it contains bundles of muscle fibers, elastic fibers, collagen fibers, and reticular fibers. This finding was parallel with that of (14) in Turkey, (19) in pea fowl, and (20) in Corvusfrugileus frugileus; however, (21) in Black shouldered. The results of (21) on broiler Ross chicken and (22) on Green-winged teal Anascarolinensis appeared to be comparable in terms of the muscularis mucosa's appearance in both species. (17) describes the submucosa as consisting of loose connective tissue that contains a large number of lymphatic nodules in the racing pigeon (Columba liviadomestica). The submucosa is composed of a layer of connective tissue that is rich in collagen fibers, and it also contains a nerve plexus and blood vessels that are not similar to each other. The muscularis externa showed two layers of smooth muscle fibers, an inner thick (circular) layer and an outer thinner (longitudinal) layer. The thick, muscular wall was considered an important factor for peristaltic movement of the colon to transport the nutrients contents, which was in agreement with (23) in duck and (24) in ostrich. In duck, the muscularis externa showed two layers The serosa of the colon is comparable to Turkey (14), blue and yellow macaws (25).

Conflict of Interest: there is no conflict of interest.

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