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Histomorphological study of intestine in wood pigeon *(Columba palumbus*(L.1758))

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Abstract

Background: Review of the Iraqi literatures reviled that there are several works have been done on the gastrointestinal tract of Iraqi birds, but we didn't find research work include details information related with the gastrointestinal tract of common wood pigeon from Iraqi environment

Aim: The current study aimed to investigate the anatomy and histology of intestine in wood pigeon **(***Columba palumbus***).**

Materials and methods: Animals were collected from Al-Najaf desert, methods of Humason and Bancroft and Stevens were employed for the histological study.

Results: Anatomical results reviled that the intestine of common wood pigeon divided into several parts represented by duodenum, ileum, and rectum. Histologically the wall of all parts of intestine in common wood pigeon as in all other birds possessed four layers (mucosa, sub-mucosa, muscularis externa, and serosa). The structural differences of duodenum were in the villi which were represented by long extensions from the epithelium of the mucosa. Results showed that the ileum in common wood pigeon showed that villi of ileum were shorter than those of duodenum, and appeared as a leaf-like shape. Large intestine in wood pigeon represented by rectum which exhibit different features in the mucosa, as the villi of rectum are flat and wide (leaf-like shape),and the lumen of rectum was wider than that of small intestine.

Conclusion: the present study reviled some differences in the mucosa of rectum as the villi appeared flat leaf-like shape and the lumen was wider than that of small intestine. The mucosal epithelium represented by simple columnar epithelium, with numerous goblet cells scattered in the epithelium.

Keywords: *Colomba palumbus*, anatomy, histology, intestine.

Introduction

The common wood pigeon is a homely, native bird commonly found in close association with human settlement. It is feeding mainly on different types of seeds, wild plants and fruits [1]. They are very careful and very difficult to nearby. They are nesting on the trees in gardens near the rivers and rods [2].

The avian digestive tract is usually different from the other animals in many aspects especially by which having physiological and histological structure [3]. In common wood pigeon as in other birds the digestive tract begins with the beak anteriorly and continued to the end with the anus at cloaca posteriorly, in addition to sharing some of the structures with other system such as the respiratory system [4].Several previous researchers studied the gastrointestinal tract in different birds from different environments [5-9]. Review of the Iraqi literatures reviled that there are several works have been done on the gastrointestinal tract of Iraqi birds [10-13], but we didn't find research work include details information related with the gastrointestinal tract of common wood pigeon from Iraqi environment. This situation support our suggestion to investigate the morphology, histology and histochemistry of the different parts of digestive tract in common wood pigeon. It is important to note that the current study is a part of an extensive study conducted to investigate the anatomy, histology, electron microscopy, and histochemistry of digestive tract in two Iraqi birds, (Wood pigeon, *Columba palumbus* (L.) and Barn owl, *Tyto alba* (Scopoli)), [14-17].

Materials and Methods

Adult common wood pigeon, *Columba palumbus* were collected from Najaf desert. The species of bird under investigation were classified according to Allose [18] and Salim *et al*. [19]. The histological methods of Humason, [20] and Bancroft and Stevens, [21] were employed for slides preparations and histological study.

Results

Anatomical study

Anatomical study results reviled that the intestine of common wood pigeon divided into several parts (duodenum, ileum, and rectum).Duodenum is a part of small intestine in common wood pigeon, which was somewhat long and has "U" shaped connected the gizzard and ileum and involves the pancreas in the middle of its loop. The mean length was (10.480 cm +_1.962) (Figure 1).Results showed that ileum which is the second part of small intestine in common wood pigeon was clearly long and narrow. It was appeared as thin coiled tube hangs with mesenteries. The mean length of this part was (11.374 cm ± 2.295). The present study was noticed that the caeca in common wood pigeon was protruded at the junction between the end of ileum and the beginning of rectum and appeared as a very small projection, it is a lymphoepithelial type. The mean length was (0.36 cm ± 0.894).

Rectum (large intestine)appeared in species under investigation as a short tube and represents the end of the digestive tract. The mean length was (2.71cm ±0.357). The present study reviled that the cloaca was followed by the rectum where the excretions drained, in addition of the digestive tract, the reproductive and the urinary tract were drained too in the cloaca which is divided into proctodeum, urodeum and coprodeum respectively. The anatomical results showed that the urodeum represented the middle region of the chamber on the dorsolateral wall of the cloaca, the coprodeum represented

the left lateral wall while the proctodeum was difficult to distinguish from the terminal portion of the rectum in the studied bird. The mean length of cloaca was (2.7 cm).

Histological study

The duodenum of the common wood pigeon possessed the same composition of the main four layers of the digestive tract in all vertebrates including birds, but the structural differences were in the villi which were represented by long extensions from the epithelium of the mucosa. The histological results showed that the villi in the duodenum were with mean height of (559.2 µm), they took finger-like shape and lined with simple columnar epithelial cells. The epithelium composed unicellular oval glands (goblet cells) along the lining epithelium. These glands appeared abundantly as colorless oval shape. The results showed that there were simple tubular glands open in between the villi and occupy most of the laminapropria between the bases of the villi and the muscularis mucosa called crypts of Lieberkuhn or intestinal glands. The remainder part of the lamina propria was composed of loose connective tissue containing fibers, blood and lymphatic vessels in addition to the nerves passing together up within the core of villus. The muscularis mucosa appeared as scattered smooth muscle fibers. The mean thickness of mucosa of duodenum in common wood pigeon was (40µm).Results reviled that the crypts of Lieberkuhn were consisted of cells with the same structure to those of the epithelium of mucosa. They built of simple columnar epithelial cells with spherical dark stained nucleus and clear cytoplasm. The submucosa appeared as somewhat thin layer filled with lymphoid tissue, nerves and blood vessels which increased the layer thickness. The muscularis externa formed from well developed inner circular smooth muscle and poor outer longitudinal smooth muscle, the histological results reviled that the circular muscle layer was subdivided into two secondary muscle layers. The longitudinal layer was contained some lymphoid aggregations similar to payer patches (Figure 2&3).

Results of the current study showed that ileum in common wood pigeon have the same layers of duodenum and appeared with shorter villi than those in duodenum, their height was (69.9 um) and they appeared as leaf-like shape. The epithelium lining of mucosa consisted of simple columnar epithelium with elongated oval dark stained hypo-nucleus and clear cytoplasm. The goblet cells were more abundant than those of duodenum. Crypts of Lieberkuhn decreased in their depth within the villi. Lamina properia composed areolar connective tissue containing blood and lymphatic vessels and nerves. The submucosa was thin, narrow, clearly distinguish layer containing blood vessels. The muscularis externa of ileum in common wood pigeon was composed of two smooth muscle layers, the inner was circular and the outer thin longitudinal. The outermost layer of ileum is serosa (Figure 4).

The ileo-caecal junction of the small intestine of the species under investigation showed some histological differences, as the villi become shorter and less than those of ileum, and the crypts of Liebercuhn decreased in their numbers. Results showed that the caecum in wood pigeon was lymphoepithelial functionless type. It was mostly built of lymphoid tissue, its mucosal epithelium appeared as few short and wide, villi-like structure and lined with simple columnar epithelial cells with oval nucleus and clear cytoplasm (Figure 5&6).

Results of the present study reviled some differences in the mucosa of rectum as the villi appeared flat leaf-like shape and the lumen was wider than that of small intestine. The mucosal epithelium represented by simple columnar epithelium, with numerous goblet cells scattered in the epithelium. Rectum opened to the cloaca which shows the same histological structure of the rectum with exception of the diameter (Figure 7&8).

Discussion

The gross anatomical results in the present study reviled that duodenum of common wood pigeon was long and relatively wide. On the other hand ileum was clearly long and narrow, this is probably due to the fact that common wood pigeon is herbivorous bird which has longer intestine than that of carnivorous [19-21]. The lumen of the small intestine was wide in common wood pigeon due to the indigested matter of the food that is caused the long feature too [25]. Results of this study confirmed the results recorded by Igwebuik and Eze[26] in their study on the small intestine in the African pied crow, (*Corus albus*) and Nasrin *et al*.,[27] on broilers chicken. Results of the present study reviled that the caeca of the wood pigeon was very short and somewhat narrow, so it may referred to be lymphoepithelial type [25] and Gali and Dauod,[24]. These result agreed with the results of Clench and Mathias [28] who reported in a review of the different types of avian caeca and Majeed *et al*., [29] who studied the broiler chicken caecum. Anatomical results showed some differences between the large intestine (rectum) and small intestine as the rectum appeared short and wide. This results were agreed with the results recorded by Nasrin *et al*., [27], the agreement may be due to the diet composition which can effects the morphological characteristics of the digestive tract [30].

The current study showed that the mucosa of duodenum in wood pigeon possessed finger-like villi, crypts of Lieberkuhn and goblet cells abundantly. This results probably due to the type of food and the function need [25, 31, 32]. Diet composition represented the main factor that may alert the histological structure, high fibers diet can quicken the food passage through the digestive tract, but on other hand, fiber cause abrasion to the mucosa, therefore, and since the goblet cells have the barrier function by secreting the mucopolysaccharides against the harmful effect of the food [33]. These aspects may be the causes of the pigeon to have goblet cells abundantly in the duodenum, which agree with the results recorded by Hamedi *et al*.,[34]. Normally and for previous probable aspects, submucosa in wood pigeon duodenum appeared somewhat thick. This may be for further nourishment with blood and lymph, this observation agreed with the results recorded by Rodrigues *et al*., [35]. Muscularis externa of wood pigeon duodenum consisted of inner circular smooth muscle for normal contraction and outer longitudinal smooth muscle for peristalsis movement to exit the digested food [34].

Results of the present study reviled that ileum in wood pigeon appeared with short villi comparing with those in duodenum. This results agreed with data recorded by Yamauchi *et al*.,[37]. Caeca in wood pigeon appeared as lymphoid tissue occupied most of the lumen with few, short, wide and villi –like structure and the mucosa had few crypts of Lieberkuhn. Caeca in wood pigeon was functionless lymphoepithelial type, in this type transport of the nutrients matter that extracted from the digested food occurred as (1%) in

the caeca therefore intestine did not required the transport or reabsorption function of the caeca especially the poor-fluid digested food [28].

Rectum in wood pigeon appeared with somewhat flat leaf-like villi, and the mucosa had goblet cells and few flat shape crypts of Lieberkhun. Histologically muscularis externa appeared thick. This results probably due to the function need for peristalsis movement [4, 25,38].

Ethical approval:

The Research approved by the Ethical Committee of College of Science, Babylon University.

Conflict of Interest:

The authors declare that they have no conflict of interest.

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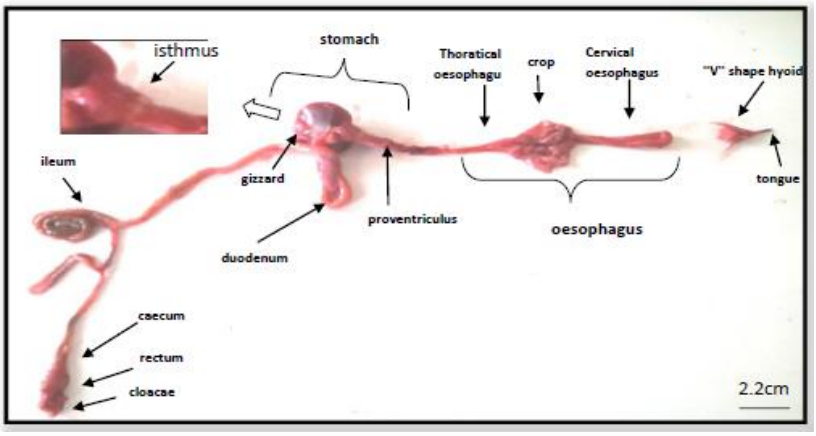


Figure(1): The digestive tract of the common wood pigeon, *Columba palumbus*.

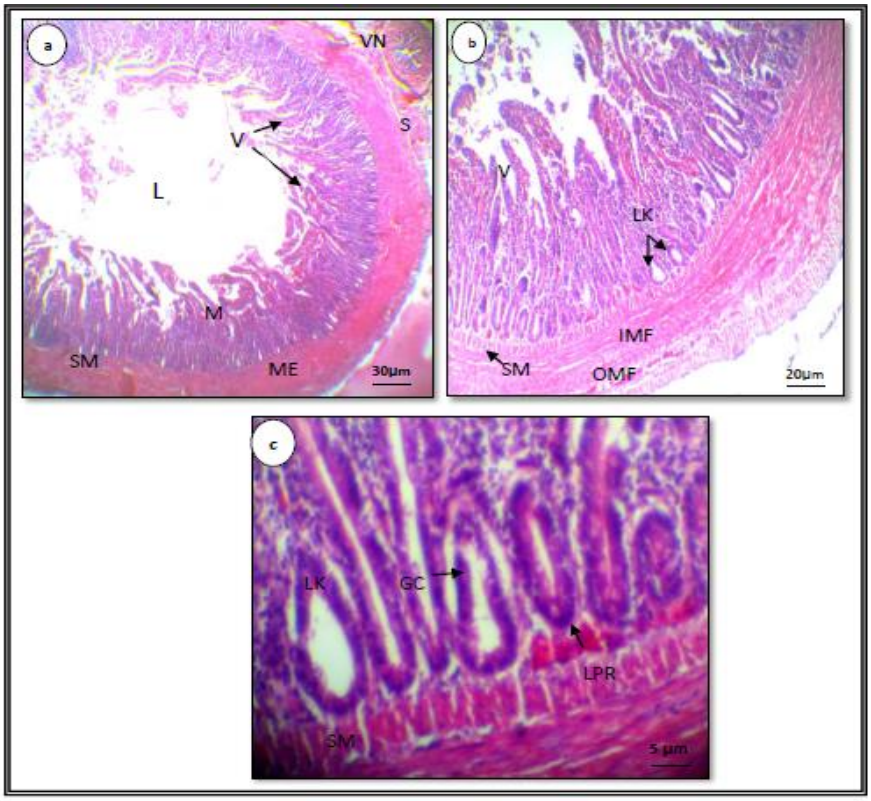


Figure (2) a: Cross section in the duodenum of the common wood Pigeon *Columba palumbus* showed the lumen (L), villi (V), mucosa (M), sub-mucosa(SM), muscularis externa(ME) , serosa (S) and the vein (VN). H&E 4x.b: Cross section in the duodenum of the common wood pigeon showed the villi (V) , crypts of Lieberkuhn(LK), sub mucosa (SM) , inner muscle fibers (IMF) and the outer muscle fibers (OMF) . H&E 10x.c: Cross section in the duodenum of the common wood pigeon showed the lamina propria(LPR) , the goblet cells (GC) , crypts of Lieberkuhn(LK) and the sub mucosa (SM). H&E 40x.

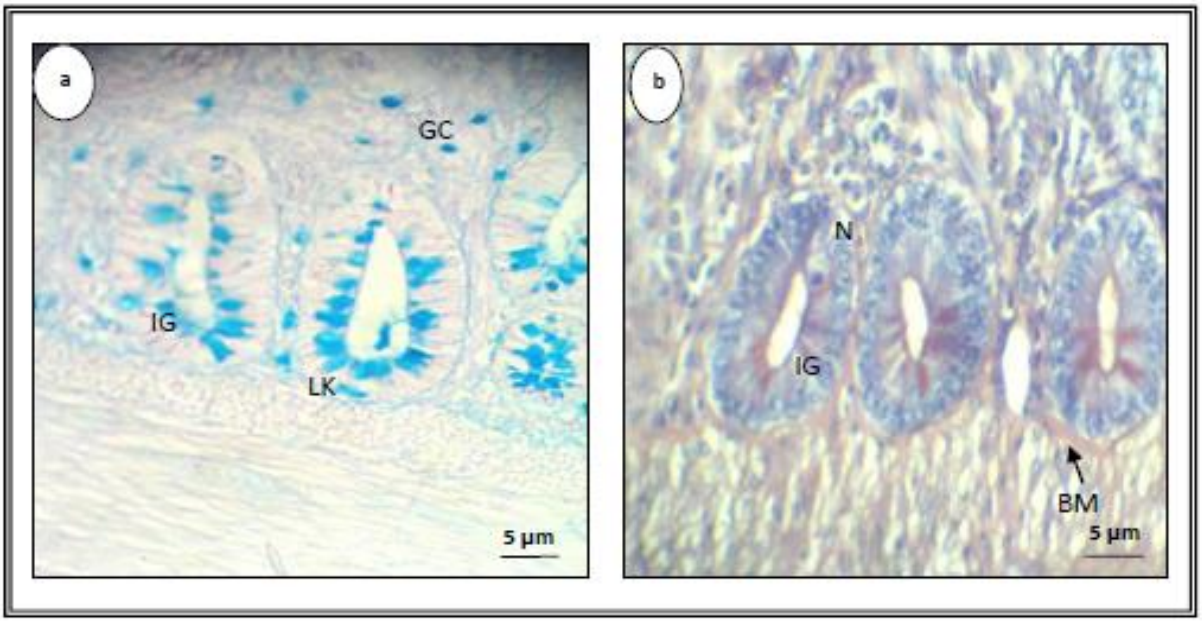
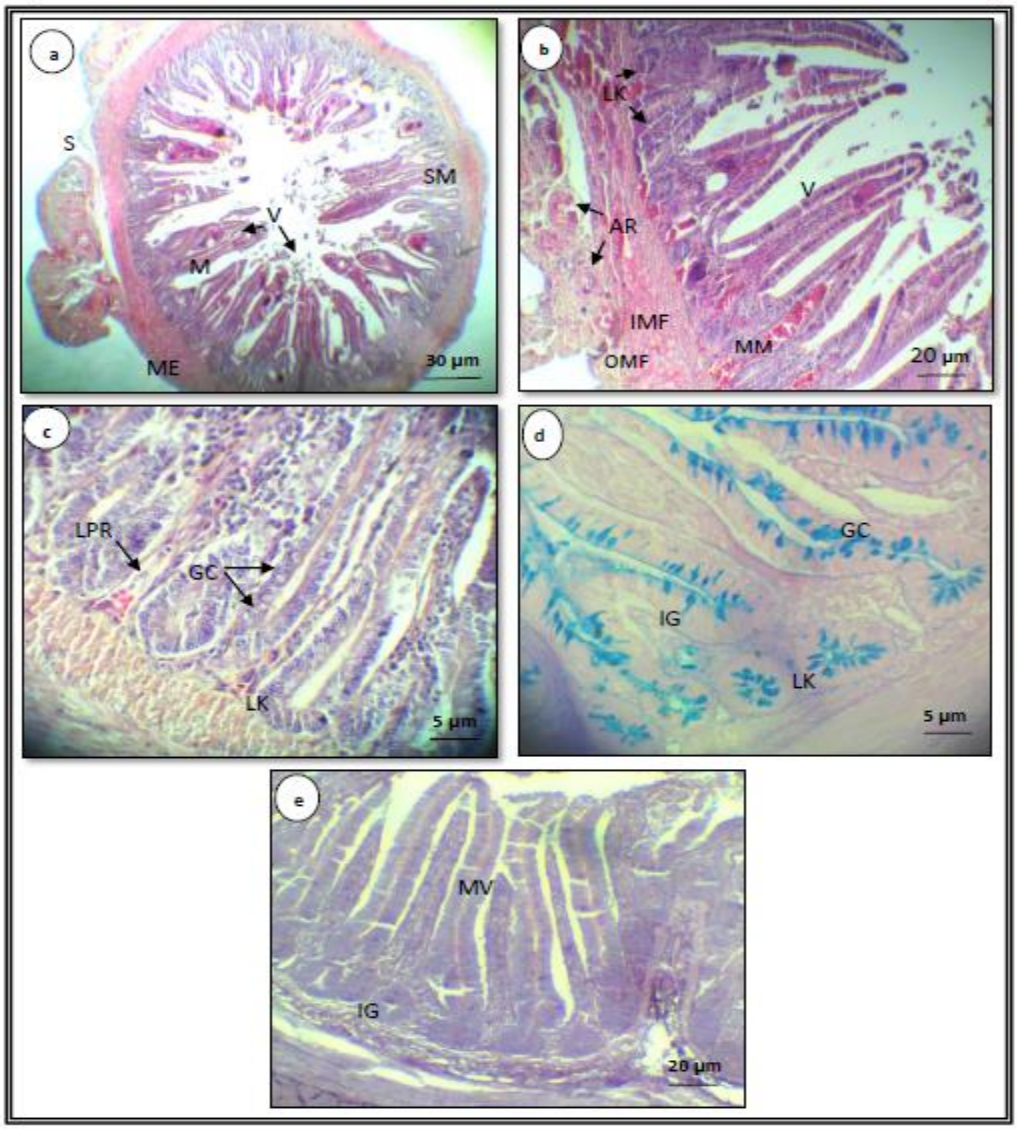
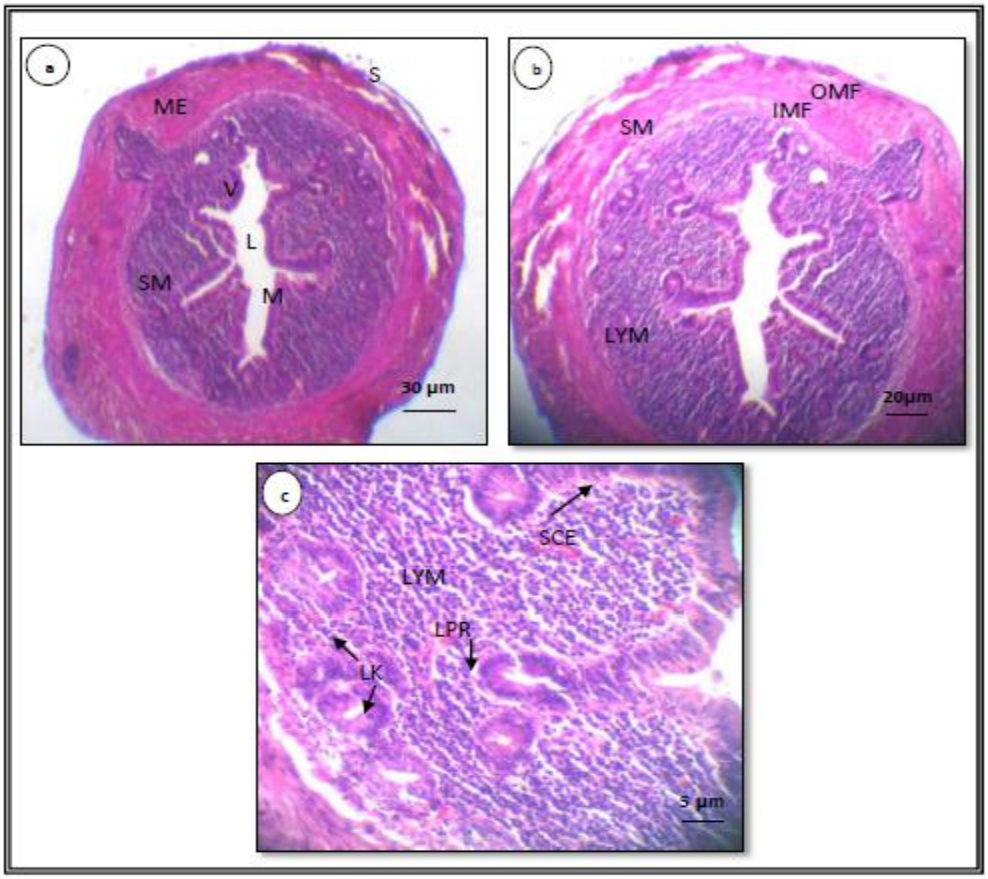


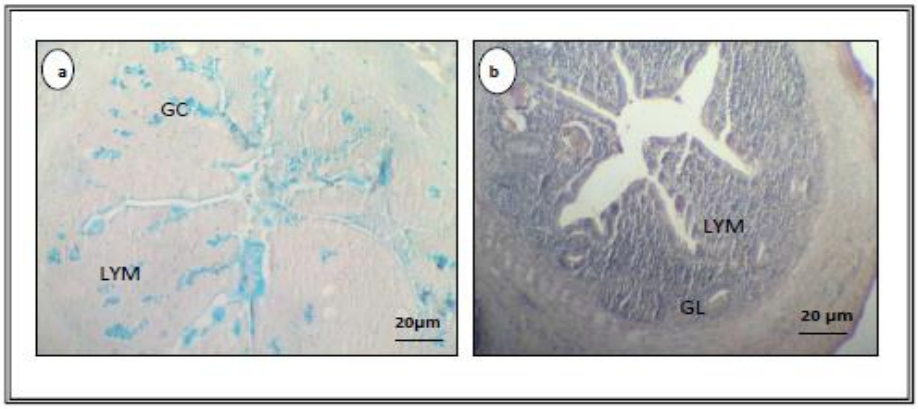
Figure (3) a:Cross section in the duodenum of the common wood pigeon *Columba palumbus* showed the goblet cells (GC) and the crypts of Lieberkuhn(LK) and the intestinal glands(IG). Note the strong reaction with the stain. AB,40x.b:Cross section in the duodenum of the common wood pigeon showed the nucleus (Nasement membrane (BM) and the intestinal glands (IG). PAS 40x.



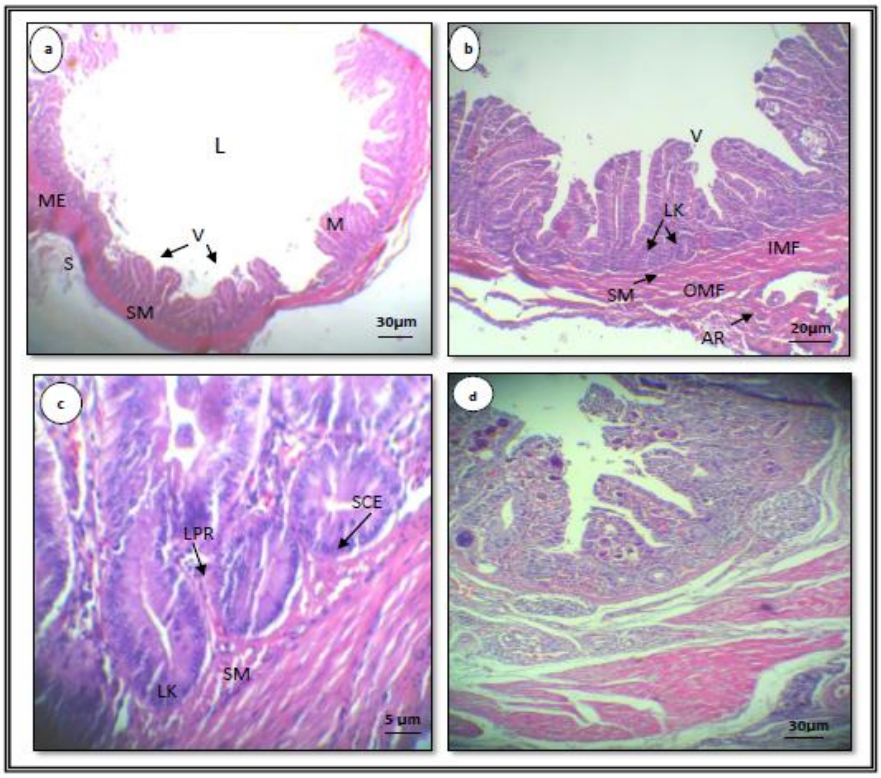
Figure(4) a: Cross section in the ileum of the common wood pigeon *Columba palumbus* showed the villi (V) , mucosa (M) , sub-mucosa (SM) , muscularis externa(ME) , and serosa (S) . H&E 4x.b: Cross section in the ileum of the common wood pigeon showed the villi (V) , crypts of Lieberkuhn(LK) , muscularis mucosa (MM) , arterioles (AR), inner muscle fibers (IMF) and outer muscle fibers (OMF) .H&E 10x.c: Cross section in the ileum of the common wood pigeon showed the goblet cells (GC) , crypts of Lieberkuhn(LK), and lamina propria(LPR). H&E 40x.d :Cross section in the ileum of the common wood pigeon showed the lamina propria(LPR) , crypts of Lieberkuhn(LK) , goblet cells GC and the intestinal glands IG. Note the strong reaction with the stain. AB 400x.e:Cross section in the ileum of the common wood pigeon showed the intestinal glands(IG) and the microvillus (MV). PAS 10x.



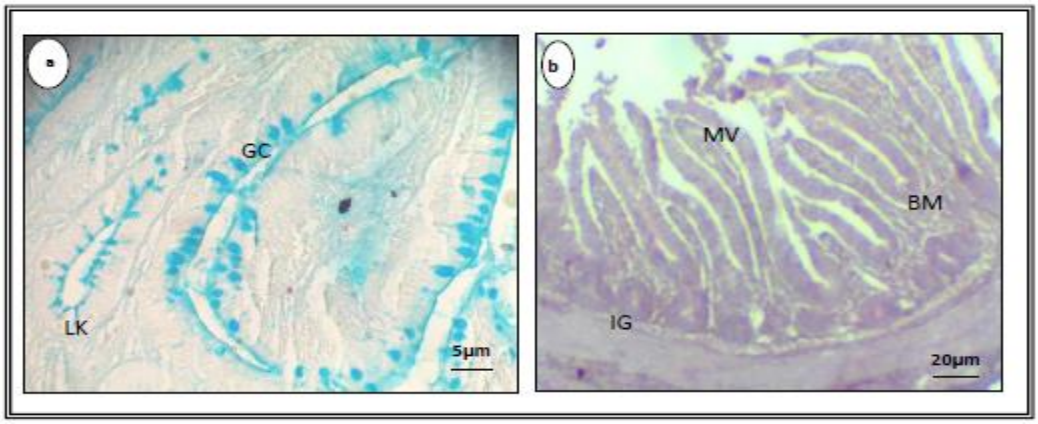
Figure(5) a: Cross section in the caecum of the common wood pigeon *Columba palumbus* showed the lumen (L), villi (V) , mucosa (M) , sub-mucosa (SM) , muscularis externa(ME) and serosa (S) H&E 4x.b:Cross section in the caecum of the common wood pigeon showed the lymphoid tissue(LYM), inner muscle fibers IMF, outer muscle fibers OMF and sub-mucosa SM. H&E 10x.c: Cross section in the caecum of the common wood pigeon showed the lamina propria(LPR) , simple columnar epithelial tissue (SCE) , crypts of Lieberkuhn (LK) and the lymphoid tissue (LYM) . H&E 40x.



Figure(6) a:Cross section in the caecum of the common wood pigeon *Columba palumbus* showed the goblet cells (GC) and the lymphoid tissue (LYM). AB, 10x.b:Cross section in the caecum of the common wood pigeon showed the lymphoid tissue (LYM) and the glands (GL). PAS 10x.



Figure(7) a: Cross section in the rectum of the common wood pigeon *Columba palumbus* showed the villi (V), lumen (L), mucosa (M), sub- mucosa (SM), muscularis externa(ME) and serosa(S). H&E 4x.b: Cross section in the rectum of the common wood pigeon showed the villi (V) , crypts of Lieberkuhn(LK) , sub-mucosa (SM) , inner muscle fibers (IMF), outer muscle fibers OMF and the arterioles AR . H&E 10x.c: Cross section in the rectum of the common wood pigeon showed the simple columnar epithelial tissue (SCE) , lamina propria(LPR) , crypts of Lieberkuhn(LK) and the sub- mucosa (SM). H&E 40x.d: Cross section in the cloacae of the common wood pigeon .H&E. 4x.



Figure(8) a: Cross section in the rectum of the common wood pigeon showed the crypts of Lieberkuhn(LK) and the goblet cells (GC) . Note the medium reaction with the stain and the reducing of the goblet cells, crypts of Lieberkuhn(LK) and the intestinal glands (IG) . AB , 400x.b:Cross section in the rectum of the common wood pigeon showed the basement membrane (BM) , micro villi (MV) and the intestinal glands (IG) , PAS 100x.

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