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Histochemical study of the duodenum in two types of bird's Guinea fowl *(Numidia meleagris)* and Falcon *(F. tinnunculus)*

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Abstract

Twenty birds, from 1-2 years, were used in the current study. Duodenum samples were collected between September 2024 and February 2025 from the Al-Samawa abattoir, and the study was carried out in the department of anatomy and histology at the University of Al-Muthanna's College of Veterinary Medicine.

The duodenal loop is a U-shaped tube made up of the descending and ascending limbs of the duodenum. located between these limbs is the pancreas. Muscularis externia, tunica mucosa, tunica submucosa, tunica serosa, and adventitia are the commonly recognized layers that make up an organ's wall.

three stains—PAS, AB (PH-2.5), and PAS_AB [pH 1]—to the histochemical process. These staining methods were used to identify if neutral mucins, acidic mucins, and neutral mucins combined with acidic mucins were present or absent. There were two different kinds of villi cells: goblet cells, which reacted positively to the PAS technique, and simple columnar cells, which reacted negatively.

Alcian-Blue (PH-2.5) staining of the goblet cells revealed strong reaction in the crypt of lieberkühn as well as in the villi. These AB stain results show that the crypts and villi contain acidic mucins.

The goblet cells reacted moderately with the stain, showing the presence of neutral and acidic muccopolysaccharide, whereas the columnar epithelial cells reacted negatively when the tissues of the guinea fowl's duodenal wall were stained with the combination PAS-AB (PH-1). The connective tissue of the serosa, submucosa, and lamina propria also reacted negatively. AB, PAS stain, and PAS + AB had negative effects on the smooth muscle fibers of the muscularis mucosa and tunica muscularis.

Key word: falcon, Guinea, Histology and Histochmistry.

Introduction

There are over 8600 different species of birds , with the biggest number being found in the order Passeriformes. In contrast, the Struthioniformes order was the smallest. In the past century, a number of researchers have examined several bird species in Iraq, including AL-Samawy, E.R.; Fayak, J.t. (2015).

Birds generally require a lot of research to understand the structure and function of their various organs (Hussien and Rezk, 2016). Domestic birds are regarded as a valuable animalist asset that can be used for a variety of purposes and are crucial for bio-protection against dangerous insects and rodents (M Hamodi, H *et al.,* 2013).

Guinea fowls (Numida meleagris) may be a viable substitute for chickens as a source of protein in the form of meat and eggs (Zvakare *et al.,* 2017).

African guinea fowls were first tamed by the early Egyptians (Oakland, 2001). At the moment, they are dispersed around the globe (Embury, 2001; Saina, 2001).

The kestrel is a distinctive member of the falcon family and one of the

most common predatory birds. It is widely distributed throughout the world, has a wide range of colors, and feeds on a variety of insects, small mammals, including mice and juvenile ground squirrels, as well as occasionally small birds (AL-kafagy, S. M. 2016).

The mouth cavity, phyranx, esophagus, crop, stomach , small and large intestines, cloaca make up the avian digestive system. In contrast to those of mammals, it is brief (Gelis, S. (2012).

The ileum, jejunum, and duodenum were the three portions that made up the birds' small intestine. The first one, which starts with the gizzard, forms a loop that contains a sizable section of the pancreas. From the diverticulum to the ileocaecal junction, the ileum is the last section of the small intestine. When linked by Mackle's diverticulum, it is the second segment between the ileum and the duodenum (Yamauchi et al., 2010).

Methods

Birds collection

The current study was carried out using twenty birds. I checked the samples to make sure there were no illnesses and they were in good health. Each male Falcon and Guinea fowl was dissected by fixing it on a suitable dissecting plate to expose the abdominal viscera, including the small intestine. A mid-line incision was made in the abdominal wall, followed by the small intestinal segment (duodenum). The study was based on the differences in their food types, and ten of each type of bird were collected.

Following the birds' dissection, the organs were promptly extracted from the abdominal cavity and cleaned with saline solution to get rid of any blood or other debris that might have adhered. The duodenum, one of the

specimens from each bird, was then collected and preserved in Bouin's solution, while the other half was preserved in 10% NBF for 48 hours (Luna, 1968).

The duodenum, one of the fixed tissues, was sliced into blocks and identified. A series of graded alcohols (70%, 80%, 90%, 95%, and 100%) were then used to dry them. After being cleaned in xylene, the blocks were penetrated by melted paraffin wax. Using a Jung Rotary Microtome (model 42339), sections of embedded tissue that were 6 μm thick were cut. (I. G. Luna, 1968).

After that, the tissues were put on clean, grease-free glass slides. The slides were made at room temperature and stained with glycoprotein (PAS) in various ways , Alcian blue (pH2.5) (Acid mucins) and Combined of PAS-AB stain (neutral mucins). A light microscope (Olympus binocular microscope) was used to examine the prepared slides. A digital microscopic objective was used to take photomicrographs of the prepared slides that were put on the binocular microscope. Following the transfer of these images to a computer, in-depth analyses were conducted. Stevens, A., and Bancroft, J. D. (2010).

Results and Discussion:

Under a microscope, the guinea fowl's duodenum reveals that the mucosal layer is made up of crypts of Lieberkühn, which constitute the intestinal glands, and mucosal folds, which represent the villi that protrude inside the intestinal lumen. The two types of cells used in their construction were goblet cells, which reacted positively with the PAS technique, and simple columnar cells, which reacted adversely with it. Similar results were found by Hamdi *et al.*, (2013) in the black-winged kite and Rana et al. (2016) in Uttara fowl. They were also similar to those

recently noted by Vaish (2005) in Kadaknath chicks.

Negative reactions are maintained by the connective tissue of the serosa, submucosa, and lamina propria. The PAS stain produced a negative reaction in the smooth muscle fibers of the tunica muscularis and muscularis mucosa. These PAS stain reactions show that the crypts and villi contain neutral mucins.

African Ostrich chicks' mucous layer is crucial for lubrication, nutrient transmission between the lumen and the brush border, and preserving the small intestine epithelial cells (Wang and Peng, 2008). Mucopolysaccharides that were both acidic and neutral made up mucin (Uni *et al.,* 2003).

Similar to Sadeghinezhad *et al.* (2012) in the small intestine of presian squirrels, the results were different from Dawood (2013) in the native ducks, who found that goblet cell secretion reacted favorably to PAS stain (red color). However, because neutral mucins were present, the goblet cells in the falcon's duodenum's villi epithelium reacted favorably and had a crimson hue when PAS staining began.

While the epithelial crypt cells showed a range of reactions, some were weak to negative, and some were positive. Although they were not very strong, mucopolysaccharide was abundant in intestinal epithelial cells.

The mucin produced by the growing number of goblet cells in the end of the intestine serves to lubricate and cover the mucosa from fecal material abrasion (Ghosh et al., 2011; Ikpegbu et al., 2014).

Alcian blue (PH-1) staining of the goblet cells showed a robust reactivity in the crypt of lieberkühn as

well as in the villi. These AB stain reactions show that the villi and crypts contain acidic mucins. The results were comparable to those of Ahmed *et al.* (2009) on Varanus niloticus, where the goblet cells exhibited a strong reactivity to the stain for acid mucopolysaccharide.

Alcian blue stain was positively reacted to by the mucous-secreting goblet cells in the falcon's villi and epithelial crypts; this result was consistent with al-Kafajy's (2016) findings in Kestrel and White-eared bulbul.

Columnar epithelial cells reacted negatively to the combined PAS-AB (PH-1) staining of the guinea fowl's duodenal wall tissues, while goblet cells reacted moderately, suggesting the presence of both neutral and acidic muccopolysaccharide. Similar results in the black-wing kite were noted by Hamdi et al. (2013), who found that the stain indicated a strong reaction for goblet cells to acid mucopolysaccharides, with the basal section of the goblet cells turning red for neutral mucin.

The duodenum wall's smooth muscle fiber and connective tissue, however, were both weakly and negatively stained using this method. Furthermore, it agreed with AL-Samawy's (2015) owl findings.

When the combined PAS-AB(PH-1) stain was applied, the goblet cells in the falcon's crypts and duodenal villi only responded favorably to the PAS portion and displayed a red hue, signifying the presence of neutral mucopolysaccharides and the lack of acidic mucin. This result contrasted with that of Zaghar (2019) in guinea fowl, where the goblet cells exhibited a positive response in both the crypts and the villi. These discrepancies could be attributed to species and food type differences.

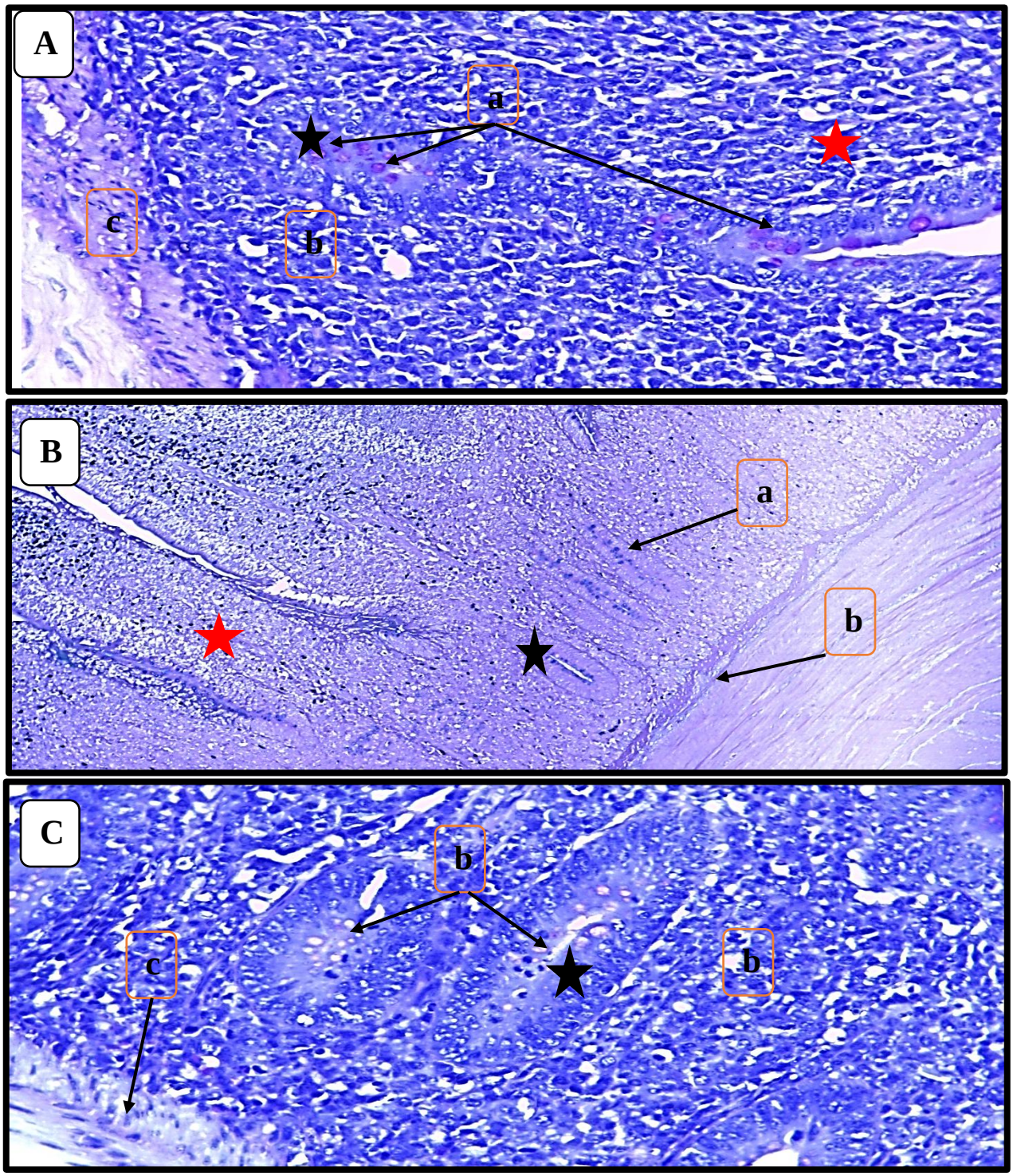
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Fig.1. photography duodenum in Guinea fowl show : (**a**) Goblet cells with mucin (**b**) laminae prepare, (**c**) Submucosa, (**red stars**) Villi, (**black star**) Crypts.

(A)X400 (PAS), (B) X100 (AB) and (C) X400 AB+ PAS.

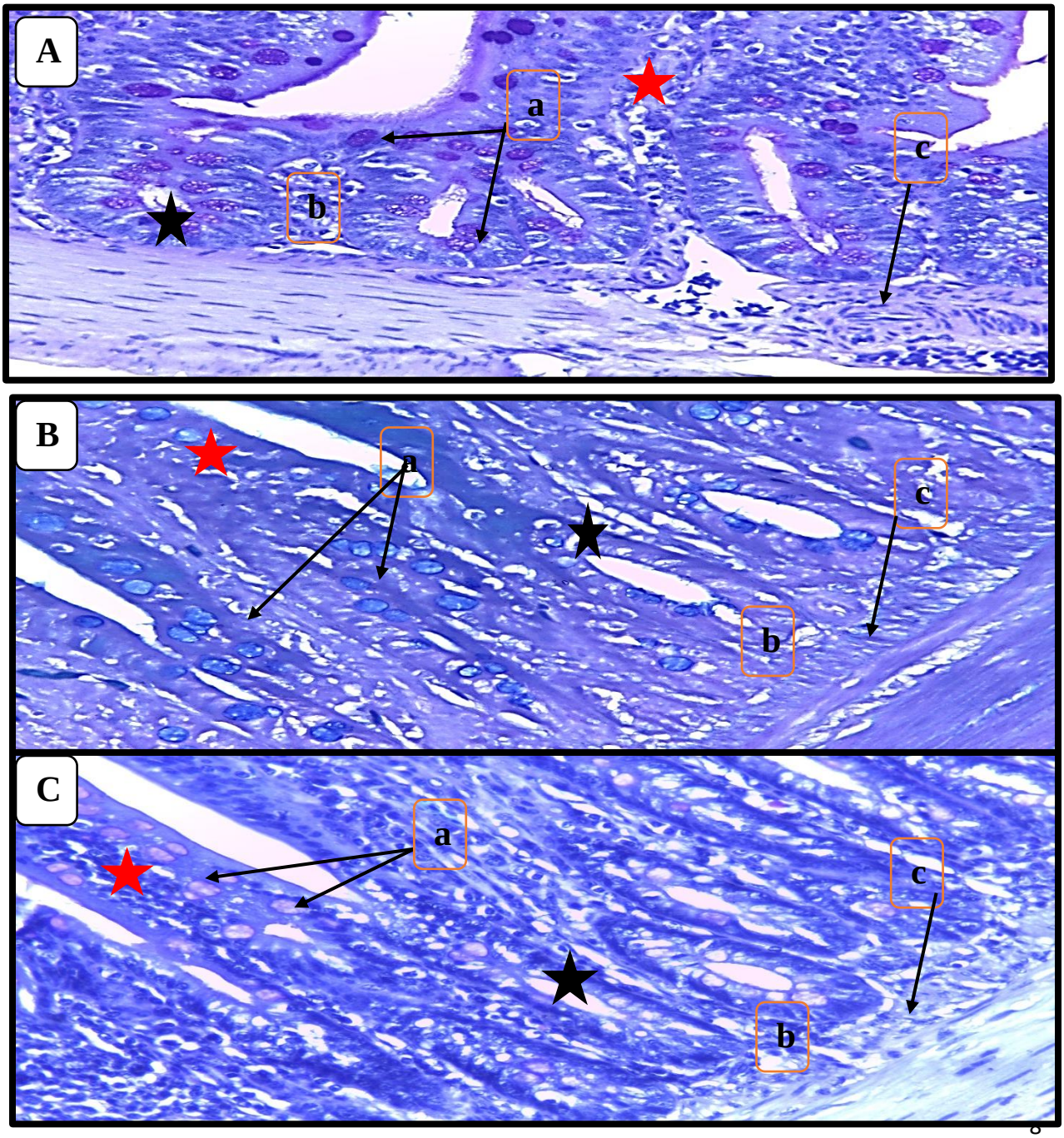

Fig.2. photography duodenum in Falco fowl show : (**a**) Goblet cells with mucin (**b**) laminae prepare, (**c**) Submucosa, (**red stars**) Villi, (**black star**) Crypts.

(A)X400 (PAS), (B) X400 (AB) and (C) X400 AB+ PAS.

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