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Original Research Article

Morphological Comparative Study of Duodenum and Jejunum Between Bronze Fallow Cockatiel and White Eared Bulbul

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Abstract: The current result aimed to investigate the comparative morphological note of duodenum and jejunum between two bird (white eared bulbul and bronze fallow cockatiel) according to their food type. In this study used (10 sample) from each bird. The small intestine was started from the pyloric opening and divided into three part (duodenum, jejunum, ileum) that located at the caudal part of abdominal cavity, there is no demarcation line between the three part and absent of Michal's diverticulum in both bird. The duodenum in bulbul was appear light yellow in color that take incomplete u shape and recognized by its largest diameter that holding the pancreas. While in cockatiel smallest in diameter and take red appearance with u shape. The jejunum of white eared bulbul appear brown in color the take single lope in shape and it's the longest part of small intestine, in cockatiel the jejunum has pink in color and the shape was parallel to u shape that absent of demarcation line with ileum.

Keywords: Bulbul, cockatiel, small intestine.

INTRODUCTION

Cockatiels are widely distributed through the Australian mainland, tending to prefer inland areas to coastlines. They tend to congregate in areas near bodies of freshwater and prefer generally open areas as opposed to dense forest. Thus, open woodland areas encompassed by waterways in addition to savannas bordering waterholes are optimal areas to find cockatiel flocks. Generally nomadic, cockatiels prefer Acacia seeds to other foods and densely populate areas with Acacia shrubs. (Pizzey, 1997; Recher, 2017).

The Pycnonotus leucotis is considered as one of the 137 species of the bulbul family; Pycnonotidae. It is found in the south and middle of Pakistan, Iraq, Iran and all around the Persian Gulf, also in far west as Bahrain (Chaffer, 2010). In addition, insects, berries, fruits and seeds are the main foods of bulbul. This bird has a medium gray body, jet-black head with a large cheek patch. It has pale eye-ring whereas the vent is yellowish in color (Srivastava, 2012).

The digestive system of any animal is important in converting the food the animal eats 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 (Jacob *et al.*, 2011).

MATERIALS AND METHODS

Current study was designed to investigated the characteristic features and differences in gross picture framework of the duodenum and jejunum in two birds based on the differences in their food types. To achieve such objectives, two different avian species were used that were Bronze Fallow Cockatiel (Nymphicus Hollandicus) which is a frugivorous bird and white-eared bulbul (Picnonotic leucotis) which is a herbivores or

frugivorous birds. They belong to the two different orders Psittaciformes and Passeriformes, respectively.

Twenty adult healthy birds (10 Bronze Fallow Cockatiel and 10 white-eared bulbul) were obtained from birds owners at local markets (Spinning market in Baghdad) without attention to their sex (male or female), for morphological study. The morphological aspect which were used in this part of study were as fallow: Description of shape, color and relationship of duodenum and jejunum, Measurements of the weight of the birds, Measurements of the weight of the duodenum and jejunum, Ratio of duodenum and jejunum weight to the body weight, Measurements of the length of the birds, Measurements of the length of the duodenum and jejunum, Ratio of duodenum and jejunum length to body length (relative length).

RESULTS AND DISCUSSION

Morphology of Small Intestine:

The result was revealed that the small intestine of white-eared bulbul and bronze fallow cockatiel was start from pylorus of stomach and ends at the ileocaecal junction and relatively short and formed of many loops that occupied the caudal area of the abdomen. It occupied the right side of coelomic cavity, the small intestine was related to the right side of proventriculus and gizzard. The small intestine was composed of three segments (duodenum, jejunum, ileum). There are no demarcation lines that separated between the three segment of small intestine in both birds. And absent of the Meckel's diverticulum in small intestine of white-eared bulbul and bronze fallow cockatiel. The duodenal flexure that holding the pancreas was marked the duodenum (Fig. 3,4,5,6), (table 1, 2).

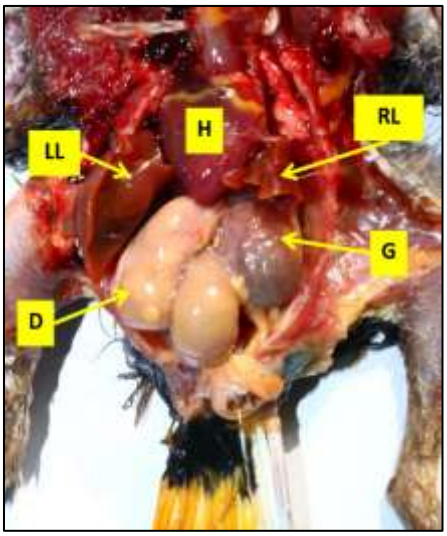

Figure 1: Photomacrograph of white eared bulbul show: heart (H), right lobe of liver (Rl), left lobe of liver (Ll), gizzard (G), duodenum (D)

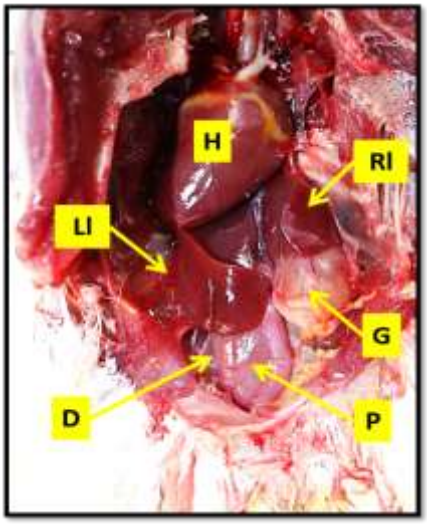

Figure 2: Photomacrograph of bronze fallow cockatiel show: heart (H), right lobe of liver (Rl), left lobe of liver (Ll), gizzard (G), duodenum (D), pancreas (P)

Table 1: The body length (cm), the intestine length (cm) and the ratio of Small intestine length to body length in bulbul and cockatiel

parameter / bird	Body length mean ± SE cm	Small intestine length mean ± SE cm	Ratio of Small intestine length / body length Cm
Bulbul	10.47 ± 0.350	11.3± 0.162	107%
cockatiel	13.42 ± 0.29*****	29.2 ± 0.856*****	217%*****

Table 2: The body weight (gm), the intestine weight (gm) and the ratio Small intestine weight/ body weight in bulbul and cockatiel

parameter / bird	Body weight mean ± SE gm	Small intestine weight mean ± SE gm	Ratio of Small intestine weight/body weight gm
Bulbul	22.60 ± 107 g	1.966*****	8.69%*****
cockatiel	103.42 ± 1.41g*****	1.539	1.48%

The small intestine begins at the pylorus of stomach and ends at the ileocaecal junction. It is divided into three unequal parts that include duodenum, jejunum and ileum (Payal Jain *et al.*, 2016). Generally, the small intestine is simple, short, highly efficient and slightly coiled in meat eating birds, while longer and highly coiled in herbivores and omnivoris birds (Dibner and Richards, 2004),(Saran *et al.*, 2019). The Grainivorous and frugiorous birds have relatively long small intestine since the high carbohydrate in its favorable food (Wijtten *et al.*, 2012); (Alshamy *et al.*, 2018);(Beheiry *et al.*, 2018), our results was agreement with that finding.

Khayoon and Reshag (2024). Report that the reported that the small intestine in both birds Harrier (Circus cyaneus) and Partridge (Alectoris chukka) consisted from 3 segments; duodenum, jejunum and ileum with no any demarcation between them. Both ratio of intestinal length to body length and of intestinal weight to body weight was higher in partridge than those in Harrier. That was similar to finding of bulbul and cockatiel in the result.

Morphology of Duodenum:

The morphological findings revealed that the duodenum of white-eared bulbul was the first loop of the small intestine, the duodenum was appearing incomplete U-shaped structure with light yellow in color. The duodenum was connecting between the gizzard and jejunum and extend caudally to the right side of the gizzard. That holding the pancreas between the descending and ascending limbs. Duodenum of white-eared bulbul showed large diameters than other small intestinal part (Fig. 3,5,6).

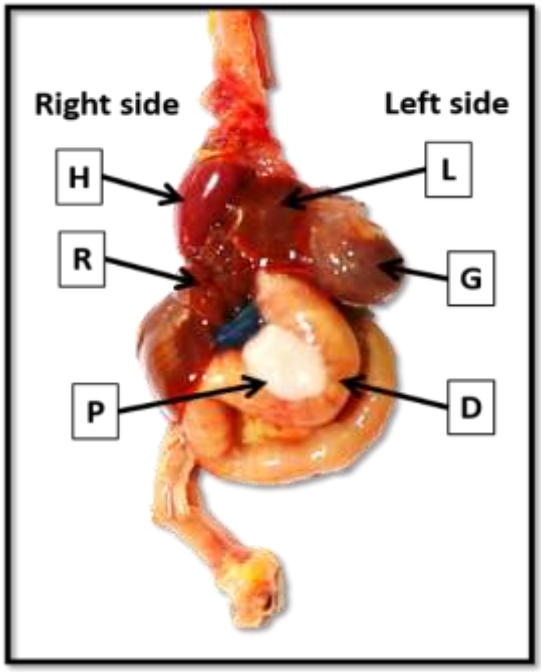

Figure 3: Photomacrograph of white eared bulbul show: heart (H), right lobe of liver (R), left lobe of liver (L), gizzard (G), duodenum (D), pancreas (P)

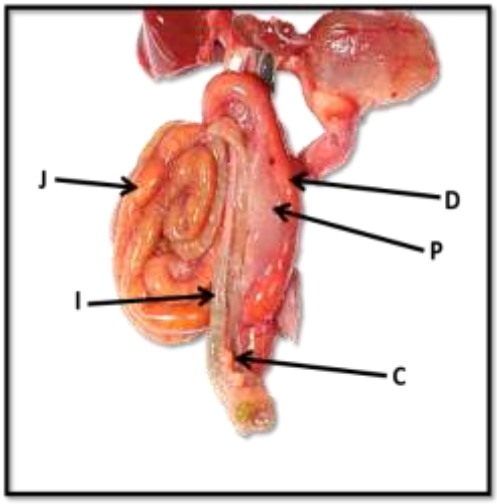

Figure 5: Photomacrograph of bronze fallow cockatiel show: duodenum (D), jejunum (J), ileum (I), cecum (C), pancreas (P)

The duodenum of bronze fallow cockatiel was same to that in bulbul, that take U-shape with red in color. That located at the right side of the gizzard and extend caudally. Duodenum of bronze fallow cockatiel showed the same diameters with the other part of small intestine (Fig. 4,6,8).

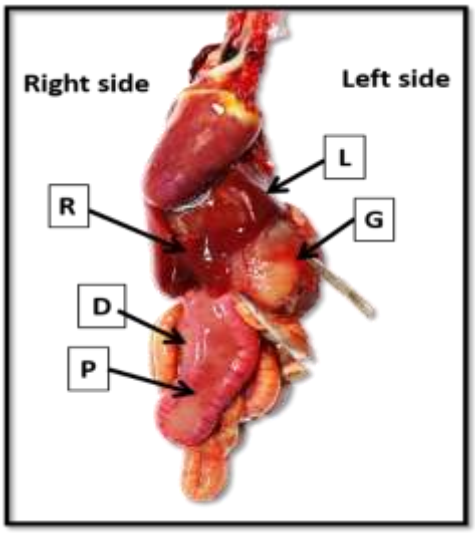

Figure 4: Photomacrograph of bronze fallow cockatiel show: right lobe of liver (R), left lobe of liver (L), gizzard (G), duodenum (D), pancreas (P)

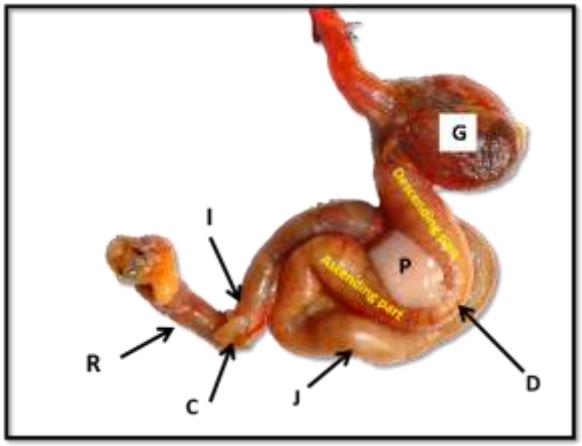

Figure 6: Photomacrograph of white eared bulbul show show: gizzard (G), duodenum (D), jejunum (J), ileum (I), cecum (C), pancreas (P), rectum (R)

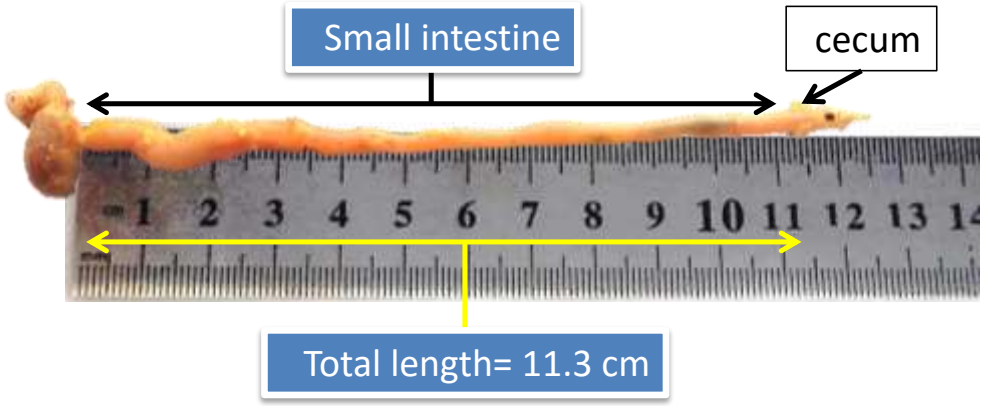

Figure 7: Photomacrograph of white eared bulbul shows: small intestine total length

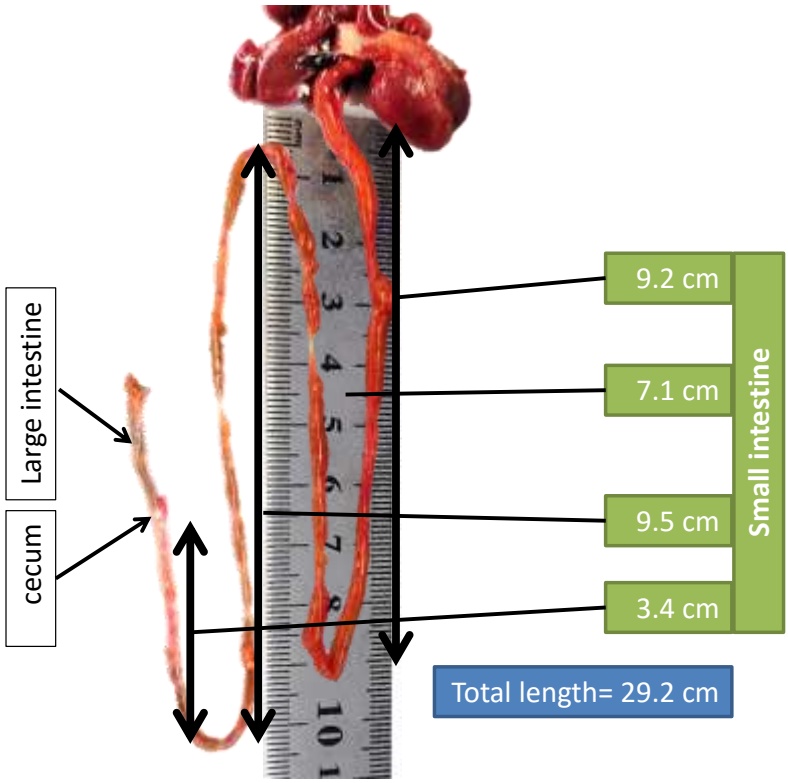

Figure 8: Photomacrograph of bronze fallow cockatiel shows small intestine total length

The finding was disagreeing with that mention, the captive bustard birds, have a "closed loop" of the intestine duodenum. The ascending loop is characteristically returns to the level of the gizzard, whereas the duodenal loop often extends posteriorly to roughly the level of the large intestine (Doukaki *et al.*, 2018).

Saran *et al.* (2019); Zghair *et al.* (2019), mention that the duodenum in guinea fowl is initiated at the pyloric of muscular stomach and forms an elongated loop then the small intestine is coiled and suspended by a thin mesentery from the dorsal abdominal wall and that similar to the result finding.

Our result was agreement with that researcher mentions, The duodenum found after the pyloric region of the gizzard The duodenum is U-shaped loop, consisting of a descending and ascending limb, where the pancreas was situated between the two limbs of it (AL-Samawy, 2015). Kestrel duodenum had a larger diameter than other small intestinal segments and formed relatively the biggest loop of the small intestine (Al-Kafagy and Ahmed, 2016).

The result was comparable to this mentions, the duodenum is bulging structure of the small intestine composing of a descending and an ascending arm enclosing pancreas ventrally as in mallard (Khaleel and Atiea, 2017), in canary (Serins canaria) by (Hristov *et al.*, 2017). and in most avian species (Hena *et al.*, 2012);.(Beheiry *et al.*, 2018). In barn owl the duodenum began from the antero-dorsal side of the muscular stomach and ended at the terminal point of its ascending

arm towards the anterior side of the coelomic cavity. Its left side is attached to the right side of the gizzard and dorsally it is related with the jejunum, cecum and ileum. Its right side is contact with right lobe of liver and lateral body wall (Oyelowo *et al.*, 2017).

Morphology of Jejunum:

The jejunum in white-eared bulbul is light brown in color. Jejunum starts at the end of ascending limb of duodenum there is no demarcation lines between jejunum and ileum and absent of Meckel's diverticulum and the duodenum was appeared like single loop (Fig .3,5,7). The jejunum of bronze fallow cockatiel appeared as a large parallel U-shaped loops supported by mesentery in the right side of the abdominal cavity. The Meckel's diverticulum was absent. (Fig 4,5,6).

These findings in both birds intersected with what reported by WO and Wensing (2002) in pigeons and Igwebuike and Eze (2010) in African Pied crow whom described the jejunum as cone shaped organ consists of several centripetal gyri then sigmoid flexure and centrifugal gyri , while their results about ileum were agreed with our findings when they described it as small segment continuous with jejunum in front of cranial mesenteric artery and end with two ceca.

In (2013) Dawood described the jejunum and ileum in indigenous ducks and his findings were similar to what we found. He reported that the jejunum is starts from the terminal point of ascending limb of duodenal loop and end at Meckel's diverticulum while the ileum extends from meckles diverticulum to the ileocecal junction.

Currently the presence of Meckel's diverticulum in two birds was disagree with the record of AL-Samawy (2015) in pigeons (coulumba liva) in which the small intestine lack Meckel's diverticulum between jejunum and ileum. On the other hand Ku *et al.* (2000) found in ducks and Zaher *et al.* (2012) found in Quial a small outgrowth called vitelline diverticulum or Meckel's diverticulum present between jejunum and ileum and therefore has obvious jejunal and ileal components. These finding were not similar to findings of present work in bulbul and cockatiel.

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