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morphological Study of the Small Intestine in the Geese (Anser anser).

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Abstract

This study aimed to identify morphological of the small intestine in adult geese. Six healthy geese were bought from the Baghdad local market, their age from (2- 5) years, and weight from (1.5 - 2.5) kg. All geese were euthanized and their coelomic cavity was dissected to determine the placement of the digestive organs, including their relative shapes. The coelomic cavity was dissected from the thoracic intake to the vent orifice. Gross descriptions and measurements of the small intestine were taken, including its length, weight, diameter, relative length, and relative weight according to the morphological investigation. Our results showed that the small intestine is made up of three segments (duodenum, jejunum, and ileum), The duodenum forms a U-shaped tube that occupied the pancreas, jejunum has (5) fluxes. Mickel's diverticulum appeared as a small bunch separating the jejunum from the illum. Illum was shorter than the rest of the small intestine.

Keywords: small intestine, geese, morphology

I. INTRODUCTION

The Canada goose (*Branta canadensis*) is a huge, wild species of goose that eats only plants. Males have a black head and neck, white cheeks, and white beneath their chins, while females have white bodies. Females typically weigh (2.5-5.5) kg, whereas males typically weigh (3.2-6.5) kg (male), Size (75-110) cm While larger subspecies can weigh more than nine kilograms and have a wingspan of more than a meter, smaller subspecies are roughly the size of a small duck (Long, 1972). The digestive tract performs a variety of essential functions for organisms, including nutrient absorption and digestion (Taha & Abed, 2022; AL-Muhammadi & AL-Taai,2020). The small intestine is the first organ to deal with secretion and absorb amino acids, fatty acids, and carbs. As a result, it can speed up digestion considerably while easing the strain on the digestive system. Morphological change is seen as crucial for the small intestine to quickly digest food and absorb its contents (Igwebuike and Eze, 2010; Hamza & Al-Mansor, 2017; Khaleel&Atiea,2017; Salih & Hamza, 2023). According to a prior study, the small intestine is relatively short in

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frugivores, insectivores, and carnivores who have eaten poorly digested foods. The food passes through the intestines of fruit-eating animals like hill mynahs (*Gracula religiosa)* and hawks of prey in about 1.5 hours, whereas red birds (Lagopus Lagopus), which primarily consume heather, take longer to pass through the intestines of grain- and herb-eating animals (Hickman *et al.,* 1974; Sklanet al., 2001; Harcourt & Chitty 2005). The small intestine in avians, that generally short, made up of numerous loops, and located in the most caudal region of the abdomen, directly to the proventriculus and gizzard on the right side of the abdominal cavity. The duodenum, jejunum, and ileum suspend cecum are the three main divisions of the small intestine, which extend from the pylorus to the junction of the colon and mesentery (Denbow,2015; Hussein & Al-Aaraji, 2020; Salih & Hamza, 2023). The small intestine appeared similarly lengthy, smooth, homogeneous throughout its length, pale pinkish, and shiny in both sexes. The three parts of the duodenum, jejunum, and ileum made up the African pied crow's small intestine (Igwebuike & Eze, 2010). In ducks, the small intestine is short, has multiple loops, and is situated in the most caudal part of the abdomen, next to the proventriculus and gizzard on the right side of the abdominal cavity (Dawood, 2013).

II. MATERIALS AND METHODS

Six healthy adult geese between the ages of (2- 3.5) years, with a weight of about (1.5-2.5) Kg. were bought from the market in Baghdad, which used to study the small intestines (shape, location, and relationship) as well as the ratios of small intestine weight to body weight and small intestine length to body length. Each bird was weighed using a sensitive balance and then anesthetized by using Ketamine (25) mg/kg of body weight administered in thoracic or femoral muscles with a syringe of (1-3) cm (Schindala,1999).

The bird was then pinned to an anatomy board and fastened there. The small intestine was exposed and made easy to identify in terms of shape, position, and relationship by creating a small fissure at the midline of the abdomen, followed by a transverse split beneath the pectoral muscle to open the body cavity. Then the bird was photographed using a digital camera.

III. RESULTS AND DISCUSSION

According to the current study, the small intestine in geese is generally short, made up of numerous loops, and located in the most caudal region of the abdomen cavity, directly to the proventriculus and gizzard on the right side of the abdominal cavity. The duodenum, jejunum, and ileum are the three main divisions of the small intestine, which extend from the pylorus to the junction of the cecum with illum (Fig. 1, 2& 3). These results were also recorded by Den Bow (2015); Hussein& Al-Aaraji (2020); Salih & Hamza(2023); Al–Zaydy(2011); Khaleel& Atiea(2017) who observed that the small intestine is divided into three anatomical sections: the duodenum, jejunum, and ileum, and e no anatomical signs between them except the duodenal flexure and Meckel's diverticulum use as signs to separate jejunum from illum**.**

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The duodenum was the first segment of the small intestine, pink in color, formed a U-shaped flexure, which arises from the pyloric region of the ventriculus as a closed loop with a U-shape and loop formed by its descending and ascending limbs attached by the pancreatic duodenal ligament which occurs by the pancreas (Fig1&3). thick mucous membrane with long, heavy projections, finger-like features, and a white color that gives the duodenum a towel appearance(Fig7) It is located on the right side of the coelomic cavity, these limbs are connected by the mesentery duodenal limbs and are directed caudoventral and caudally to the abdominal wall, the duodenum made an extended loop before coiling and being suspended from the dorsal abdominal wall by a thin membrane (mesentery), this membrane granted gastrointestinal blood vessels (Fig 1,2&3). The duodenal aperture was not round but rather slit. The outer lip had deep, clearly, defined ridges and furrows that rested on the inner and straight lip, whereby the transit of food and indigestible substances is controlled, such as avoiding glass stones, and is divided into three sections: descending, middle, and ascending (Fig. 3). The pancreas fixed to each arm of the duodenum and situated between the loop's arms, holds the two arms together. a tiny peritoneal fold connects the descending or ventral limb and ascending or dorsal limb, which holds out the single-lobed pancreas. The two pancreatic ducts are opened into the ascending loop of the duodenum bile duct and pancreatic duct (Fig. 6). The mean total length, weight, and diameter of the duodenum were about (35.166) cm, (13.166) mg، and (1.5) mm respectively (Table 1). The above results were described by Altman *et al.,* (1997); Geyra, & Sklan (2001); Naser & Khaleel (2020) mentioned that the duodenum arises from the pyloric region of the gizzard and forms U shape loop, this loop consists of ascending and descending limbs, and the pancreas is located between them, duodenum joined with jejunum criminally with no clear demarcation**.** As well as, AL-Aaraji& AL-Kafagy (2016). on kestrel; Khalaf & Mirhish (2019) on ostrich; and Wang & Peng (2008) on the African pied crow (*Corvus Albus*) recorded that the duodenum has a U-shaped that connected to the pancreas at the distal end of the ascending duodenum, four pancreatic ducts and two bile opened up. In Iraqi mallards (Al-Samawy et al, 2017), in Iraqi ducks (Khaleel and Atiea, 2017), and in canary (Hristov et al, 2017), there is two pancreatic and bile duct draining in the duodenum in geese this result similar in guinea fowl (Zghair and Khaleel, 2019) and disagreement within indigenous duck by Khaleel and Atiea (2017) there are three pancreatic ducts.

The jejunum was the second and longest section of the small intestine and is occupied by the cranioventral part of two celomic cavities that extend from the distal portion of the duodenum loop to illum, until the ileum-jejunum junction. The jejunum is located dorsal to the duodenum in the cranioventral region of the belly and developed large coils, it is formed by many loops that form a garland appearance containing a thin mesentery and are attached by long mesentery mesenteric folds which carry the jejunum arteries (Fig1,2&4). The inner surface was a rough mucous membrane, shorter than the duodenum(fig7-2). Mickel diverticulum found in the jejunum wall appeared as a process or small pouch about 1 cm in length its previous connection to the yolk sac (Fig2). The jejunum extended from the distal part of the dumdum loop (duodenal-jejunum flexure) (Fig1&2). The jejunum is the long part of the small intestine in geese (table 1) may be due to the function of the jejunum in absorbed the sugars, amino acids, and fatty acids the amino acid is part of the plant's structure which is the main food for geese. Our results were compatible with the result in chicken

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that observed the proximal and distal parts of the jejunum are nearly straight and most part it is arranged in several short garlands at the end of the mesentery (Getty1975). It is suspended towards the dorsal part of the coelomic cavity by the mesentery and appeared as the longest part of the small intestine in the barn owl (Oyelowo *et al.*,2017). Shows as the small intestine project al the middle of the small intestine of chicken (Nasrin *et al.*,2012) while in geese it is very clear. , this finding is similar to in Guinea fowl (Gosomji et al, 2015; Zghair and Khaleel, 2019), but disagreement with the jejunum adult bronze male turkeys Naser& Khaleel (2020).that record the jejunum composed of six to nine flexure this is due to the large size of turkey than geese

Table (1) showed that the mean total length, weight, and diameter of the jejunum are (109.166) cm, (36.833) mg, and (1.3) mm respectively. The morphometric parameters revealed that the jejunum formed the greatest weight & length in comparison with the other parts of the small intestine which is very close to the measurement in geranium fowl (Zghair et al, 2019).

Ilium is the last and shortest segment of the small intestine of geese that appears as a straight tubular organ extended between the two ceca at the ileocecal junction which joined with the jejunum cranially and extended caudally to join with the cecum and the ileocecal junction (Fig2&5). The inner layer of the mucous membrane was thick, and dense projections give the mucous membrane a velvet appearance(fig7-3) It started from the jejunum to the ileocolic junction, where the cecum began, the final branches of the cranial mesenteric artery separate the ileum from the jejunum. The ileocecal ligament and mesentery that adhere on either side of the ileum, are the only loosely connected to the bases cecum. The demarcation between the jejunum and Illum was the last branch of the crawl mesenteric artery that supplies the small intestine (Fig5). Our results were parallel to the result in birds by Marshall (2013) mentioned that the ilium appears as appeared as a tubular organ sauce like observed as granivores and herbivores tend to be relatively long.

The morphometric measurement of the ileum was listed in Table (1) the mean total length is (15.833) cm, the mean total weight is (4.666) mg and the mean total diameter is about (0.65) mm. These results were also by Al-Saffar& Al-Samawy(2015) who observed that the mean length & weight was less than that of the duodenum and jejunum.

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Table (1): Gross measurement (Mean ± SE) of the small intestine (duodenum, jejunum, and ileum) in geese:

Organ / Gross measurement	Duodenum Mean ±SE	Jejunum Mean ±SE	Ileum Mean ±SE
Weight (mg)	13.166±0.833	36.833±0.703	4.666±0.760
Length (cm)	35.166±1.327	109.166±2.688	15.833±1.447
Diameter (mm)	1.500±0.223	1.300±0.057	0.650±0.076

Table (2): Gross measurement(Mean ± SE) of the body length (cm), small intestine length (cm), and the ratio of the small intestine (duodenum, jejunum, and ileum) in geese:

parameter / Bird	Body length(cm) Mean ±SE	Intestine length (cm) Mean ±SE	The ratio of intestinal length/body length % Mean ±SE
Geese	53.666±2.231	161.08±0.38	٣،٠٠1±0.171

Table (3): Gross measurement(Mean ± SE): the body weight (gm), small intestine weight (gm), and the ratio of the small intestine (duodenum, jejunum, and ileum) in geese:

Parameter / Bird	Body weight(mg)	Intestine weight (mg)	Ratio of intestinal weight/body weight%
Geese	1783±149.21	55.01±0.15	0.030±0.001

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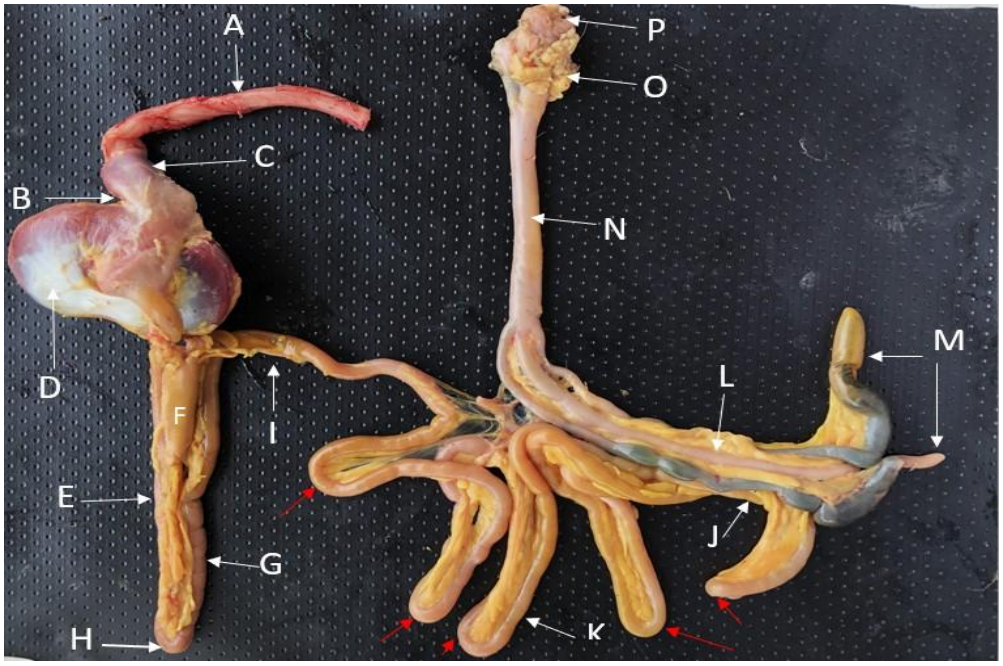

Figure (1): Macrograph illustrates a ventral view digestive system in geese(A) Esophagus,(B)gastric isthmus,(C)Proventiclus,(D)Ventriculus,(E) descending Duodenum,(F)Pancreas,(G) ascending duodenum (H)Caudal Duodenal flexure,(I)duodenum-jejunum junction,(J)jejunoileum junction,(K)Jejunum,(L)Illum,(M)right and left Cecum,(N)rectum,(O)Cloaca,(P)VENT, Fluxer(red arrow).

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Figure (٢): Macrograph illustrates a ventral view In geese part of the small intestine(A) Duodenum,(B)Jejunum(C)Illum. (D) Meckel's diverticulum,(E) duodenum-jejunum junction,(F)Pancreas,(G)Ventriculus

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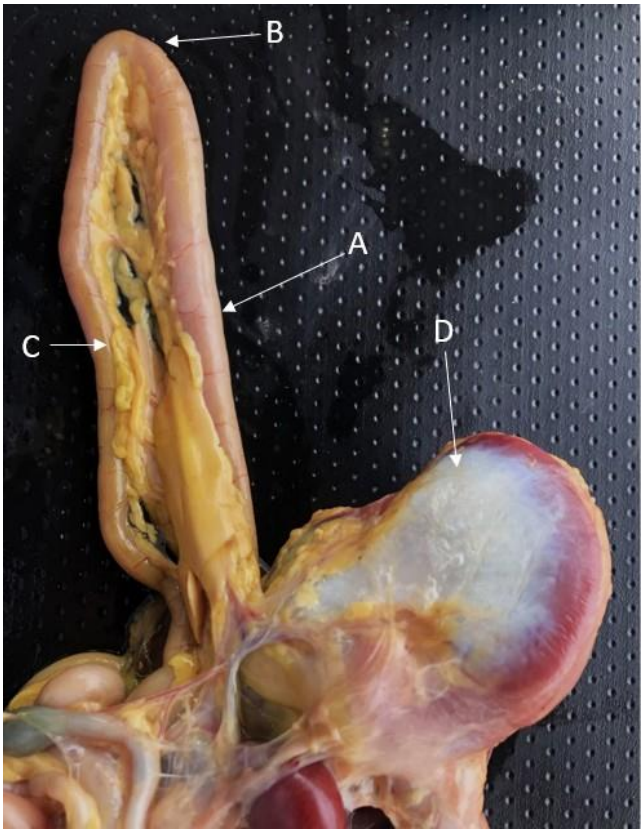

Figure (3): Macrograph illustrates part of duodenum:(A) descending duodenum, (B) duodnal flexure,(C)Ascending duodenum,(D) Ventriculus

Figure (4): Macrograph illustrates Jejunum in geese shows: (A)Jejunum, (B)mesentery (red arrow) flexure

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Figure (5): Macrograph illustrates illum in geese shows:
(A)Illum(B)Right and left cecum, (C)ileocecal junction, (D)colon.

Figure (6): Macrograph illustrates duodenum ducts in geese
(A)bile,(B)duodenum,(C)liver,(D)pancreas,(E)proventriculus,(F)bile duct,(J)pancreatic duct

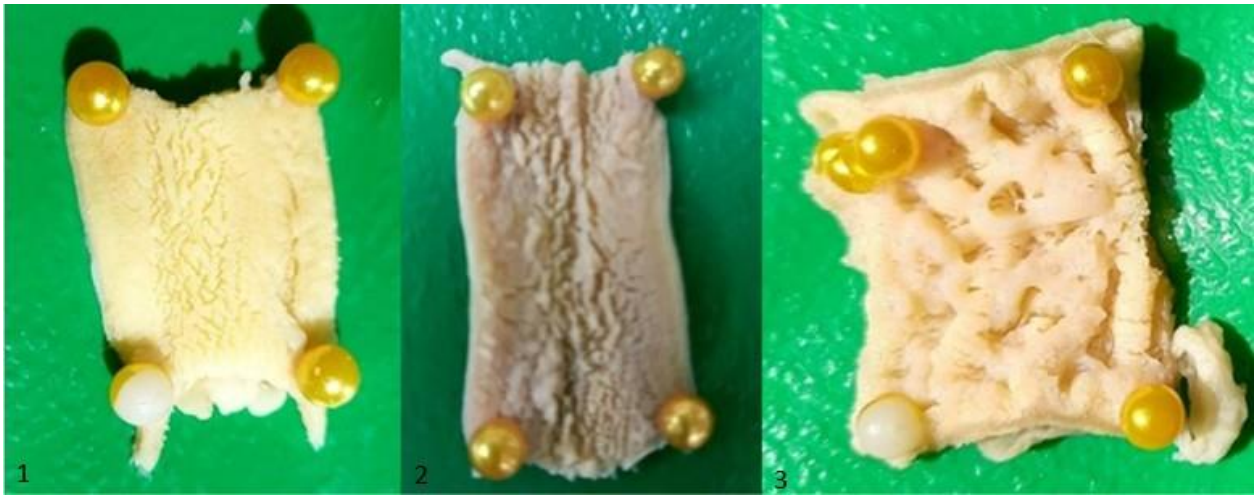

Figure (7): Macrograph illustrates the internal surface of the small intestine (mucous membrane) of the duodenum, jejunum, and ileum.

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