Morphological and histochemical features of the cloaca of Turkey hen *Meleagris Gallopavo*

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Summary

The study includes six adult healthy hen Turkey. The cloaca has three compartments separated by two circular folds and next to rectum is the coprodeum which is the largest and measured (2.5±0.2 cm) in length and (2.1±0.1cm) in diameter. The middle and smallest is the urodeum that measured about (1.01±0.2 cm) in length and (1.2±1cm) in diameter, and receives the ureter and left oviduct. Posteriorly, the proctodeum that measured about (1.4±0.1cm) in length and (1.6±1cm) in diameter. The coprodeum mucosa has short and flat villi. The urodeum mucosa has tall branching pyramidal mucosal villi. The mucosa of proctodeum has lost the villi pattern. The three compartments were lined with mucous secreting columnar cells, most of these epithelial cells were positive for Alcian blue (2.5 pH) stain and few were positive for PAS stain. The epithelial tubular glands showed positive reaction for Alcian blue satin only. The lamina propria of these compartments was cellular loose connective tissue displayed numerous of lymphatic nodules. The muscular mucosa is lost in proctodeum only. Tunica muscular is composed of two layers of smooth muscles fibers in coprodeum and urodeum and turned into skeletal type in proctodeum. The mean height of mucosal villi has significantly increased in urodeum.

Keywords: Cloaca, Coprodeum, Urodeum and Proctodeum in Turkey.

Introduction

Avian species havedifferent adaptations at the digestive system associated with physiological performace (1). In avian the large intestine consisted of paired caeca, colon or rectum and cloaca, (2). The cloaca is the last part of avian digestive system which receives the ends of ureters and left oviduct or ductus deference and composed of three chambers which involved coprodeum, urodeum and proctodeum; finaly, the vent which transverses the opening in the ventrocaudal body into outer environment, is composed of two lips of voluntary muscles sphincter (3). The cloaca is an important region as outer opening of digestive, urinary and genital organs. It also play an important role in making a bird capable for evaporating enough water from the cloaca consequntly important for thermoregulation site (4). Because the complex anatomical structure of cloaca the health of this structure is pertinent to the well being of the avian. The causes of cloacal disease could be related to any of the organs those related with cloacal structure consequently cloacal abnormalities include infections, inflammation, fecalith or urolith formation, retained eggs, prolapse, and neoplasia (5 and 6).The present study is aimed to investigate features of cloaca in henTurkey.

Materials and Methods

A total six adult turkey hens, weighing 3.5-4.6 Kg have brought from Baghdad local market. The birds have been slaughtered and the coelomic cavity has incised in order to collect the samples of cloaca. For morphological study, the number, length and height of the primary and secondary cloacal folds as well as the length and the width of the vent orifice have been estimated. For histochemical study, specimens from cloacal parts (Coprodeum, urodeum and proctodeum) have been fixed in Bouin's solution. Following fixation, the specimens have been washed up with tap water in order to remove the remnants of picric acid, then dehydrated with a series of increasing alcohol concentrations (70%, 80%, 95%, 100%), and cleared by two changes of xylene and passed the tissue through two changes of paraffin infiltration (56-58C). The tissues have sectioned at 5-6 micron. Tissue sections were stained by haematoxylin-eosin and combined Alcian blue 2.5pH and PAS stains and examined them with light microscopy (7). The data have statistically

analyzed by using SPSS (version 16.0). All numerical results have expressed as the mean ± standard error (SE). For comparisons, the statistical significance was assessed by ANOVA. The significance level was set at ($P< 0.05$).

Results and Discussion

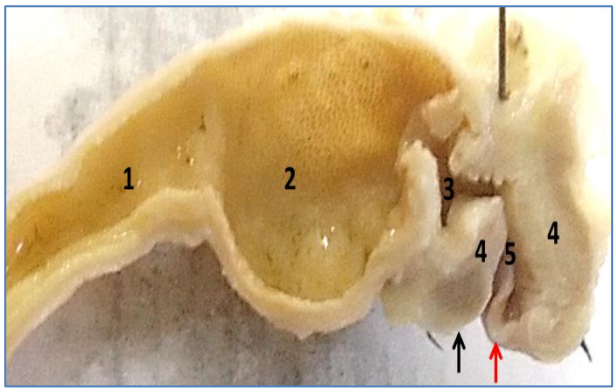
Morphologically**,** the cloaca was a bulbous structure and its internal chamber showed three separate compartments; the coprodeum, urodeum and proctodeum (Fig.1). This result was similar with (8). In pigeons the coprodeum was the largest compartment (Table, 1). It continued cranially with the terminal end of the rectum. Acoprourodeal fold separated the coprodeum and urodeum (Fig.1). This result was similar to the finding of (9) in Gallus domesticus, and the present result suggests that the largest size of coprodeum make it a temporary site as storage for a large quantity of fecal contents and consequently give a suitable time for microflora to recycle some of body nitrogenous and electrolytes requirements. Such a suggestion is supported by (9) who is showed that in avian one of most adapted performance of cloaca when the urinary excretions arriving in the cloaca becomes incorporated with the ingesta and move in a retrograde to the caeca to absorb the important water and electrolytes from the urinary waste. Urodeum was the middle and the smallest compartment (Table, 1), it received the vaginal part of left oviduct and ureter and its mucosa has clearly folded mucous membrane (Fig.1). An uroproctodeal fold separated the urodeum and proctodeum (Fig.1). This result coincided with (9) in Gallus domesticus, the presence of coprourodeal and uroproctodeal folds suggested that these folds are preventing the over mixing of faces and urine, consequently prevent effects of increased pressure and prevents the reflux of urine to the upper ureteral part. On other hand observation has agree with result of (10) whom studied the cloaca of 67 avian species, which included both sexes, with different habitats and differing dietary habits, found that in all species the ureters have been opened into the urodeoum except those in Rhea bird and several *tinamous* species their ureters have been opened into the proctodeum and their urodeum was received the ductus deferens or oviduct. The proctodeum was the final compartment which is the site of the bursa of Fabricius opening (Fig.1). The proctodeum was opened into the exterior through the cloacal lips (Fig.1). The morphometrical measurements showed significant differences ($P<0.05$) in the number of primary (10.01±0.61) and secondary (4.81±0.31) cloacal folds (Table, 1). The length and the height of the primary and secondary cloacal folds showed the same significant differences (Table, 1). The vent was a horizontal slit like end opening that opened to the outer environment (Fig. 1). Histologically; the wall of coprodeum was thin and its tunica mucosa has thrown into spares, short, and flat villi, the lamina propria composed of single layer of wide epithelial crypts of Lieberkuhn (Fig. 2 and 3). The mean height of coprodeal villus was (500.10±9.7µm) and its diameter was (210.7±11.1µm). The lining epithelium of this compartment was tall mucous secreting simple columnar epithelium that showed secretory activity and its mean height was (60.9±3.2µm). The lamina propria was loose connective tissue display ednumerous of lymphocytes with plasma cells and macrophages. The muscularis mucosa was well developed of coprodeum showed 4-5 layers of smooth muscle fibers (Fig. 4 and 5). The histochemical result showed that, most epithelial cells have positive reaction for Alcian blue (2.5 pH). Stain which revealed the presence of acidic mucous secretion especially those lined the sides of the villi, on other hand the epithelial cells of the apical part of villi showed positive reaction for PAS stain which revealed the presence of neutral mucous secretion. The epithelia of tubular glands (crypts of Lieberkuhn) also showed acidic mucous secretion (positive for Alcian blue 2.5 pH satin) only (Fig. 5)**.** Urodeum was the narrows compartment. Its tunica mucosa was showed tall branching pyramidal mucosal villi which measured about (1400.12±11.6µm) showed many of wide tubular epithelial glands (Fig. 6). The villi were lined with mucous secreting columnar cells with mean epithelial height of (73.9±1.1µm) (Fig. 6). The lamina propria was cellular loose connective tissue occupying by lymphocytes, plasma cells and

macrophages. The muscular mucosa was thin and composed of (2-3) layers of smooth muscle fibers (Fig. 6). Tunica muscularis appeared thick and composed of thick inner circular and thin outer longitudinal layers of smooth muscle fibers (Fig. 7). This result was similar with (8). The histochemical result of this compartment was similar to the coprodeum. The epithelium of urodeum was similar with that recoded by (11) in turkey. Proctodeum is characterized by the thickened tunica mucosa which has lost the villi pattern and showed thick lamina propria. Lamina propria is composed of loose connective tissue occupied by numerous of lymphatic nodules with many wide tubular epithelial gland (Fig. 8). The present result agrees with (11) in turkey. The mucosa was lined with mucous secreting columnar cells with mean epithelial height of (87.4±2µm) that turned into stratified squamous epithelium near the vent (Fig. 9) Also this result was similar to (8). At the proctodeum the muscular mucosa is lost and tunica muscular has turned into skeletal type and composed of thin inner longitudinal and thick outer circular muscle fibers (Fig. 8 and 10).

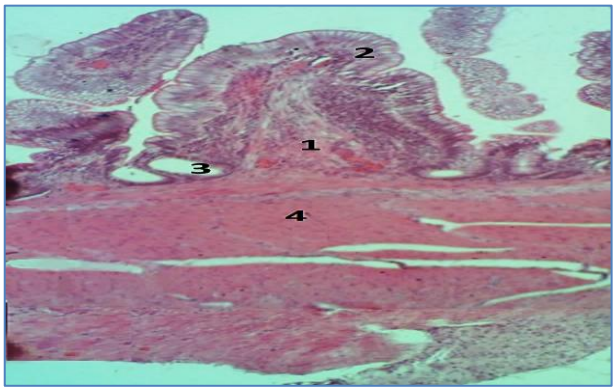
Table, 1: Show the morphological parameters (length and diameter) of the three compartments of cloaca.

Compartments of cloaca	Length/ cm	Diameter/ cm
Coprodeum	2.5±0.2 a	2.1±0.1 a
Urodeum	1.01±0.2 b	1.2±1 b
Proctodeum	1.4±0.1 a	1.6±1 a

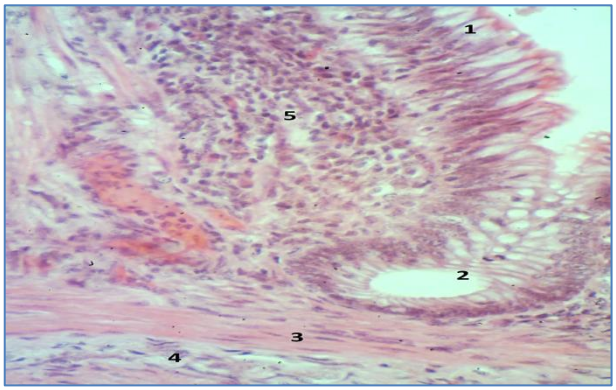
The different litters (a,b) represents significant values at (P<0.05).



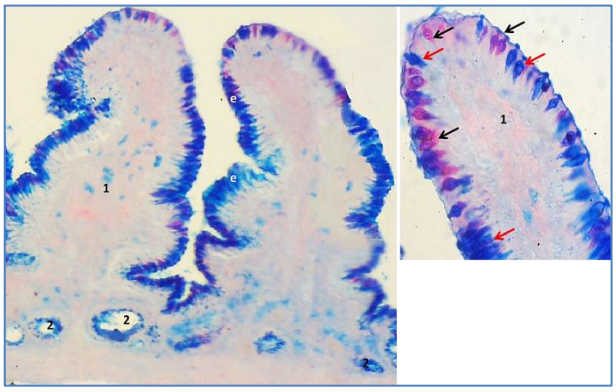
Figure, 1: Sagittal section of cloaca (turkey hen) shows: rectum (1), coprodeum (2), urodeum (3), cloacal sphincter muscles (4), proctodeum (5), and perforation of the left oviduct into the wall of urodeum (pin), dorsal labium of cloaca (Red arrow) and ventral labium of cloaca (Black arrow).



Figure, 2: Coprodeum wall (hen turkey) shows: lamina propria (1), epithelium (2), epithelial tubular gland (3) and tunica muscularis (4), (H and E) satin. 100x.



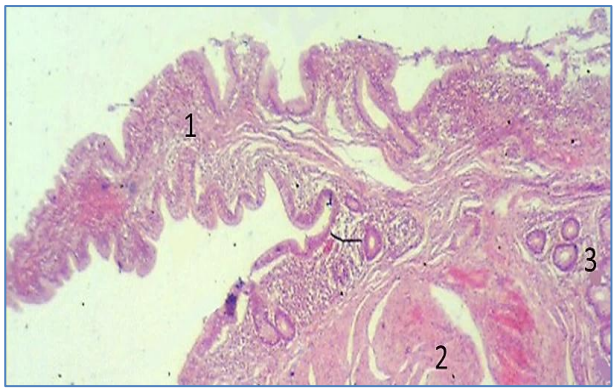
Figure, 3: magnified section of coproedeum villus (hen turkey) shows: epithelium (1), epithelial gland (2) muscularis mucosa (3), submucosa (4), and lymphocytic nodules (H and E) satin. 400x.



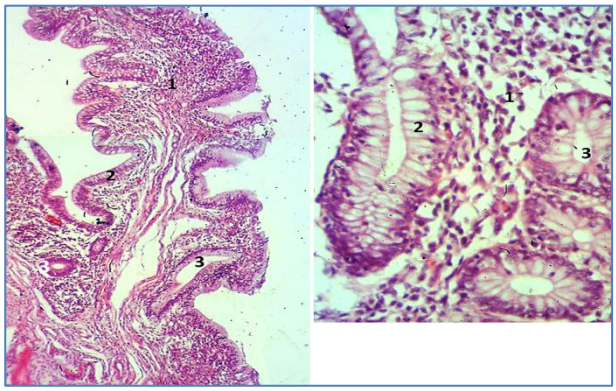
Figure, 4: The villi of coprodeum (hen turkey) shows: Lamina propria (1), epithelial tubular glands (2), epithelium (e), Alcian blue positive cells (Red arrows) and PAS positive cells (Black arrows). (Combined AB&PAS) satin. 100x and 400x.

The histochemical result of this compartment was similar to the coprodeum. The presence of epithelial tubular glands in urodeum and proctodeum suggests that, the presence of theses glands is relats to the fact that in avian the phallus is classified in two main types (protrudens phallus and non-protrudens (12). Thus, in case of non-protrudens phallus, the spermatozoa could be

discharged from proctodeum into outer environment consequently many of sperm will temporarily have storage in these glands in order to be released in other time, thus urodeum and proctodeum are considered a primary storage sites for spermatozoa. This supported by the presence of two types of mucus secretions (acidic and neutral). Thus the neutral mucous secretion is important to optimize the prolonged storage of spermatozoa within epithelial tubular glands and is thought to produce a "frothylike fluid" in male turkeys (13) and in quails by (14).

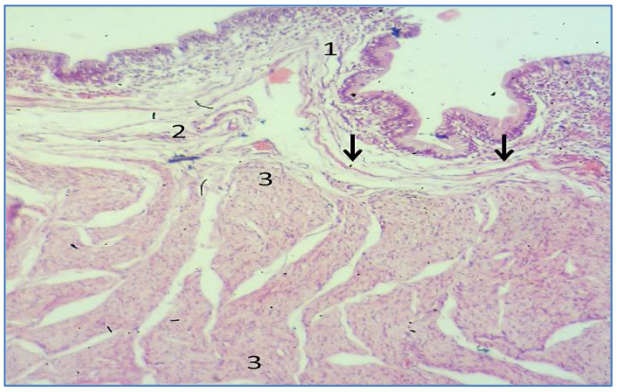


Figure, 5: Wall of the urodeum (hen turkey) shows: villi (1), tunica muscularis (smooth muscle fibers) (2) and epithelial tubular glands (3), (H and E) satin. 40x.

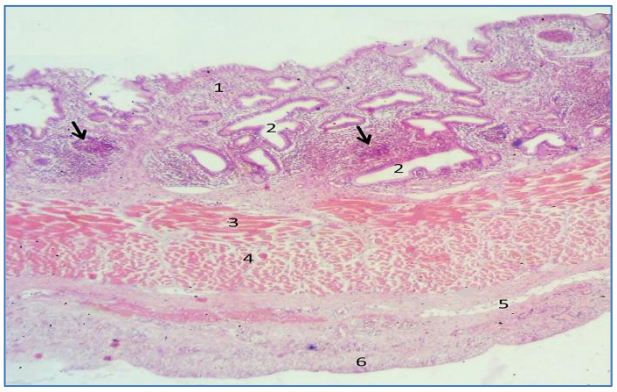


Figure, 6: magnified sections of urodeum villus (hen turkey) shows: lamina propria (1), mucous secreting epithelium (2) and epithelial tubular glands (3), (H and E) satin. 100x and 400x.

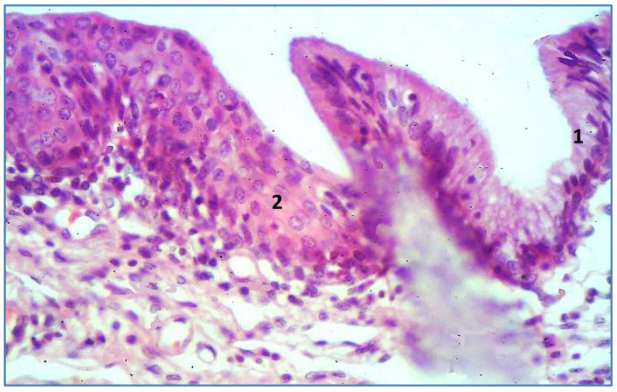
The bursa of Fabricius is situated on the dorsal wall of cloaca and connected to the proctodeum throughout cloacal duct (Fig.1). The duct was covered by epithelium that continued of the epithelium of the bursa which organized into follicles and with epithelium of proctodeum such an observation has been recorded by (15 and 16).



Figure, 7: urodeum wall (hen turkey) shows: mucosal villus (1), tunica submucosa (2) inner circular smooth muscle fibers (3), and muscularis mucosa (arrows) (H and E) satin. 100x.

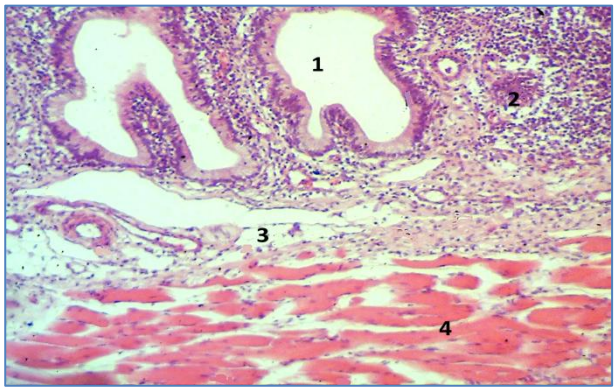


Figure, 8: longitudinal section of proctodeum wall (hen turkey) shows: tunica mucosa (1), epithelial glands (2) inner longitudinal striated muscle fibers (3), outer circular striated muscle fibers (4) hypodermis adipose tissue (5) and dermis (6) lymphatic nodules (arrows) (H and E) satin. 40x.



Figure, 9: epithelium of proctodeum (hen turkey) shows: simple columnar epithelial (1) and stratified squamous epithelial (2) (H and E) satin. 400x.

This result suggested that the infiltration of mono nuclear leukocytes (MNL) in the proctodeum and urodeum was related to immune response which has demonstrated in cloacal area in those birds that more capable of producing IgA (17).



Figure, 10: proctodeum wall (hen turkey) shows: tubular epithelial glands (1) lymphatic nodule (2), tunica submucosa (3) and inner longitudinal striated muscle fibers (4). (H and E) satin.100x.

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الصفات الشكلية والكيميائي النسجي للمجمع في أناث دجاج الرومي (*Meleagris Gallopavo*)

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الخلاصة

شملت الدراسة ستة من أناث دجاج الرومي السليمة صحياً. تكون المجمع من ثلاث اجزاء منفصلة عن بعضها بواسطة طيتين من النسيج المخاطي. وبعد المستقيم يبدأ كوبروديم وهو أكبر الأجزاء ويبلغ طوله (2.5±0.1) سم بينما يلغ قطره (2.1±0.1) سم. الجزء الأوسط والأصغر حجماً هو أورويديم والذي بلغ طوله (1.01±0.2) سم في حين بلغ قطره (1.2±1) سم وفي جداره يفتح الحالبين وقناة البيض إلى اليسار، وإلى الخلف يقع بروكتوديم. ظهرت الغلالة المخاطية للكوبروديم مكونة من زغابات مخاطية قصيرة وعريضة في حين أورويديم كانت الزغابات طويلة ومنقسمة ذات شكل هرمي، في الغلالة المخاطية للبروكتوديم بينت اختفاء الزغابات المخاطية. وأظهرت المخاطية للأجزاء الثلاثة أنها تبطن بالخلايا العمودية البسيطة ذات الافراز المخاطي والتي أظهرت غدد ظهارية انبوبية داخل الصفيحة اللبادية والأخيرة بدورها تكونت من النسيج الضام الرخوي الخلوي والغني بالعقيدات اللمفاوية. تكونت الغلالة العضلية من طبقتين من العضل الأملس في الجزأين الأوليين في حين في الجزء الأخير من المجمع تحولت العضلية من النوع الأملس إلى العضل المخطط. ظهر فارق احصائي مهم في قيم ارتفاع زغابات المخاطية في أورويديم. معظم الخلايا الظهارية أظهرت تفاعلاً ايجابياً لصبغة الاليشيان الأزرق (الأس الهيدروجيني 2.5) خصوصا تلك التي تغلف جوانب الزغابات في حين اظهرت الخلايا الظهارية في قمة الزغابات تفاعلاً ايجابياً لصبغة كاشف الشفت الايودي واظهرت الخلايا الظهارية للطويقات الظهارية تفاعلاً ايجابياً للاليشيان الأزرق فقط.

الكلمات المفتاحية: المجمع، كوبروديم، أورويديم، بروكتوديم في الرومي.