

THE MORPHOLOGICAL AND HISTOLOGICAL STUDY OF THE CAECUM IN BROILER CHICKEN

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ABSTRACT

Morphological and histological study were performed in the cecum of ten, six months broiler chicken. The present study was observed that the morphological study distinguished three region from cecum .The proximal ,middle ,and distal represented (23.65%),(42.28%),(34.06%) respectively of the total length of right caecum ,and (23.59%),(43.45%),(23.95%) respectively of the total length of left caecum. The total length of the right caecum were (13.15 ± 0.21) while the total length of left caecum were (13.14 ± 0.44) , also was observed that caecal wall composed of four layers (mucosa , submucosa , muscularis and serosa) .The regions of caecum were proximal with developed villi and numerous folds, middle with small villi and numerous folds, while the distal with small villi and avoid of folds .In present study the lymphatic nodules were mostly found in proximal part, but they were less prominent at the distal and least in the middle part of the caecum .the wide and length of lymphatic nodules were more major in the distal part than in the middle and proximal part. .

INTRODUCTION

Chickens large intestine consist of paired cecum and a short straight rectum joined to ileum and cloaca .cecum are two ,right and left elongated blind sac, each consisting of three parts: proximal or base, middle or body and distal or apex (1) .The short proximal part has a narrow lumen and a relatively thick wall, the long middle part is wider with thinner wall, the short distal part is extend to appointed end .Caecum wall is thinner than other parts of intestine, contain lymphatic tissue mostly in the basal part forming caecal tonsil (2) .Both the body and the apex of ceca allow the residence of uric acid degrading bacteria (3) .it is hypothesis that cecal environment should be maintained by wall developed immune defense mechanism ,such as the organization of enormous lymphoid nodules throughout the mucus membrane ,therefore the lymphatic nodules in the caecum are considered in important site both for immune responses and medicinal therapies(4).cecum may serve as site for several function, especially digestion of small food particles, absorption of nutrient, production of immunoglobulin and antibodies, microbial action of beneficial and pathogenic organism, utilization and absorption of water and metabolism of uric acid into amino acid(5). According to these significant ,the present study aimed to anatomical and histological study of caecum.

MATERIALS AND METHODS

A total of 10 broiler chickens aged six months were used in this study. The specimens were isolated after cervical exsanguinations under anesthesia by inhalation of diethyl ether. Twenty caecum(10L,10R) were isolated from ten animals at the

iliocaecal junction and separated from mesenteries and iliocaecal ligaments. and gently straightened on a flat plane. The full length of each caecum was measured using slide calipers as were the length of base ,body and apex. Differences between the right and left caeca were assessed statistically. For histological study five caeca were cut. The specimens were immersed in formalin20% for 7 days, following embedding in paraffin and finally the sections were cut at 6 μ thickness, after cutting the sections were floated on warm water bath at 37c for stretching and then the sections were mounted on clean slides (6). the histometrical analysis for wide, length and number of lymphatic nodules were measured.

RESULTS

Gross anatomy

The cecum was paired struction ,at their origin they have as smaller diameter, but they gradually increase in size until at their termination they formed a blind end. The gross morphometry distinguished three regions in the caecum.Caecal tonsil was located near the opening of each cecum(in the proximal one third of paired tubular cecum, with broad tubular in shape, it can easily separated from other parts due to thickening of wall (fig:2).The results showed that the length of the right and left cecum were (13.15 $\pm$ 0.21)cm,(13.14 $\pm$ 0.44)cm, respectively ,no significant differences was found between the length of the right and left cecum ($p>0.01$). The results also showed that the length of proximal part of right and left cecum were(3.11 $\pm$ 0.02)cm,(3.10 $\pm$ 0.01)cm respectively or 23.65% , 23.59% of the total length of caecum . No significant differences was found between the length of proximal parts of right and left caecum($p>0.01$).The length of middle part of right and left caecum were (5.56 $\pm$ 0.03)cm,(5.56 $\pm$ 0.07)cm, respectively or (42.28%),(43.45%) of the total length of caecum .No significant differences were found between the length of middle part of right and left caecum. The length of distal part of right and left caecum were(4.48 $\pm$ 0.01)cm,(4.33 $\pm$ 0.02)cm , respectively or 34.06% , 32.95% of the total length of caecum. No significant differences were found between the length of distal part of right and left caecum. the length of caecal tonsil of right and left caecum were(0.62)cm,(0.61)cm , respectively. No significant differences was found between the length of tonsil of right and left caecum(Tab.1).

Light microscopy

the results revealed that the caecal wall consist of four histological layers(mucosa ,submucosa, muscularis and serosa).the proximal part with well developed villi ,the middle part with small villi ,and distal part with small villi similar to middle part (fig:1,3,4.) our results appears that numerous folds protruded into the lumen of base, body, but low or absent in the apex. The lymphoid tissue were most commonly distributed in the mucosa, lamina propria and sub mucosa, and core of villi (fig:5).The muscularis layer of proximal part arranged in same directions ,but in the distal part the arrangement of fibers are in different direction(fig:7,8).The histometrical analysis of lymphatic nodules showed that the number of lymphatic nodules showed significant differences among three parts of caecum , they were (0.46 $\pm$ 0.02) \mm2, (0.04 $\pm$ 0.01)\ mm2 and (0.07 $\pm$ 0.01)\mm2 in proximal, middle and distal part ,respectively .the wide of lymphatic nodules showed no significant differences between the proximal and middle part, but there were significant differences between above parts and distal par, they were(81.20 $\pm$ 0.10 μ),(82.13 $\pm$ 1.33 μ),(92.34 $\pm$ 0.17 μ) in the proximal ,middle and distal part. the length of lymphatic nodules showed no significant differences between the proximal and middle part, but there were

significant differences between above parts and distal part, they were($54.63 \pm 0.23 \mu$),($56.41 \pm 0.11 \mu$)and($61.22 \pm 0.53 \mu$),(Tab-2)

Table -1- the length and percentage of the caecum parts

region	Total length of cacum/cm	Proximal part			Middle part		Distal part	
		Length / cm	%	C.T L cm	Length / cm	%	Length / cm	%
Right caecum	13.15±0.21a	3.11±0.02a	23.65	0.61a	5.56±0.03a	42.28	4.48±0.01a	34.06
Left caecum	13.14±0.44a	3.10±0.01a	23.59	0.62a	5.56±0.007a	43.45	4.33±0.02a	32.95

Values are expressed as mean ± SD. n=10

Different vertical letters= significance differences ($P < 0.01$)

Table -2- Histometrical analysis of lymphatic nodules in caecum

	Lymphatic nodules wide / μ	Lymphatic nodules length/ μ	Lymphat nodules No. Mm^2
Proximal part	81.20±0.10a	54.63±0.23a	0.46±0.02a
Middle part	82.13±1.33a	56.41±0.11a	0.04±0.01b
Distal part	92.34±0.17b	61.22±0.53b	0.07±0.01c

Values are expressed as mean ± SD. n=10

Different vertical letters= significance differences ($P < 0.01$)

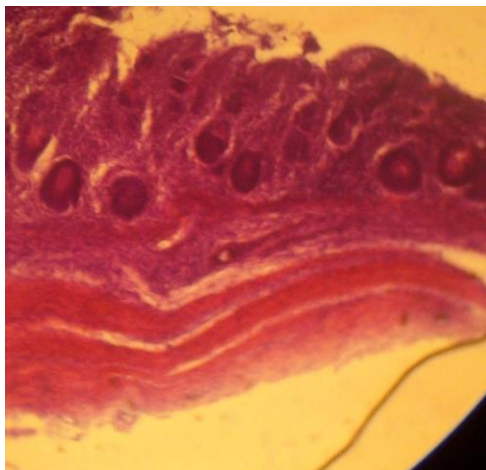


fig.1



fig.2

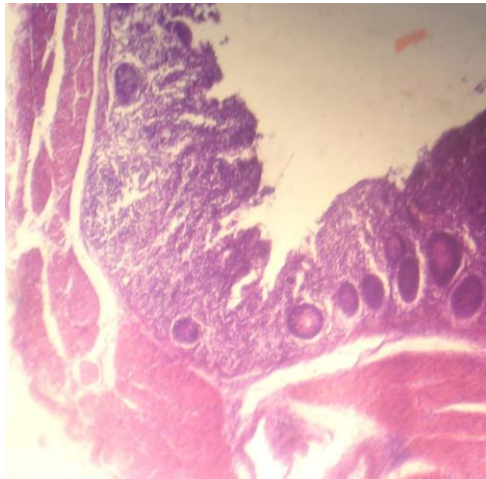


fig.3

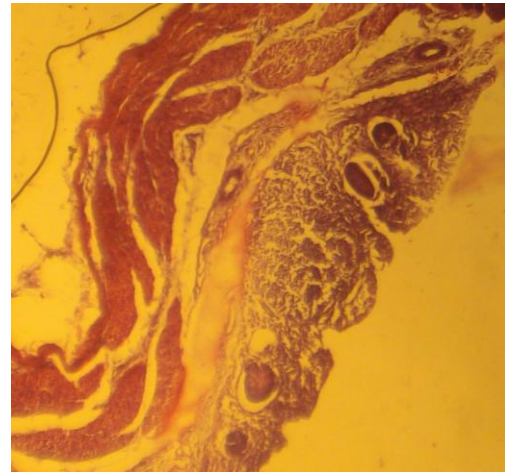


fig.4

fig.1: Cross section of proximal part of caecum show well developed villi and numerous folds (400X)

Fig.2: caecum of broiler chicken show Proximal part (p),Middle part (m), Apex (a) ,caecal tonsil(ct)(400X)

Fig.3: Cross section of middle part of caecum show small developed villi and numerous folds (400X)

Fig.4: Cross section of apical part of caecum show small developed villi an less folds. (250X)

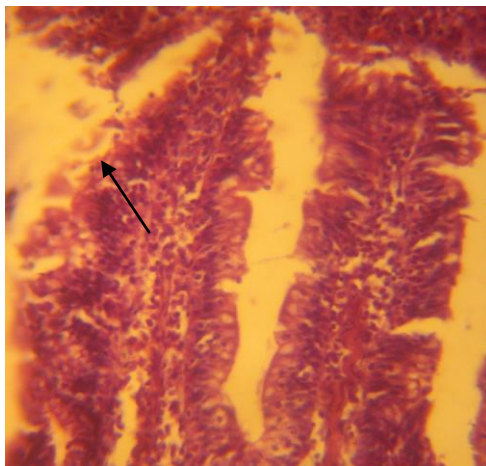


fig.6

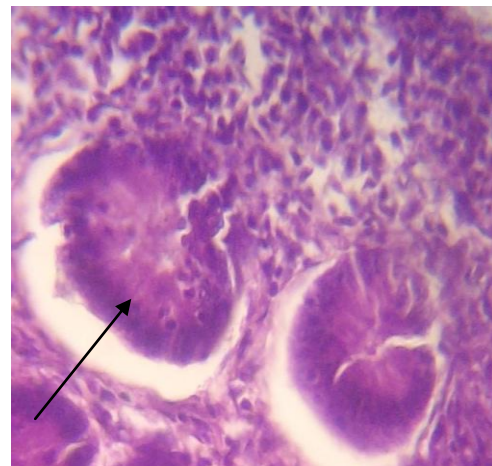


fig.5



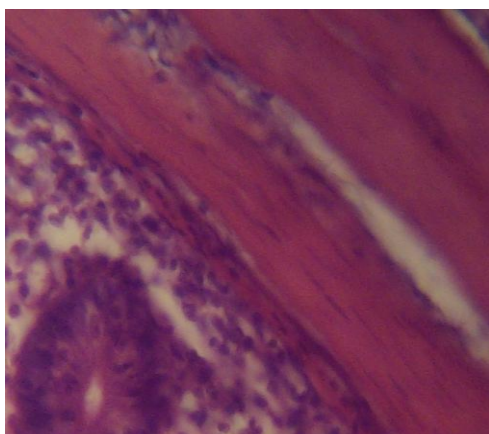


fig.7

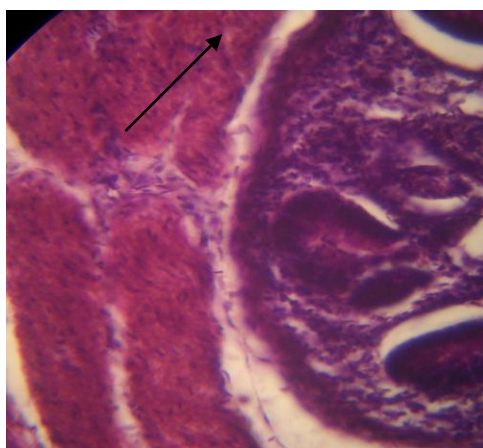


fig.8

fig.5:longitudinal section of villi in proximal part of caecum showed lymphatic nodules in core of villi (800X)

fig.6:longitudinal section of proximal part of caecum showed lymphatic nodules. (800X)

Fig.7:longitudinal section of proximal part of caecum showed fiber of : muscularis one direction(arrow) (800X)

Fig.8: longitudinal section of proximal part of caecum showed fiber of muscularis in different direction(arrow) (800X)

DISCUSSION

The present study showed anatomical and histological differences between three regions of chickens caeca. the finding of non significant differences in the length of right and left caeca and their regions are in agreement with the result made by(1).the higher development of proximal caecal apical support the view that this region is better adapted for absorption of nutrient than the other caecal region(7) .our results are in agreement with the report of(8) who reported that there were variances in the mucosal surface in the three parts of caecum of white Plymouth rock hens, giving morphological evidence for different function between the three compartments. the mucosa of surface of quail caecum showed much highly developed pattern of villi in order to a greater potential capacity for absorption(9).The shape of the caecal tonsil in this study was similar to the report of(10) in the hybrid chicken .The caecum of the ostrich was observed to contain folds that gradually decrease and disappear 14 cm from the apex ,it suggested that the fold play an important role in the absorption of volatile fatty acids and other metabolites produced by microbial fermentation of cell cellulose and hemicellulose(11).The folds were changed in relation to the content of lumen(1).our results were in agreement with study of(12) who reported that lymphatic nodules were most commonly distributed in the epithelium, lamina propria and sub mucosa .caeca of chicken of Bangladesh , these development of population of lymphocyte were vary with aging. Lymphatic nodules consistently

found in the proximal region of each chicken caecum at approximately (3cm) from iliocecal junction, they were observed with naked eye in infected bird with *Eimira tunella* but not in normal chicken (13). In duck ceca, lymphatic nodules are also distributed densely in the proximal (14). The present finding of highly developed lymphatic nodules in the apex confirm the suggestion that the apex is an important site for immunological surveillance in comparison with the caecal tonsil (15). Proximal part is the major lymphatic tissue in the ceca (14), in his study, (45%) of caecal lymphatic nodules were found in proximal part, because the chicken caecum takes in the black flowing urine through the rectum from the uroderm of coaca (16). It is evident that proximal portion of caecum is confronted with continued invasion of bacterial or non bacterial antigen of extra caecal origin, therefore, these lymphatic nodules could play a highly important role in immunological surveillance against foreign microorganism.

دراسة تشريحية ونسجية للأعور في الدجاج البياض

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الخلاصة

أجريت الدراسة التشريحية والنسجية في الأعور لعشرة من الدجاج البياض بعمر ستة أشهر شكليا تبين في هذه الدراسة أن الدراسة التشريحية ميزت ثلاثة مناطق في الأعور: الجزء الداني، الأوسط، القاصي، اللذين يمثلون (34.06%)، (42.28%)، (23.65%) على التوالي من الطول الكلي من الأعور الأيمن وكذلك (23.95%)، (43.45%)، (23.59%) من الطول الكلي من الأعور الأيسر، كان الطول الكلي للأعور الأيمن (13.15±0.21) بينما كان الطول الكلي للأعور الأيسر (13.14±0.44)، كذلك لوحظ إن جدار الأعور يتكون من أربع طبقات هي الطلانية، تحت الطلانية، العضلية والمصلية. إن مناطق الأعور هي الجزء الداني ذو الزغابات المتطورة جيدا والطيات المتعددة، الجزء الأوسط ذو الزغابات الصغيرة والطيات المتعددة، والجزء القاصي ذو الزغابات الصغيرة والخالي من الطيات. لوحظ في هذه الدراسة إن العقيدات اللمفاوية منتشرة بصورة أكثر في الجزء الداني ولكنها أقل انتشارا في الجزء القاصي وأقل في الجزء الأوسط. إن عرض وطول العقيدات اللمفاوية كانت أكبر في الجزء الداني مقارنة مع الجزء الأوسط والداني.

REFERENCES

- 1.Hirosh,K;Tomohiro,M.and Masato ,C(1998) The apical caecal diverticulum of the chicken identified as a lymphoid organ .
- 2.Kajiwara,E.A;Shigeta,H.;Horiuchi,H.;andFurusawa ,S.C(2003).Development of payers patch and caecal tonsil in gut- associated lymphoid tissue in the chicken embryo.Soc. Vet.Sci,65:607-614 .
- 3.Mead,G.C.(1989).Microbes of the avian cecum: type present and substrates utilized .J.Exp .Zoology.supp 3,48-54 .
- 4.Koto,A.;Hashimoto;Kon.Y.;Sugimura,M.(1992).Are there M.cell in the cecal tonsil of chicken .J.Vet.Sci.54,999-1006
- 5.Mary,H.C.(2006).The avian cecum.J.Exp. zoology, vol 283,issue 4-5,pp 441-447.

6.Luna,L.G.(1968).Manul of histologic staining methods of armed forces institute of pathology.3rd edition .McGraw-Hill bookcompany

7.Ferrer,R.;Jana,M.P.andDurfort, M.M.(2008). . Morphological study of the cecal epithelium of chicken.British poultry science,vol 32,issue 4 pp679-691.

8.Vibek,D.(2005).Ultra structure difference between the two major component of chicken ceca .j.Exp.zoology.Vol.252 issue 53,pp21-31.

9.Thomas,R.;Strong;Paulette,R.Randldan,j.B.(1989).Morphometry of galliform ceca comparative Gumbels quail and domestic fowl. J. cell ,Tissue Research vol 259 pp 511-518.

10.Hodger,R.D.(1974).The histology of the fowl,pp.64-88.London:academic (press).

11.Bezuidenhout,A.J.(1993).The spiral folds of the caecum in the ostrich.J.Anat.183,pp.567-592.

12.Ruhma,M.L;Islam,M.R.Asaduzzaman , M . and Khan, M.Z. (2003) .Lymphoid tissue in the digestive tract of Deshi chicken in Bangladesh.Pakistan .J.Biol.Scie 6;1145-1150.

13.Imilio,D.C;Margarita,G.;Albina,S;Agustin,Z.(2004). Characterization of distal lymphoid nodules in the chicken caecum. Anat. Rec.vol 237 issue 4,pp512-517.

14.Kitamura,H.;Sugimura, m ; Hashmoto ,Y.; Yamano ,S.N .(1976). Distribution of lymphatic tissue in duck ceca .Jap.J.V et,Research,24,37-42.

15.Kitagawa,H.Y.;Hiratsuka,T.andUehar,M.(1998). Distribution of lymphoid tissue in the caecal mucosa of chickens J.Anat,192,293-298.

16.Brun ,E.J.;Campbell,C.E.(1989).Uric acid decomposition in the lower gastro intestinal tract.J.Exp.zoology.(suppl.3),70-74.