

How to Cite:

Aljanabi, A. M., & Zabiba, I. M. J. (2022). Embryological study for jejunum development in

broiler chicks. *International Journal of Health Sciences*, 6(S6), 2925–2931.

<https://doi.org/10.53730/ijhs.v6nS6.10519>

Embryological study for jejunum development in broiler chicks

Ali M. Aljanabi

Department of Anatomy and Histology, College of Veterinary Medicine, Al-Qasim Green University, Babylon, Iraq

*Corresponding author email: ali.muslih@vet.uoqasim.edu.iq

Isam M. J. Zabiba

Department of Anatomy and Histology, College of Veterinary Medicine, Al-Qasim Green University, Babylon, Iraq

Abstract--The purpose of this research to study histological and histochemical characteristics of the jejunum in broiler Ross – 308 chicks. A total of 120 commercial broiler eggs (Ross-308) were used to conduct this research, with embryos and chicks ranging in age from (11,15,21) pre hatch to (7,14,21) post hatch ,The samples were stained using Hematoxylin-Eosin, Periodic Acids Schiff (PAS), Alcian Blue (AB pH-2.5), and Masson's Trichrom , measure the length and width of the villi, height epithelium, depth crypt, thickness mucosa ,sub mucosa ,muscularis, serosa, and number of goblet cell per 100 simple columnar epithelium , the villi height increase with age significantly ($p \leq 0.05$). the highest value of villi height $1054.46 \pm 5.422 \mu\text{m}$, width of villi $137.78 \pm 12.531 \mu\text{m}$,height epithelium $73.5 \pm 3.316 \mu\text{m}$, depth crypt $189.74 \pm 3.087 \mu\text{m}$, number goblet cell $70\% \pm 4$ per 100 simple columnar epithelium ,and thickness tunica mucosa $1293.44 \pm 4.495 \mu\text{m}$, tunica sub mucosa $12.66 \pm 1.711 \mu\text{m}$, tunica sub muscularis $230.86 \pm 4.283 \mu\text{m}$, tunica serosa $34.26 \pm 2.843 \mu\text{m}$, respectively were found in jejunum at age 21 post hatching This revealed that broiler chicken had a high rate of digestion and absorption (Ross -308) occur at 21 days, followed by excess of height , width of villi, as well as number goblet cells, resulting in an increase in broiler chicken absorption and digestion (Ross- 308). The present histological findings revealed that the jejunum wall was histologically divided into four layer : tunica mucosa, submucosa, muscularis, and serosa . Lieberkühn crypts appeared as simple glands covered via simple columnar epithelium . The submucosa was thin, Its development increases with age and identify tunica muscularis except blood arteries, Tunica muscularis showed itself as an inner circular layer and longitudinal smooth muscle bundle external. Tunica serosa was the most outer layer, made mostly of collagen fibers. Also

histochemical results revealed that the goblet cells found of villi and tubular gland reacted positively for PAS and AB, whereas the columnar cells reacted negatively to the same stains. Masson's Trichrom indicated the presence of collagen fiber in the connective tissue.

Keywords--broiler chickens, embryological study, jejunum.

Introduction

The broiler chicken's small intestine (Ross-308) The jejunum and ileum have no distinct boundary, but Meckel's diverticulum appears as a tiny structure projecting (bulge) in the small intestine's middle (Nasrin *et al.*, 2012). During development, small intestine actions increase , with rapid changes in the villus expansion of the duodenum, jejunum, and ileum (Al-khakani., *et al* 2020). In herbivores and omnivores, the small intestine is longer and more convoluted, whereas in meat-eating birds, it is simple, short, highly efficient, and slightly twisting (Adel, K. and Zabiba, I. M. J. 2021), The small intestine of frugivores and granivorous avian species is longer. The small intestine of graminivorous animals such as ducks and geese is comparatively long, but fruit eaters and foliose have a shorter small intestine but a larger diameter (Lopez-calleja and Bozinovic, 2000 ; Jacop *et al.*, 2011). The jejunum histology of avian jejunum wall has four tubular organs (parts): mucosa, submucosa, muscularis, and serosa (Caceci, 2003 and Samuelson., 2007). histochemistry jejunum's mucosa, show a strong magenta color for PAS stain, whereas the ground cytoplasm of these columnar cells shows a mild PAS reaction (Hamid *et al.*, 2013).

Material and Methods

We placed the chicks on a dissection board to examine their anatomy, and then performed a mid-line incision in the abdomen of the chicks, removing the jejunum for morphological and histological preparation. For the fixative, the samples were stored in 10% natural formalin. Then study histology preparation techniques.(Luna *et al.*, 1972). The histomorphometric measurements were done and subsequent by statistically analyzed using SPSS version 16. The values were expressed as Mean \pm SE and all the numerical findings were analyzed with one a nova test.

Result and Discussion

Present Histology study of The tunica mucosa, tunica submucosa, tunica submusclaris, and tunica serosa are four layers the jejunum. present study were consistent with previous research by (Albideri and Jawada.,2015) in adult rock dove. The villi of varying sizes are surrounded by simple columnar epithelium in the jejunum tunica mucosa (fig.1,6). The villi's centers are made up of loose connective tissue. Tubular glands (crypt Lieberkuhn) were found near base the villi, localize he majority of the lamina propria, Inner and outer longitudinal smooth muscle layers made up the muscular layer A loose connective tissue tunica serosa (Fig.3,4). goblet cells of jejunum react positively to AB and PAS

staining (Fig.1,5,2) respectively. The villi increase the amount of surface region in adhere with the digestible feed, which improves the efficiency of nutrient breakdown and assimilation, (Godwin *et al.*, 2016).

crypt Lieberkuhn glands were found at the bases of villi, and they like found in other avian species (Nasrin, 2012 & Hamdi *et al.*, 2013). the upper region of goblet cell enlarged, while the below part strict , as reported in a prior study (Khaleel & Atiea, *et al.*, 2017). Tunica submucosal layer was lost Bruner's glands, as previous study of avian species (Aitken, 1958; Al-Taee *et al.*, 2017). present histochemicaly study showing that PAS and AB stains respond positively with goblet cells. This conclusion was similar to the findings of other investigations (Al-Taee, 2017; Godwin *et al.*, 2016; Hamdi *et al.*, 2013).

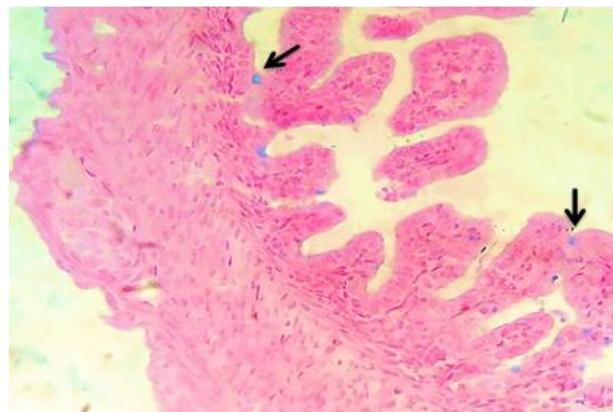


Fig. 1. Photomicrograph Jejunum in 11 day pre hatch of broiler Ross – 308 shows positive reaction for Alcian blue stain, goblet cells (black arrows) , (AB stain) .20X

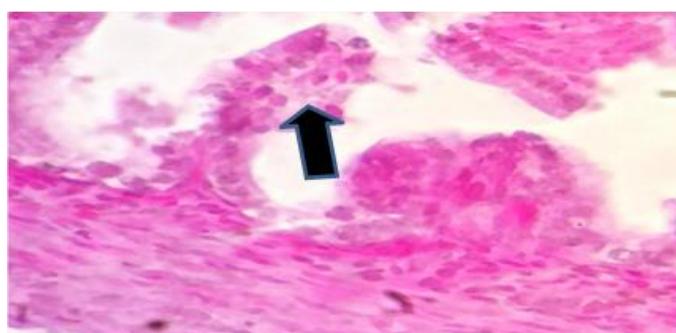


Fig. 2. Photomicrograph Jejunum in 11 day pre hatch of broiler Ross - 308 shows : have positive reaction for PAS stain goblet cells (black arrows) and connective tissue with smooth muscle fiber .(PAS stain). 20X

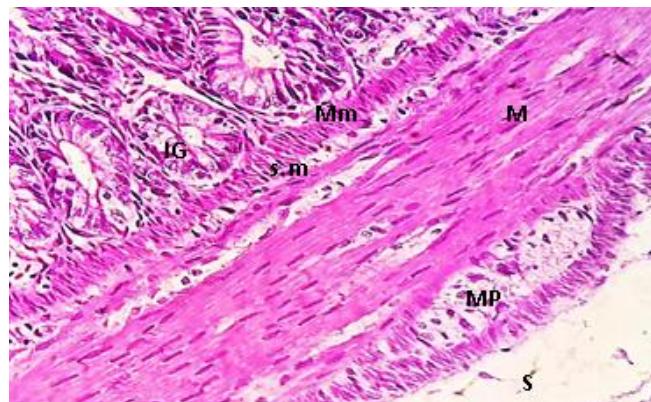


Fig. 3. Photomicrograph Jejunum in 11 day pre hatch in broiler Ross -308 showing intestinal glands (IG), muscularis mucosa(Mm), sub mucosa(S.M), muscularis (M),,myentric plexus (MP)and serosa(S).(H&E stain). 20X

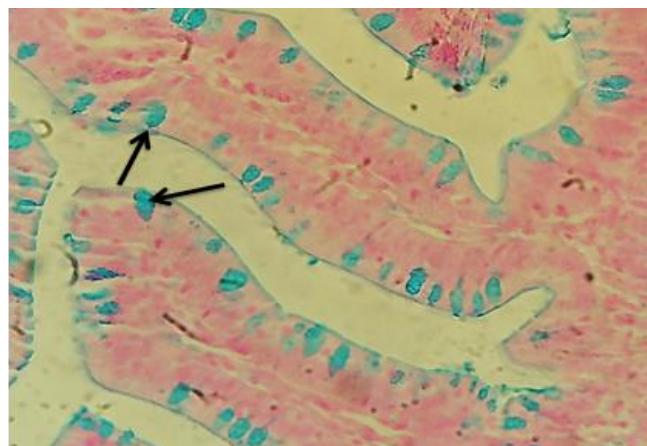


Fig. 4. Photomicrograph Jejunum in 11 day pre hatch broiler Ross – 308 shows: mild present of collage fiber (black arrow), (Masson trichrom stain). 20X

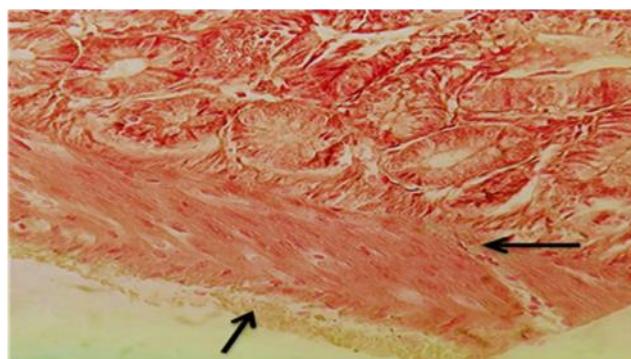


Fig. 5. Photomicrograph Longitudinal section of the jejunum in 14 day post hatch in broiler Ross -308 shows : positive reaction for Alcian blue stain goblet cells (black arrows), (AB stain) . 40X

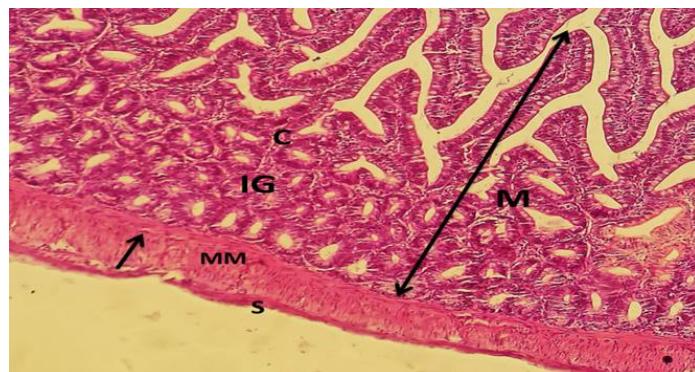


Fig. 6. Photomicrograph Longitudinal section of the jejunum in 14 day post hatch in broiler Ross-308 showing : tunica mucosa(M), tunica sub mucosa(black arrow), tunica muscularis (MM), tunica serosa(S), intestinal gland(IG), crypt(C) .(H&E stain) .40X

Table 1, showing the development height villi, depth of crypts, height epithelium, width villi of the jejunum in pre and post hatching of broiler (Ross- 308).

Table 1
Height villi, depth of crypts, height epithelium, width villi of the jejunum in pre and post hatching of broiler

Measurement (μ m)	Jejunum Mean \pm SE					
Age	11	15	21	7	14	21
Height of villi	345.16 \pm 4.861	452.66 \pm 4.434	514.16 \pm 1.517	652.46 \pm 4.439	962.5 \pm 14.866*	1054.46 \pm 5.422
Depth of Crypt	85.16 \pm 2.719	88.54 \pm 2.0156	90.16 \pm 1.722	135.72 \pm 3.693	179.5 \pm 4.527*	189.74 \pm 3.087
Height epithelium	40.96 \pm 2.846	57.22 \pm 1.907	69.72 \pm 1.025	70.7 \pm 2.588	72.14 \pm 1.627	73.5 \pm 3.316
Width of villi	126.38 \pm 4.103	126.2 \pm 1.780	127.94 \pm 5.439	134.3 \pm 2.820	135.86 \pm 0.918	137.78 \pm 12.531

The numbers represent mean \pm standard error.

* statistically significant difference (P = <0.05)

The histological study showing height villus increased with age (11,15,21) pre hatch and (7,14,21) post hatch respectively , as well as there was high significant deference at age (7-14) post hatch , this research agreement with (Brudnicki, *et al.*,2017) , as well as for the depth of the crypt in this table data indicated high significant deference at age (7-14) post hatch.

Table 2, showing the development tunica mucosa, submucosa , muscularis and serosa, number goblet cell of the jejunum pre and post hatching of broiler (Ross- 308).

Table 2
Tunica mucosa, submucosa, muscularis and serosa, number goblet cell of the jejunum pre and post hatching of broiler

Measurement (μm)		Jejunum Mean \pm SE					
Age		11	15	21	7	14	21
Thickness	Tunica mucosa	5	480.9 \pm 4.78	594.02 \pm 4.108	654.78 \pm 2.176	837.86 \pm 3.098	1191.32 \pm 4.01
Thickness	Tunica submucosa	3	10.14 \pm 1.80	10.54 \pm 1.176	11.32 \pm 1.091	11.5 \pm 1.095	11.96 \pm 1.3776
Thickness	Tunica Muscularis	24	119.82 \pm 4.3	138.6 \pm 2.066*	200.26 \pm 1.786	225.88 \pm 2.306	224.92 \pm 4.886
Thickness	Tunica serosa	1	16.52 \pm 2.07	17.8 \pm 0.953	19.18 \pm 1.942	20.28 \pm 2.142	25.88 \pm 1.171
No of Goblet cell per 100 epithelium	lining		15 \pm 0.836	20 \pm 1.224	34 \pm 0.547	63 \pm 4.438*	67 \pm 4.969
							70 \pm 4

The numbers represent the mean \pm standard error.

* = There is a statistically significant difference ($P = <0.05$)

The result showed in the table (2) thickening of the mucous layer, data indicated that there is a significant difference in the age of 7 after hatching over the age of 21 at hatching. As well as thickness tunica muscularis increase in 15 days pre hatch and 7 days post hatch, finally increase number goblet cell per 100 villi significant height at hatch and (7) days post hatch.

References

Al-Bideri, A.W. and A.N. Jawad (2015). Comparative Anatomical and Histological study of the Duodenum between Laughing Dove *Streptopelia senegalensis* and white breasted Kingfisher *Halcyon Smyrnensis*. Zoology Classification QL 801-950.

Al-khakani,S.S.A.,Zabiba ,I,M,J(2020) Some histological study of the testes in male white-eared bulbul(*Pycnonotus leucotis*) during reproductive season 20,pp.3613-3617.

Al-taee, A. A. (2017). Macroscopic and Microscopic Study of Digestive Tract of Brown Falcon *Falco berigora* in Iraq. Journal of Babylon University/Pure and Applied Sciences/ No.(3)/ Vol.(25).

Adel, K , Zabiba, I. M. J.(2021) Histomorphological study of the role selenium nano particle on chicken embryo development and metabolic rate 21(1),pp.299-304.

Aitken, R. (1958) . A histochemical study of the stomach and intestine of the chicken. Journal of Anatomy, 92(Pt 3), 453.

Brudnicki et .al (2017). Histo-morphometric adaption in the small intestine in broiler chicken after embryonic exposure to a- calactosides. The Journal of Animal & Plant Sciences, 27(4): 2017, Page: 1075-1082.

Caceci, T. (2003). Avian Digestive System. Academic Press, itheca, New York. Pp.: 94.

Godwin, O. C., Clifford, A. N., Agatha, A. (2016). Evaluation of the morphological adaptations of the small intestine of the African pied crow (*Corvus albus*). *J. O. B. A. Z.*, 75, 54-60.

Hamdi, H., El-Ghareeb, A., Zaher, M. and AbuAmod., F. (2013). Anatomical, Histological and Histochemical Adaptations of the Avian Alimentary Canal to Their Food Habits: II- *Elanus caeruleus*. *Internat. J. Sci. and Engineering Research*, Volume 4, Issue 10.1355-1364.

Jacob, J., Pescatore, T. and Cantor, A. (2011). Avian digestive system. University of Kentucky, College of Agriculture.

Khaleel, I. M. and Atiea, G. D. (2017). Morphological and His tochemical Study of Small Intestine In Indigenous Ducks (*Anas platyrhynchos*). *IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)* ,p-ISSN: 2319-2372. Volume 10, Issue 7 , www.iosrjournals.org.

Kalita, P.C., Singh, G.K. and Kalita, A. (2012). Gross morphological and morphometrical studies of small intestine in post hatched kadaknath fowl. *Indian Journal of Veterinary Anatomy*. 24(2): 74-75.

Luna, L.G. (1972). Manual of Histological staining Methods of the Armed Forces Institute of Pathology. The Blakiston Division, McGraw Hill Book Co. N.Y. pp. 162-163 and 164.

Lopez-Calleja, M. V. and Bozinovic, F. F. (2000). Energetic and nutritional ecology of small herbivorous birds. *Rev. chil. hist. nat.* Vol. 73 n. 3.

Nasrin, M., Siddiqi, M. N. H., Masum, M. A., and Wares, M. A. (2012). Gross and histological studies of digestive tract of broilers during postnatal growth and development . *J. Bangladesh Agril. Univ.* 10(1): 69-77, ISSN 1810-3030.

Samuelson, D. A. (2007). Textbook of Veterinary Histology. Saunders Elsevier, China. Pp.: 348- 352.

Wang, J., & Peng, K. (2008). Developmental morphology of the small intestine of African ostrich chicks. *Poultry Science*, 87(12), 2629-2635.

Gede Budasi, I. & Wayan Suryasa, I. (2021). The cultural view of North Bali community towards Ngidih marriage reflected from its lexicons. *Journal of Language and Linguistic Studies*, 17(3), 1484-1497

Kustina, K.T., Dewi, G.A.A.O., Prena, G.D., Suryasa, W. (2019). Branchless banking, third-party funds, and profitability evidence reference to banking sector in indonesia. *Journal of Advanced Research in Dynamical and Control Systems*, 11(2), 290-299.

Sarada, V., & Mallikarjuna, T. (2018). Socio-economic and psychological problems of third gender people living with HIV/AIDS: A study in A.P. International Journal of Health & Medical Sciences, 1(1), 10-17. <https://doi.org/10.31295/ijhms.v1n1.34>