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## Embryological study for jejunum development in broiler chicks

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**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 Bozinoveic, 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-Tae *et al.*, 2017). present histochemically study showing that PAS and AB stains respond positively with goblet cells. This conclusion was similar to the findings of other investigations (Al-Tae, 2017; Godwin *et al.*, 2016; Hamdi *et al.*, 2013).

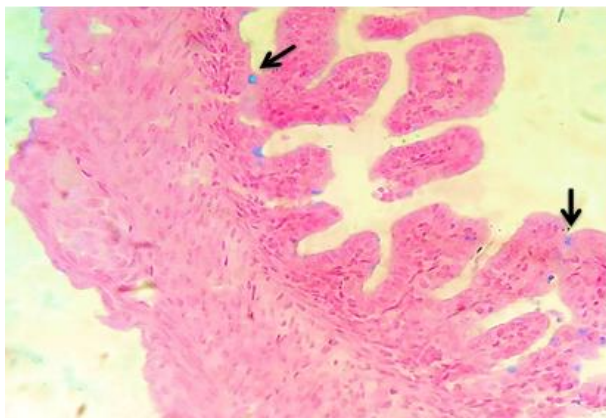


Fig. 1. Photomicrograph Jejunum in 11 day pre hatch of broiler Ross – 308 shows positive reaction for Alcian blue stain, goblet cells (black arrows) , (AB stain) .20X

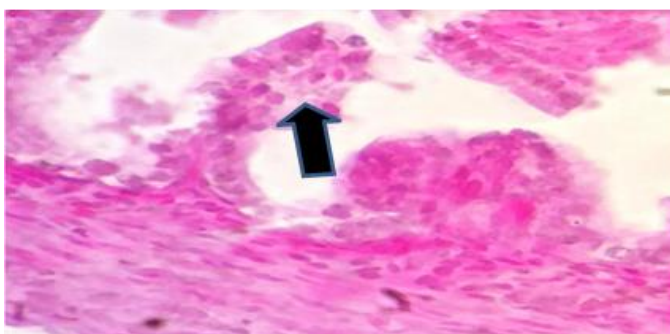


Fig. 2. Photomicrograph Jejunum in 11 day pre hatch of broiler Ross - 308 shows : have positive reaction for PAS stain goblet cells (black arrows) and connective tissue with smooth muscle fiber .(PAS stain ). 20X

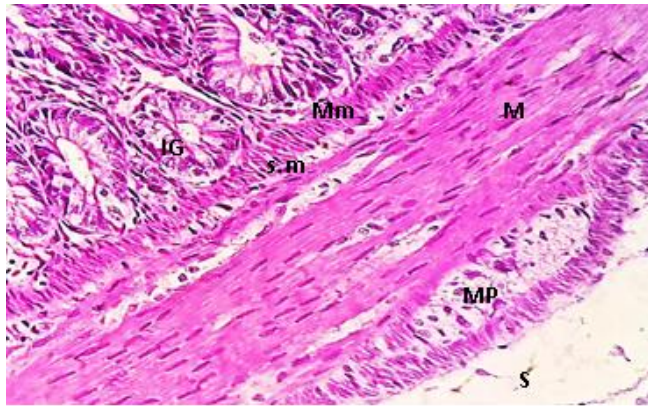


Fig. 3. Photomicrograph Jejunum in 11 day pre hatch in broiler Ross -308 showing intestinal glands (IG), muscularis mucosa(Mm), sub mucosa(S.M), muscularis (M), myenteric plexus (MP) and serosa(S). (H&E stain). 20X

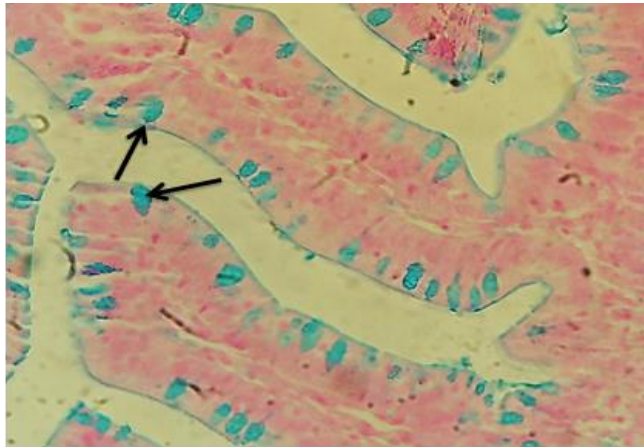


Fig. 4. Photomicrograph Jejunum in 11 day pre hatch broiler Ross - 308 shows: mild present of collagen fiber (black arrow), (Masson trichrom stain). 20X

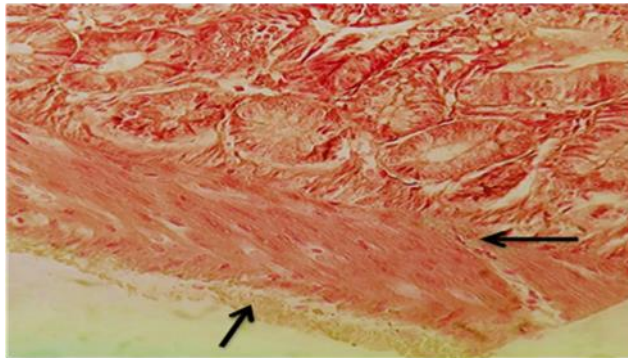


Fig. 5. Photomicrograph Longitudinal section of the jejunum in 14 day post hatch in broiler Ross -308 shows : positive reaction for Alcian blue stain goblet cells (black arrows), (AB stain) . 40X



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

The numbers represent mean ± 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 difference 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 difference 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 ( $\mu\text{m}$ )		Jejunum Mean $\pm$ SE					
Age		11	15	21	7	14	21
Thickness	Tunica mucosa	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	1293.44 $\pm$ 4.495
		5			*	4	
Thickness	Tunica submucosa	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	12.66 $\pm$ 1.711
		3					
Thickness	Tunica Muscularis	119.82 $\pm$ 4.3					
		24	138.6 $\pm$ 2.066*	200.26 $\pm$ 1.786	225.88 $\pm$ 2.306	224.92 $\pm$ 4.886	230.86 $\pm$ 4.283
Thickness	Tunica serosa	16.52 $\pm$ 2.07					
		1	17.8 $\pm$ 0.953	19.18 $\pm$ 1.942	20.28 $\pm$ 2.142	25.88 $\pm$ 1.171	34.26 $\pm$ 2.843
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.

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