A COMPARATIVE STUDY ON THE HISTOMORPHOLOGY OF ILEUM AND COLO-RECTUM IN PEAFOWL (*Pavo cristatus*)

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ABSTRACT

The ileum extended from the Meckel's diverticulum of jejunum to the ileo-ceco-colic junction. It was straight and had a long ascending part and a short descending part. The colo-rectum was short and straight and opened into the cloaca caudally. The mucosa of ileum and colorectum showed villi which were longer in the latter. The surface of villi and crypts of the two segments of small and large intestine were lined with simple columnar epithelium comprising chief cells and goblet cells. The goblet cells were more in the colorectum. The epithelial cells of the crypts of Lieberkuhn were smaller than those of the villi. The crypts were considerably reduced in depth and smaller in the colorectum as compared to that of ileum. Lamina propria was formed of loose connective tissue with numerous blood vessels and nerve fibers in addition to the tubular glands. Central lacteals were absent in the villi. The muscularis mucosa consisted of a layer of longitudinal smooth muscle fibres and extended into the corium of the villus in the colorectum. The submucosa was poorly developed so as to be almost non-existent in most part of the ileum and colo-rectum. The tunica muscularis consisted of smooth muscle fibers arranged in well developed inner circular and a thin outer longitudinal layer. The inner circular layer was thinner in the colo-rectum when comparedto that of the ileum. Externally a serosa was present.

Key words : *Histomorphology, ileum, colo-rectum, pea-fowl*

INTRODUCTION

The digestive system in the domestic fowl is very simple but efficient with many unique anatomical characteristics. The ileum and colo-rectum form the terminal parts of the small and large intestine respectively. While ileum functions both as an enzymatic digestion and absorption site as well as microbial-based digestion region for enzyme-resistant feeds, the relatively short colo-rectum retrieve nutrients remaining in the digesta from the ileum, prior to eventual expulsion from the digestive tract (Adeola, 2006). Hence to elucidate the basic structure of the terminal segments of the small and large intestines and paucity of coherent literature on histomorphology of these segments in peafowl lead to pursue the present study.

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MATERIALS AND METHODS

Samples were collected from ileum and colo-rectum of an eight month old female peafowl brought to the Veterinary College for post-mortem examination. After recording the topography and gross observations, tissue pieces were fixed using 10 per cent neutral buffered formalin and processed conventionally to obtain paraffin-sections. The sections were stained using Haematoxylin and Eosin (H & E) and micrometry was done with the help of calibrated ocular micrometer.

RESULTS AND DISCUSSION

The ileum was pale red and extended from the Meckel's diverticulum of jejunum to the ileo-ceco-colic junction. It was almost straight and began at the midline ventral to the colo-rectum and cloaca and ran in the cranial direction as the long ascending part of ileum. At the level of ovary it bent dorsally and to the left and terminated in the colo-rectum

forming the short descending part. The ileum was flanked on both sides by the caeca, to which it was joined by the ileo-caecal ligament. The muscular stomach was seen on the left, jejunum on the right while spleen and ascending duodenum were located ventral to the ileum. The colo-rectum was short and light grey in colour which ran in nearly a straight line below the vertebrae and opened into the ileum cranially and cloaca caudally. The left caecum was seen ventrally on its left and right caecum was on its right side. These findings were in accordance with the reports of Bradley and Grahame (1960) in domestic fowl. The length and diameter of ileum and colo-rectum were recorded as 11 cm and 0.5 cm and 6 cm and 0.7 cm respectively. Gupta *et al.* (2008) reported that in adult White Leghorn fowl, the ileum measured 10.74 cm with a diameter of 0.54 cm while the length and diameter of colorectum was 6.04 cm and 0.82 cm.

Histologically the wall of the ileum consisted of only three coats within outwards viz. tunica mucosa, tunica muscularis and tunica serosa. The mucosa consisted of surface epithelium, lamina propria and lamina muscularis. The villi seen in the mucosa were club shaped with a thin base and a distal triangular part with a pointed apex (Fig. 1). These findings are in line with the report of Lim and Low (1977) in domestic fowl. The average length of the villi was 2.25 mm. Crypts of Lieberkuhn occupied most of the lamina propria between the bases of the villi and the muscularis mucosa (Fig. 1.). These observations colloborated the findings of Kalita and Singh (2010) in fowl.

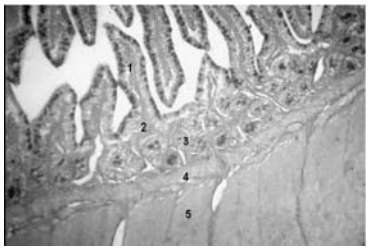

Fig.1. Section of ileum of peafowl. H&E. x 100
1. Villi lined with simple columnar epithelium
2. Lamina propria 3. Crypts of Lieberkuhn
4. Lamina muscularis 5. Tunica muscularis (inner layer)

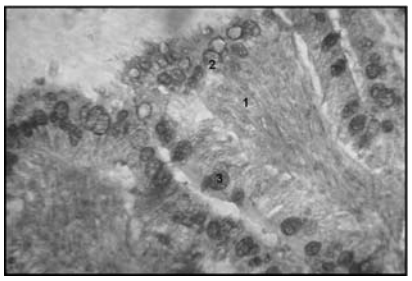

Fig. 2. Section of ileum of peafowl showing the villi. H&E. x 400
1. Lamina propria inside the villi
2. Goblet cells 3. Chief cells

The villi and glands were lined by a simple columnar epithelium. The epithelium comprised the chief or main cells and the goblet cells (Fig. 2). The apical border of chief cells were striated. An oval nucleus was situated in the basal half of the cell, but was usually closer to the middle of the cell than to basal pole. The chief cells of the glands of Lieberkuhn differed from those of the villi. The crypts were simple tubular type with slightly globular bulged base. The nucleus was large and was situated close to the basal membrane. A striated border was absent and the cytoplasm had a stronger affinity for the dyes such as haematoxylin than that of the cells of the villi. Hodges (1974) noted that the chief cells appeared tall, narrow and columnar in shape in the villi and glands of duodenum. The chief cells measured 20 μm in height and 4 μm in width where as in fowl it measured up to 50 μm in height by 8-10 ìm in maximum width (Hodges, 1974). The goblet cells in the ileal villi of peafowl did not have a clearly defined striated border as stated by Kalita and Singh (2010) in Kadaknath fowl.

In the lamina propria loose connective tissue with numerous blood vessels and nerves were observed in addition to glandular tissue. Diffuse lymphatic tissue could be seen in the core of the villi. Contrarily, Marshall (1960) identified solitary lymphatic nodules throughout the length of the small intestine. There was absence of central lacteals in the villi, each villus core being occupied by a capillary bed. Similar reports were made by Bell and Freeman (1971) in domestic fowl. This can be correlated with the poorly developed

lymphatic system of the fowl and with the biochemical evidence for lipid absorbtion into the portal blood.

The muscularis mucosa was 240 μm thick and consisted of a layer of longitudinal smooth muscle fibres. Farner *et al*. (1972) opined that the muscularis mucosa could be a compact functionally effective layer in birds. The submucosa was poorly developed and almost non-existent in some places. It consisted of very thin layer of connective tissue separating the tunica muscularis from the muscularis mucosa. Hodges (1974) reported identical observations in fowl.

The tunica muscularis consisted of smooth muscle fibers arranged in two layers viz., a well developed inner circular and a weakly developed outer longitudinal muscle layers. Thickness of the inner layer was about 2.24 mm while that of the outer layer was 0.65 mm. Contrarily Kachave *et al.* (2009) stated that in small intestine of chicken lamina muscularis mucosae was absent and the tunica muscularis consisted of smooth muscle fibers arranged in three layers viz., inner longitudinal, middle circular and outer longitudinal. This might be due to the very thin nature of the submucosa and the consequent difficulty in separating the muscularis mucosae from the tunica muscularis. The tunica serosa consisted of loose connective tissue, blood vessels and nerves and was lined externally by mesothelial cells.

In the colo-rectum the villi were longer and measured about 3.20 mm. The mucosa was folded extensively to increase the absorptive area (Fig. 3). Hodges (1974) reported that the condition of mucosa depended upon the degree of distension of the intestine. When the intestine was contracted, the villi appeared as numerous long flat leaf shaped structures which filled a large proportion of the lumen. The crypts of Lieberkuhn were considerably reduced in depth and opened not only around the villi, but also on the flat areas between them. The lamina propria was infiltrated with lymphoid cells but nodular arrangement could not be located contrary to the reports of Calhoun (1954) in adult fowl. The epithelium was similar to that seen in ileum but the chief cells were obscured by the relatively larger number of distended mucous cells (Fig. 4). The goblet cells were so numerous that they were even found to be among the

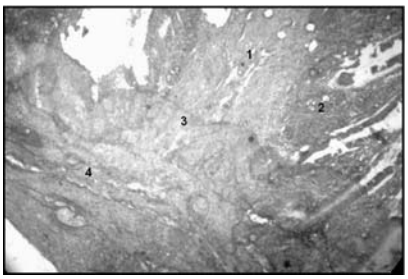

Fig.3. Section of the colo-rectum of peafowl. H&E. x 100
1. Folded mucosa 2. Villi
3. Lamina muscularis 4. Tunica muscularis

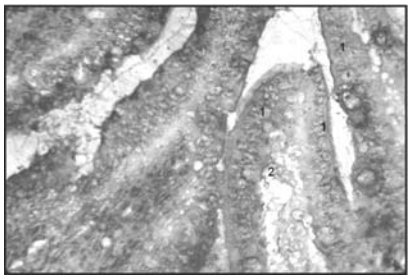

Fig.4. Section of colo-rectum of peafowl showing the villi filled with goblet cells. H&E. x 400
1. Goblet cells 2. Lamina propria inside the villi

glandular cells of the crypts of Lieberkuhn. These findings are in line with the reports of Hodges (1974) in fowl. The muscularis mucosa was 160 μm thick and extended into the corium of the villus. In the tunica muscularis, the inner circular layer was thinner (1.12 mm) than that seen in the ileum. The outer longitudinal layer measured 0.65 mm. Well developed tunica muscularis might facilitate the movement of the extensively folded mucosa.

The presence of more number of chief cells and well developed crypts of Lieberkuhn in the ileum as compared to the colo-rectum might help in completing much of the digestion of the food in the small intestine. The mucous cells were more in colo-rectum to facilitate the passage of the contents of large intestine. The efficiency of the absorption in the terminal part of the large intestine was increased by the well developed villi and folds in the mucosa which increased its surface area for absorbtion of all the nutrients prior to evacuation.

REFERENCES

Adeola, O. 2006. Review of Research in Duck Nutrient Utilization. *Int. J. Poult. Sci*. **5** (3): 201-218.

Bell, D. J. and Freeman, B. M. 1971. The structure of the alimentary tract. *Physiology and Biochemistry of the Domestic Fowl.* Vol.1. Academic Press, London, New Work.

Bradley, 0. C. and Grahame, T. 1960. *The Structure of the Fowl.* 4th Ed., Edinburg, Oliver and Boyd. 31-50.

Calhoun, M. L. 1954: *Microscopic Anatomy of the Digestive System of the Chicken.* Iowa State College Press, Ames, Iowa. 1-108.

Farner, D. S., King, J. R. and Parkes, K. C. 1972. Digestion and the digestive system. *Avian Biology.* Vol. II. Academic Press, New York, San Francisco, London. 343-405.

Gupta, S. K., Prakash, A. and Ram, R. 2008. Morphometric study of the intestine of adult White Leghorn fowl. *Indian J. Vet. Anat.* **20** (1):16-18.

Hodges, R.D. 1974. *The Histology of the Fowl.* Academic Press, London. 105-112.

Kachave, C. D., Bhosle, N. S., Mamde, C. S. and Lambate, S. B. 2009. Histological observations on small intestine in broiler and layer of poultry birds. *Royal Vet. J. India.* **5** (1): 5-9.

Kalita, P. C. and Singh, G. K. 2010. Histology and Histochemistry of the small intestine of the post-hatch Kadaknath fowl. *Indian J. Anim. Sci.* **80** (7): 656-660.

Lim, S. S. and Low, F. N. 1977. Scanning electron microscopy of the developing alimentary canal in chick. *American J. Anat.* **150**: 149-173.

Marshall, A. J. 1960. Digestion and the digestive system. *Biology and comparative physiology of Birds.* Vol. I. Academic Press, New York and London. 411-449

KVASU NEWS

INTERNATIONAL EDUCATION FAIR AND OVERSEAS EDUCATION SEMINAR HELD AT POOKODE.

Kerala Veterinary and Animal Sciences University celebrated the first Foundation day celebrations of the University on 14 June 2011. As part of the foundation day celebrations, in order to exploit the potentials of overseas education and to create awareness on study abroad programmes among the students, University organised an International Education fair and a one day workshop on overseas education at Pookode campus,Waynad from 14th to 15th June 2011. Experts from overseas education initiatives, which promote awareness programmes on overseas education in India like British Council, United States India Education Foundation, Canadian Education Center, Australian Education Center, Campus France, etc, participated in the Edufair and Workshop.

Hon. Minister for Agriculture and Animal Husbandry, Govt of Kerala, Sri. K.P.Mohanan inaugurated the foundation day celebrations and launched the new courses of the University on14th June2011. Wayanad District panchayat President Sri. K.L.Poulose inaugurated the One day workshop on overseas education and International Education Fair. Hon'ble MLA Sri. Sreyamskumar presided over the function. Kalpetta Block panchayat President Sri. Salim Memana released the overseas education directory and Milma Chairman Sri.P.T.Gopalakurup inaugurated the GIS application for locating Veterinary Services in the state. Elected representatives from District, Block and Grama Panchayat offered felicitations. Vice Chancellor, KVASU Dr.B.Ashok IAS welcomed the gathering and Registrar Dr.C.B.Manomohan expressed vote of thanks. Around 2000 students from different universities in the state visited the Edufair and 200 final year students participated in the one day workshop