GENERAL HISTOMORPHOLOGY AND DEVELOPMENTAL CHANGES IN THE OVIDUCT OF KUTTANAD DUCKS (*Anas platyrhynchos domesticus*)

H. S. Patki[1], K. M. Lucy[2], K. R. Harshan[3] and J. J. Chungath[4]
Department of Veterinary Anatomy and Histology
College of Veterinary and Animal Sciences
Mannuthy-680 651,Thrissur, Kerala

Abstract

Postnatal developmental pattern of the oviduct in Kuttanad ducks was investigated using 78 ducklings from day-old to 24 weeks of age. The material was collected at fortnightly intervals from six birds in each group. Throughout the postnatal period, the structural blue print of the oviduct was seven layered and was devoid of any muscularis mucosa. The mucosal folds were seen more or less continuous throughout the oviduct, although their height and thickness varied from region to region. Vagina had the thickest tunica muscularis while the infundibulum had the thinnest. The monolayered lamina epithelialis which was made up of ciliated cells and secretory cells, showed two rows of nuclei and was responsible for creating a false impression of cellular stratification. The glandulogenesis as well as the ciliogenesis occurred almost at the same time in almost all the segments of the oviduct.

Key words: *Postnatal Development, Histomorphology, Oviduct, Kuttanad duck*

Kuttanad breed of ducks, native to Kerala, are well known for their good egg production and attractive egg size (Jalaludeen *et al.*, 2004). The oviduct acts as the final assembly room where the albumen and egg envelopes are added and final steps of egg formation occurs resulting in the calciferous porous egg specific for each avian species. The characteristics such as egg size, egg weight and efficient egg production in turn depends upon the histomorphology of the oviduct unique to each avian species and more so on the way of occurrence of the postnatal development of the oviduct. Research has been conducted on the gross morphology and histology of the avian oviduct by many workers namely Yu and Marquardt (1972), Hodges (1974), King and Mc Lelland (1975) and Naragude *et al.* (1999) in domestic fowl, Lucy and Harshan (1999a) in Japanese quail, Moraes *et al.* (2007) in Nothura spotted quail, Mohammadpour and Keshtmandi (2008) in turkey and pigeon and Ozen *et al.* (2009) in Pekin duck. However, the information regarding the general developmental pattern of the oviduct in Kuttanad duck is scanty. Hence, the present work was undertaken to investigate the development and general histomorphology of the oviduct during the postnatal period in Kuttanad ducks.

Materials and Methods

In the present study, 78 Kuttanad ducks were used. Selection of the birds was done randomly from a single hatch and reared at the University Poultry Farm, Mannuthy under semi-intensive system of management. Feed and water were provided *ad lib*. The ducklings were not given any vaccination. The study was carried out in birds of different age groups, ranging from day-old to 24 weeks and the material was collected from six birds in each

1. Teaching Assistant, UAS, Hebbal, Bangalore
2. Associate Professor
3. Professor (Retd)
4. Professor and Head, CVAS, Pookode, Wayanad

group at fortnightly intervals. After recoding the gross features, the material was fixed in 10% neutral buffered formalin. Different segments of the oviduct were processed and paraffin sections of 5mm thickness were taken for histological studies.

Results and Discussion

During the postnatal period, it was observed that in all age groups, the wall of the oviduct was made up of seven layers *viz.,* tunica serosa an outer covering of peritoneum made of connective tissue and mesothelium, an outer longitudinal smooth muscle layer covering an inner circular smooth muscle layer with an intervening connective tissue layer rich in blood vessels and nerves, a layer of connective tissue internal to the circular muscle layer followed by the mucosa consisting of a lamina propria containing glands in most

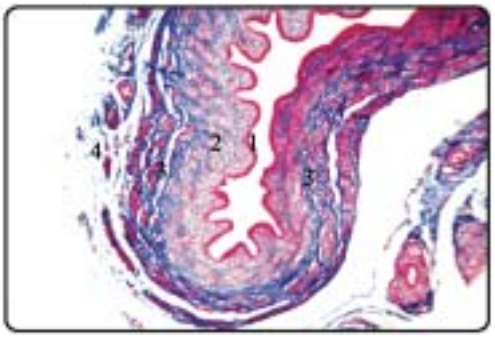

Fig. 1. C. S. of uterus (4 weeks).
Gomori's one step trichrome method x 100
1. Lamina epithelialis 2. Lamina propria 3. Tunica muscularis 4. Serosa

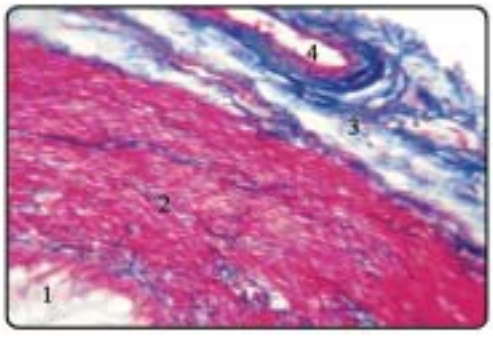

Fig. 2 C. S. of vagina (4 weeks).
Gomori's one step trichrome method x 400
1. Mucosa 2. Tunica muscularis 3. Serosa 4. Blood vessel

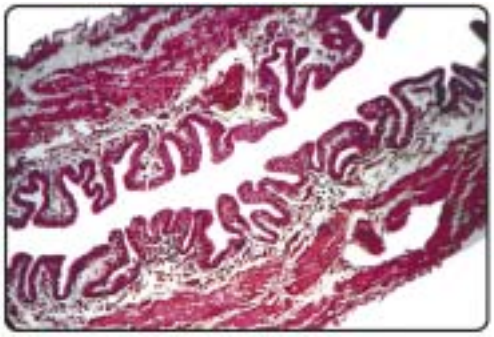

Fig. 3 C. S. of infundibular neck (20 weeks). H & E. x100
1. Lamina epithelialis 2. Lamina propria
3. Tunica muscularis 4. Serosa

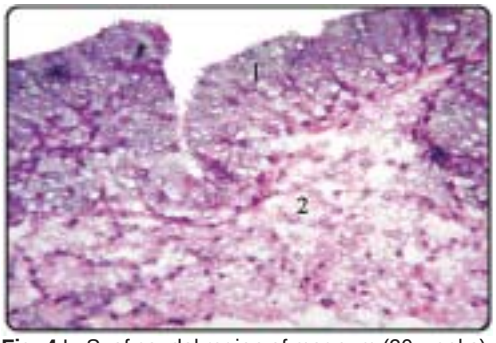

Fig. 4 L. S. of caudal region of magnum (20 weeks). H & E. x 400
1. Lamina epithelialis with tall goblet cells
2. Lamina propria

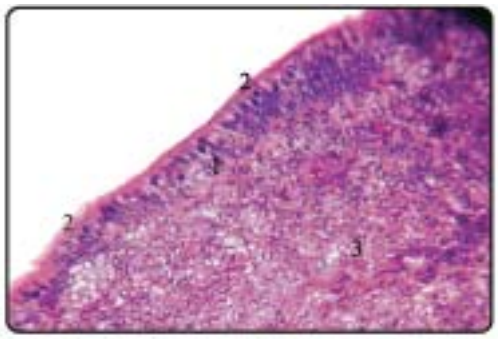

Fig. 5 C. S. of uterus showing the lining epithelium (22 weeks). H & E. x 400
1. Basal cells 2. Apical cells 3. Lamina propria

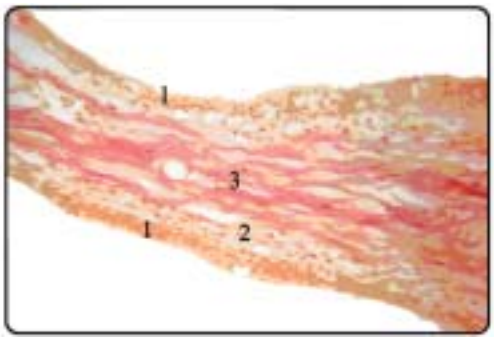

Fig. 6 C. S. of vaginal fold (22 weeks). Van Gieson's stain x 400
1. Lamina epithelialis 2. Lamina propria
3. Core with bundles of collagen fibres

regions of the oviduct and an inner epithelial lining (Fig. 1). Similar arrangement was described by Hodges (1974) and King and Mc Lelland (1975) in domestic fowl.

The oviduct of Kuttanad duck throughout the developmental period was devoid of any muscularis mucosa. Such marked absence of muscularis mucosa was also recorded by Rao (1994) in duck.

The mucosal folds were seen more or less continuous throughout the oviduct, although they varied in height and thickness. Throughout the postnatal period, among all the segments of the oviduct, the vagina had the thickest tunica muscularis (Fig. 2) while the infundibulum had the thinnest (Fig. 3). These results are in total agreement with findings of King and Mc Lelland (1975) in domestic fowl and Lucy and Harshan (1999b) in Japanese quail.

In immature ducks, the ciliated and secretory cells lining the epithelium and the proprial glands were not fully developed and during this pre-laying period ciliated cells showed a great predominance. These observations are in accordance with those of Bakst and Howarth (1975) in domestic fowl. Similar to adult Muscovy duck (Evencioneto *et al.,* 1997), the mucosal folds and its lining epithelium in the adult Kuttanad duck in the laying period, were much more developed, with a certain predominance of non-ciliated cells (Fig. 4).

In the present study it was observed that the ciliated cells and secretory cells of uterus which formed the monolayered lamina epithelialis (Fig. 5) showed two rows of nuclei which was responsible for creating a false impression of cellular stratification or pseudostratification and this was mainly because of the differential positioning of the nuclei of these cells, i.e. ciliated cells possessed more apically placed nuclei and secretory cells showed more basal nuclei. The fact was confirmed from the observations that this false impression of stratification was least visible in thin sections of 4mm thickness, where, exact two rows of nuclei could be distinctly identified whereas, in thicker sections layers of cells overlapped to give a multilayered appearance. Similar findings were also documented by Hodges (1974) in domestic fowl, Lucy and Harshan (1999a) in Japanese quail and Moraes *et al.* (2007) in Nothura spotted quail. The ultramicroscopic studies on the mucosa of the oviduct by Ozen *et al.* (2009) had supported and confirmed this fact in the case of the Pekin duck.

The glandulogenesis started in the developing oviduct of Kuttanad duck at about 12th week of age when the oviduct weighed around 5.59 ± 0.02 g. Contrary to this, in the developing oviduct of fowl, Yu and Marquardt (1972) observed that the tubular gland formation started much earlier in the postnatal period at a stage when oviduct weighed only about one gram. However, it is noteworthy that, similar to the domestic fowl (Yu and Marquardt, 1972) and Japanese quail (Pageaux *et al.,* 1986), the glandulogenesis as well as the ciliogenesis occurred almost at the same time in almost all the segments of the oviduct of Kuttanad duck during the postnatal period.

In the present study, bundles of collagen fibres were observed between the muscle cells (Figs. 1 and 2) primarily in uterus and vagina. In the case of quail, however, Arjaama and Talo (1983) were able to detect bundles of collagen fibres between the muscle cells in the magnum and to a lesser extent in the isthmus. Apart from this, the connective tissue component of lamina propria in all the segments formed a rich vascular central core of the mucosal fold comprising of supporting meshwork of collagen fibres (Fig. 6). Similar to adult Japanese quail (Geetha *et al.,* 1992), elastic and reticular fibres were also present in the lamina propria of all the regions of the oviduct in adult Kuttanad duck.

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