

## Short Communication

# A COMPARATIVE MICROMETRY AND HISTOCHEMICAL STUDY ON THE OVIDUCT OF WHITE LEG HORN AND RHODE ISLAND RED CHICKEN

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**ABSTRACT:** The present work was conducted on oviduct of 20 weeks old White leg horn (WLH) and Rhode Island Red (RIR) chickens to observe and compare the micrometrical variation and histochemical reaction of the oviduct segments between WLH and RIR breeds of chickens. The micrometrical observation revealed that there were better developments of mean thickness of tunica mucosa and epithelial surface height of different parts oviduct in WLH than RIR chickens. In both the breeds the thickness of the tunica mucosa gradually increased from infundibulum to vagina but the tunica mucosa of isthmus was thicker than that of uterus where as the epithelial height was more in vagina and less in infundibulum. Finding of more glycogen content by best carmine staining and the PAS activity for neutral mucopolysaccharide in various segments of WLH's oviduct suggested better mitochondrial activity and functional ability for egg production in WLH in comparison to RIR chickens.

**Key words:** Histochemistry, Micrometry, Oviduct, White Leg Horn, Rhode Island Red.

White leg horn (WLH) and Rhode Island Red (RIR) breeds of chickens are mostly used in layer backyard poultry farming. The avian oviduct consists of the infundibulum, magnum, isthmus, shell gland and vagina. The yolk formed in the ovary passes down through the oviduct and during this process albumin, shell membrane and eggshell are deposited on the yolk in the magnum, isthmus and shell gland respectively. The time spent by eggs in the magnum, isthmus and shell gland is approximately 3 h, 1.5 h and 20 h, respectively, in chickens (Warren and Scott 1935, Ogawa *et al.* 1996). The avian oviduct is a complex biological organ that undergoes a series of hormonal, neuronal, biochemical and cellular changes during the formation of an egg. The present study is aimed to observe and compare the micrometrical variation and histochemical reaction of the oviduct between WLH and RIR breeds of chickens.

### The study

12 numbers of 20 weeks old WLH and RIR chickens, six from each breed were procured from poultry farm. These birds were sacrificed by humane method. The body cavity was opened and the oviduct was excised, washed in normal saline for a half an hour then dissected into its

segments. For micrometrical and histochemical study the segments of oviduct like infundibulum, isthmus, magnum, uterus and vagina were taken, and placed immediately for 24 hours into the fixative of buffered neutral formalin and carnoy's fluid for the presence of glycogen. Then dehydrated in gradient alcohol series and embedded in paraffin. Sections of 7 micrometer were obtained. For micrometrical study the sections were stained with Harris Hematoxylin and Eosin (Vacca 1985). Morphometric measurements were obtained using ocular micrometer to demonstrate the mean thickness of the wall and mean epithelial surface height. The other staining techniques used were Periodic acid Schiff (PAS) for visualisation of neutral mucopolysaccharides (McManus 1946) and best carmine (Luna 1968) for histochemical analysis of oviduct.

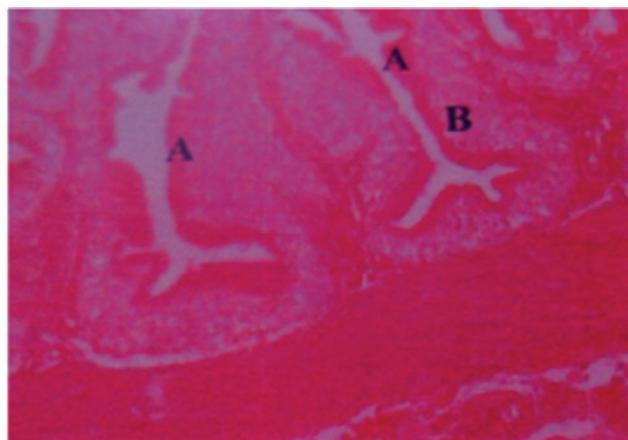
The micrometrical observations of mean thickness of tunica mucosa and epithelial surface height of different parts of oviduct *i.e.* infundibulum, magnum, isthmus, uterus and vagina in 20 wk old RIR and WLH bird were presented in Table 1. From Table 1 it was found that there were better developments of mean thickness of tunica mucosa ( $\mu\text{m}$ ) and epithelial surface height ( $\mu\text{m}$ ) in WLH breed than that of RIR breed. In both the breeds

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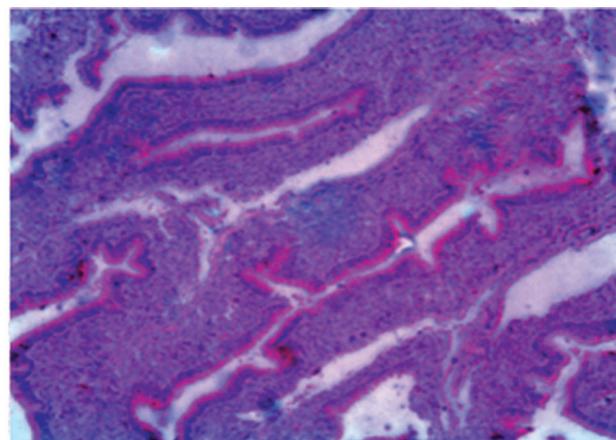
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**Table 1. Thickness of tunica mucosa and epithelial surface height in 20 wk old WLH and RIR birds.**

Sl. No.	Region	Mean thickness of tunica mucosa ( $\mu\text{m}$ )		Epithelial surface height ( $\mu\text{m}$ )	
		WLH (20 wk)	RIR (20 wk)	WLH(20 wk)	RIR (20 wk)
1	Infundibulum	122.62 $\pm$ 3.76	119.73 $\pm$ 2.81	18.26 $\pm$ 3.32	14.29 $\pm$ 3.76
2	Magnum	170.3 $\pm$ 20	167.36 $\pm$ 17.58	27.38 $\pm$ 4.74	26.74 $\pm$ 5.81
3	Isthmus	195.08 $\pm$ 27.67	187.31 $\pm$ 34.24	23.08 $\pm$ 7.59	21.15 $\pm$ 2.20
4	Uterus	172.95 $\pm$ 20.47	160.86 $\pm$ 26.12	31.71 $\pm$ 4.69	28.12 $\pm$ 8.60
5	Vagina	219.66 $\pm$ 23.99	195.77 $\pm$ 24.20	35.20 $\pm$ 7.41	32.65 $\pm$ 6.94



**Fig. 1. Photomicrograph of uterine wall (WLH-20 wks) showing in best carmine stain (10X). A-surface epithelium, B-Glandular cell.**



**Fig. 2. Photomicrograph of Isthmus (WLH-20 wks) showing intense PAS activity of tubular epithelium (10X).**

the thickness of the tunica mucosa increased gradually from infundibulum to vagina but the tunica mucosa of isthmus was thicker than that of uterus where as the epithelial height was more in vagina and less in infundibulum.

The mean thickness of tunica mucosa and epithelial surface height of infundibulum was 122.62 $\pm$ 3.76  $\mu\text{m}$  and 18.26 $\pm$ 3.32  $\mu\text{m}$  in WLH while that of RIR was 119.73 $\pm$ 2.81  $\mu\text{m}$  and 14.29 $\pm$ 3.76  $\mu\text{m}$  respectively. Our results slightly varied in comparison to the findings of Patki *et al.* (2013) and Khokhlov (2008) who reported that the Tunica mucosa width 103.50  $\pm$  2.85  $\mu\text{m}$  and 234.2 $\pm$ 15.7  $\mu\text{m}$  and Ciliated Epithelium height 20.13  $\pm$  0.87  $\mu\text{m}$  and 18.5 $\pm$ 0.6  $\mu\text{m}$  of infundibulum in 24 weeks Kuttanad duck and in 150 days old Lohmann Brown Hen respectively.

The height of magnal epithelium measured about 26.74 $\pm$ 5.81  $\mu\text{m}$  in RIR and 27.38 $\pm$ 4.74  $\mu\text{m}$  in WLH chicken before the egg passes the magnum region. In comparison with results of Richardson (1935), the height of magnal epithelium measured about 30  $\mu\text{m}$  before the egg passes the magnum region in fowl. It suggested that this was due to the abundant goblet cells with secretory

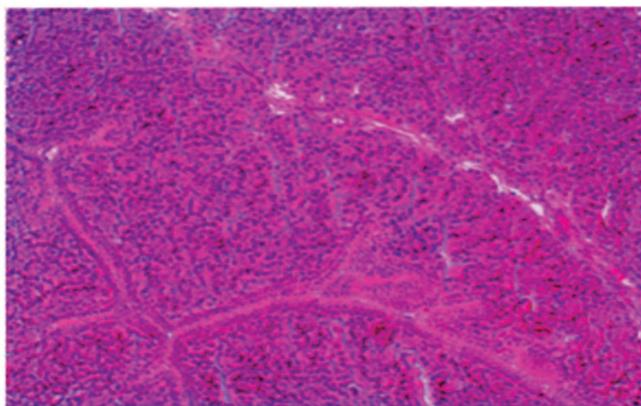
materials. After the magnum discharged its secretion, the ciliated cells predominated and the surface epithelium measured 15.63 $\pm$ 3.21  $\mu\text{m}$  and 17.72 $\pm$ 4.68  $\mu\text{m}$  in RIR and WLH respectively in height.

Balash and Baghdady (2013) measured the pseudostratified columnar surface epithelium about 20 $\pm$ 0.01  $\mu\text{m}$  in height and comprised of two cell types, ciliated columnar cells with apical nuclei and non ciliated secretory cells which have basal nuclei in isthmus Segment of turkey at egg-laying Stage. In WLH and RIR the same segment have the surface epithelium height of about 23.08 $\pm$ 7.59  $\mu\text{m}$  and 21.15 $\pm$ 2.20  $\mu\text{m}$  respectively.

Ibrahim *et al.* (2015) recorded the morphometric measurements of the uterus epithelium height of 23.32  $\pm$  1.91  $\mu\text{m}$  at adult stage of Japanese quail. In our study the same segments height were more in comparison to Japanese quail.

The vaginal wall was thicker than that of the other oviduct portions. Bansal and Pathak (2010) recorded the epithelial height of vaginal wall 22.18 $\pm$ 1.52  $\mu\text{m}$  in Punjab white quail. In our findings the vaginal epithelial height was 35.20 $\pm$ 7.41  $\mu\text{m}$  in WLH and 32.65 $\pm$ 6.94  $\mu\text{m}$  in RIR.

The mean thickness of tunica mucosa of various



**Fig. 3. Photomicrograph of Magnum (RIR-20 wks) showing PAS activity (10X).**

segments of oviduct of WLH and RIR were recorded. The mucosal fold width of different segments of oviduct in emu birds were more as pointed by Vijayakumar *et al.* (2016) and in ostrich by Sharaf *et al.* (2012) as compared to WLH and RIR birds. The thickness of tunica mucosa of isthmus, uterus and vagina showed deviation in our findings as compared to the reports of Mohammadpour *et al.* (2012) who recorded the tunica mucosa width of isthmus, uterus and vagina  $337.22 \pm 109.46 \mu\text{m}$ ,  $122.22 \pm 20.84 \mu\text{m}$ ,  $75.41 \pm 13.43 \mu\text{m}$  respectively in hen.

The best carmine staining for glycogen granules in various components of oviduct revealed the vagina and magnum were less reactive than infundibulum, uterus (Fig. 1) and isthmus, in contradiction to the findings of Ozen *et al.* (2009) where staining with Best's carmine gave a positive reaction in only the epithelial cells of the region of the isthmus and not in other segments of oviduct in duck. The intensity of best carmine was more in the surface epithelium and moderate in glandular epithelium in both breeds but WLH showed better reaction in comparison to RIR due to more mitochondrial activity. The apical border of the surface and glandular epithelium showed intense PAS reaction but more in WLH than RIR. The infundibulum, magnum (Fig. 3) and uterus were more PAS positive than the isthmus (Fig. 2) and vagina suggesting the functional ability of egg production. Similar findings have been reported in the magnum of hen by Artan and Daghoglu (1984). Bansal and Pathak (2010) found a strong PAS positive reaction in the isthmus of Punjab white quails. Ozen *et al.* (2009) could not demonstrate PAS +ve reaction in the proprial glands of Pekin duck.

Based on the findings of present study, it can be concluded that the thickness of tunica mucosa and epithelial surface height of different parts of oviduct in WLH were more as compared to RIR breed of chicken.

Tissue sections of WLH showed better staining intensity for best carmine and PAS reaction than RIR.

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