

Histomorphological Studies on Oviduct of Nigerian Genotypes Chicken

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How to cite this paper: James Gana, Aboje John Eche, Kabir Ibrahim Kontagora, Kelechi Mgbonu. (2022) Histomorphological Studies on Oviduct of Nigerian Genotypes Chicken. *International Journal of Food Science and Agriculture*, 6(2), 192-199.

DOI: 10.26855/ijfsa.2022.06.009

Received: April 28, 2022

Accepted: May 25, 2022

Published: June 13, 2022

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Abstract

The study was conducted at the poultry unit in the research and teaching farm of the Department of Agricultural Education of Federal College of Education, Kontagora, North central, Nigeria. Thirty apparently healthy adult Normal feathered (NF) and naked-neck (NN) genotypes of Nigerian chickens were purchased from local market in Kontagora, slaughtered and the oviducts were harvested. The tissues (mid portions of infundibulum, magnum, isthmus, shell gland and vagina) were fixed followed by routine histological staining technique (H & E). The wall of the left oviduct of both groups comprised four basic layers viz. tunica mucosa, submucosa, tunica muscularis and serosa from inside to outward. Due to absence of lamina muscularis, tunica mucosa and tunica submucosa formed a combined layer here onwards referred to as propria submucosa, which formed the core of the mucosal folds. Tunica mucosa possessed considerable complexity, being thrown into well-developed folds. Tunica muscularis was made up of two layers; inner circular and outer longitudinally oriented smooth muscle layer. The outermost layer was tunica serosa, which was made up of loose subserosal connective tissue covered externally by the mesothelium. In the infundibulum, mucosal folds were short, narrowed, predominantly primary with the thickness of its wall in NF been observed to be less than that in NN birds. Almost all mucosal folds in the magnum were pedunculated. The mucosal folds of the magnum were wider in NN compared to the NF. In the isthmus, most of the mucosal folds were narrow and tapered towards the centre of lumen. Folds were wider in NN as compared to NF. The Vascularity was highest in this shell gland compared to infundibulum, magnum and Isthmus. The mucosa of the vagina exhibited short folds of uniform height.

Keywords

Genotypes, Chicken, Oviduct, Histomorphology, Nigeria

1. Introduction

The Nigerian native chickens does not only as one of backbones of rural economics but also contribute substantially to the Gross National Product [1] and due to their inherent advantages over the exotic breed, they have remained predominantly in villages. Most of the birds are kept in small flocks and are fed with household refuse, homestead pickings, crop residues, herbage, seeds, green grasses, earthworms, and small amount of supplemented feeds offered by the flock owner. They are well adapted to the adverse climatic conditions of the tropical environment and low management inputs. They contain a highly conserved genetic system with high levels of heterozygosity [2]. Ebozoje and Ikeobi [3] reported the adaptive potentials of the Nigerian indigenous chicken to varied ecological conditions, stresses and diseases. One of these adaptive potentials is the ability to produce a reasonable number of eggs when compared to their counterpart hybrids raised under intensive conditions. The Nigerian local chickens (naked neck, frizzled and normal fea-

thered) constitute about 80% of the 120 million poultry birds. These varieties, particularly the naked neck have been reported to possess a good egg laying characteristic [4]. Since the success of the local chicken enterprise depends on the total number of quality eggs produced [5], then understanding the normal histology of the oviduct of these local chickens becomes paramount. The wall of left oviduct consisted of tunica mucosa, tunica muscularis and tunica serosa [6]. In all areas of the oviduct except the infundibulum and vagina, the tunica mucosa epithelium was lined with ciliated pseudo stratified columnar epithelium, and the lamina propria-submucosa contained branched tubular glands in turkey [7]. The tunica mucosa of the first part of infundibulum (funnel) showed low and closely packed spiral folds, which increased in height in second part (neck) of the infundibulum, where secondary and tertiary folds were also recorded [8]. In the magnum, the number, height and thickness of mucosal ridges with longitudinal and spiral orientation was found to be increased. Presence of the secondary and tertiary folds was not observed [9]. The wall of the isthmus showed mucosa, muscularis, and serosa with in outward in duck [10]. The mucosal folds with secondary branching are reduced in height and number. Nickel *et al.* [11] observed flat, discontinuous, leaf shaped and longitudinally oriented mucosal folds in the shell gland and while Mehta *et al.* [9] observed branched and long pillar like folds. Histologically, the mucosa of the vagina is raised into numerous narrow filiform longitudinal ridges, which are regular in arrangement. These are narrow as compared to the other parts of the oviduct. Primary, secondary and tertiary folds are present. The secondary folds are perpendicular to parent ridges [6]. Very little information exists in the literature regarding the genotypic variations in the oviduct of the Nigerian indigenous chickens. Thus, this study was conducted with the aim of studying the histomorphological studies on the oviduct of two genotypes of chicken in Nigeria.

2. Materials and Methods

The study was conducted at the poultry unit in the research and teaching farm of the Department of Agricultural Education of Federal College of Education, Kontagora, Niger State Nigeria. Geographically, Kontagora is located at latitude 10°24'1" North and longitude 5°28'1" East and at an elevation of 335m above sea level [12]. Twenty-five apparently healthy adult Normal feathered and naked neck genotypes of Nigeria indigenous chickens (Eleven males and fourteen females all above one year of age) were purchased from local market in Kontagora. They were quarantined for two weeks and stabilized for another two weeks in a pen at poultry unit, livestock farm of the college. They were fed commercial grower diet (Animal care(R) feed); within these periods and water ad libitum under a good management practice. At the end of these periods, all birds were fasted for 12 hours, live body weights were recorded and then all of them were slaughtered using Halal method [13], of slaughtering. They were allowed to bleed for two (2) minutes before been de-feathered. The tissues (mid portions of infundibulum, magnum, isthmus, shell gland and vagina) obtained were fixed and stained with routine Haematoxylin and Eosin (H & E) [7]. All micrographs were made using a Light microscope with the aid of a digital eyepiece (TuscenCMOS Camera: IS500, Resolution: 5.0 megapixels) attached to a light microscope (Leica®, Germany) which conveyed the images to a Personal Computer (PC) at low and high magnifications.

3. Results and Discussion

Histologically, the wall of the left oviduct was comprised of four basic layers viz. tunica mucosa, submucosa, tunica muscularis and serosa from inside to outward, which corroborates with the reports of Trautmann and Fiebiger [14], Banerjee *et al.* [15] and Garg [6]. However, Bradley and Grahame [16], Romanoff and Romanoff [17], Hodges [18], Gopinath and Hafeezuddin [19] and Ingole [20] reported seven layers. Due to absence of lamina muscularis, tunica mucosa and tunica submucosa formed a combined layer here onwards referred to as propria submucosa, which formed the core of the mucosal folds. Tunica mucosa possessed considerable complexity, being thrown into well-developed folds. It was comprised of an innermost lamina epithelialis resting on loose connective layer, the lamina propriasubmucosa. Tunica muscularis was made up of two layers; inner circular and outer longitudinally oriented smooth muscle layer. The outermost layer was tunicaserosa, which was made up of loose subserosal connective tissue covered externally by the mesothelium. The thickness of wall was measured from the base

4. Infundibulum

The folds were lined by non-ciliated pseudo stratified columnar epithelium (Figs.1&2). Mucosa was thrown into the lumen to form mucosal or mural folds. Mucosal folds were short narrow and predominantly primary. Few secondary folds were also observed in two birds. The folds were lined by nonciliated pseudo stratified columnar epithelium. Das and Biswal [21] revealed single layered ciliated columnar lining with goblet cells and comparatively shorter folds in Duck. Banks [22] observed similar lining epithelium with mostly clubshaped branched folds upto secondary branching. Naragude *et al.* [23] reported simple columnar epithelium equally populated with ciliated and nonciliated cells and three types of folds viz primary, secondary and tertiary in NN birds at 16th week of age. Whereas, Lucy and Harshan [24] observed that infundibulum with low primary mucosal folds lined by simple columnar epithelium in quail. The thick-

ness of the infundibular wall in NF was significantly less than that in NN birds. However, Garg [6] noticed the thickness of wall 174.6 μ m which was lesser as compared to both birds.

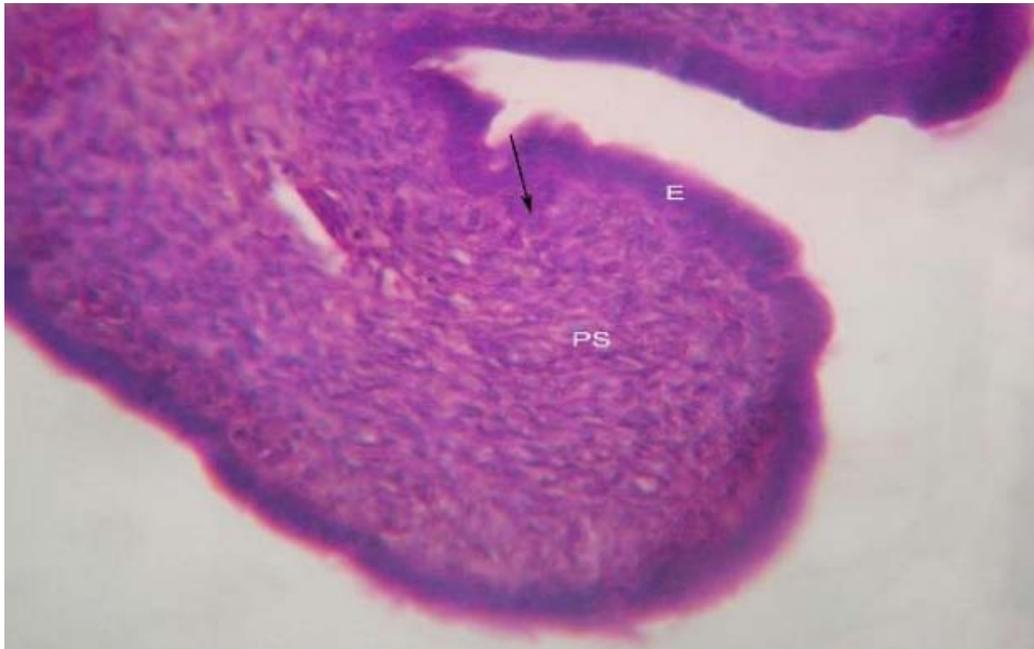


Figure 1. Photomicrograph of infundibulum of Normal feathered chicken, showing epithelium (E), propria submucosa (PS) and migration of epithelium cells (arrow), (H&E, 400X).

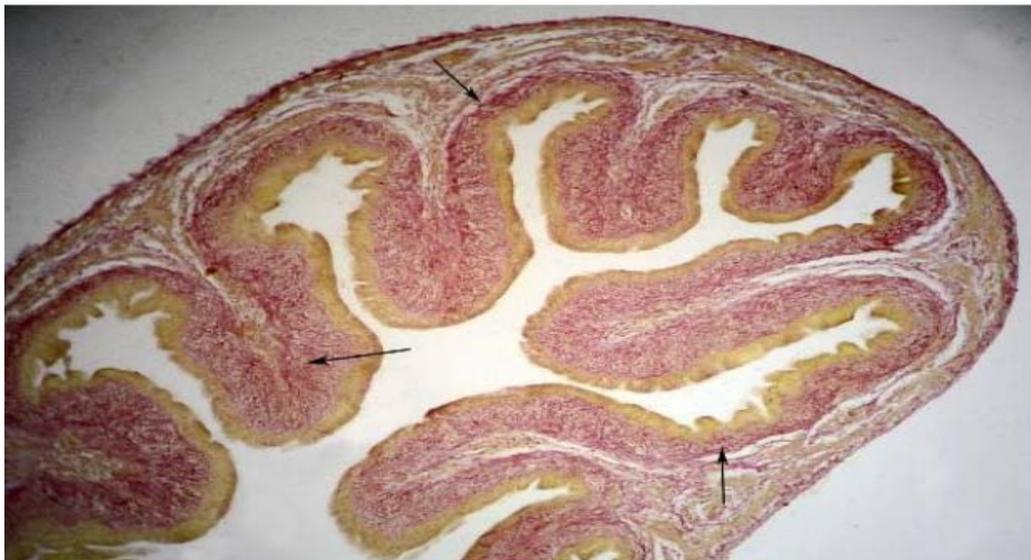


Figure 2. Photomicrograph of infundibulum of Naked-Neck showing collagen fibres (Van-Gieson's, 100X).

5. Magnum

The epithelium was non ciliated pseudostratified columnar in both genotypes. However, Ingole [20] and Mehta *et al.* [9] reported ciliation in the epithelium. Almost all mucosal folds were pedunculated. The mucosal folds were wider in case of NN. Secondary fold formation was also noticed at the base of mucosal folds (Fig. 3). In most of the folds, the epithelium was thicker on the sides than at the top in NN birds. The propria submucosa of the core of the mucosal folds was made up of loose fibrocellular connective tissue. Several capillaries were located between the connective tissue cell and the fibres. The connective core was richly fibrocellular in NN as compared to NF. Vertically ascending fibrocellular cord formed the central core of the mucosal folds. Concentration of the fine collagen fibers was more in the central part of the core of the mucosal folds in NF, however, they were uniformly distributed in the core of the mucosal fold with less density in the central part in NN birds (Fig. 4).



Figure 3. Photomicrograph of magnum of Naked-Neck showing epithelium (E), propria submucosa (PS) and secondary fold formation (arrow) (H&E, 400X).

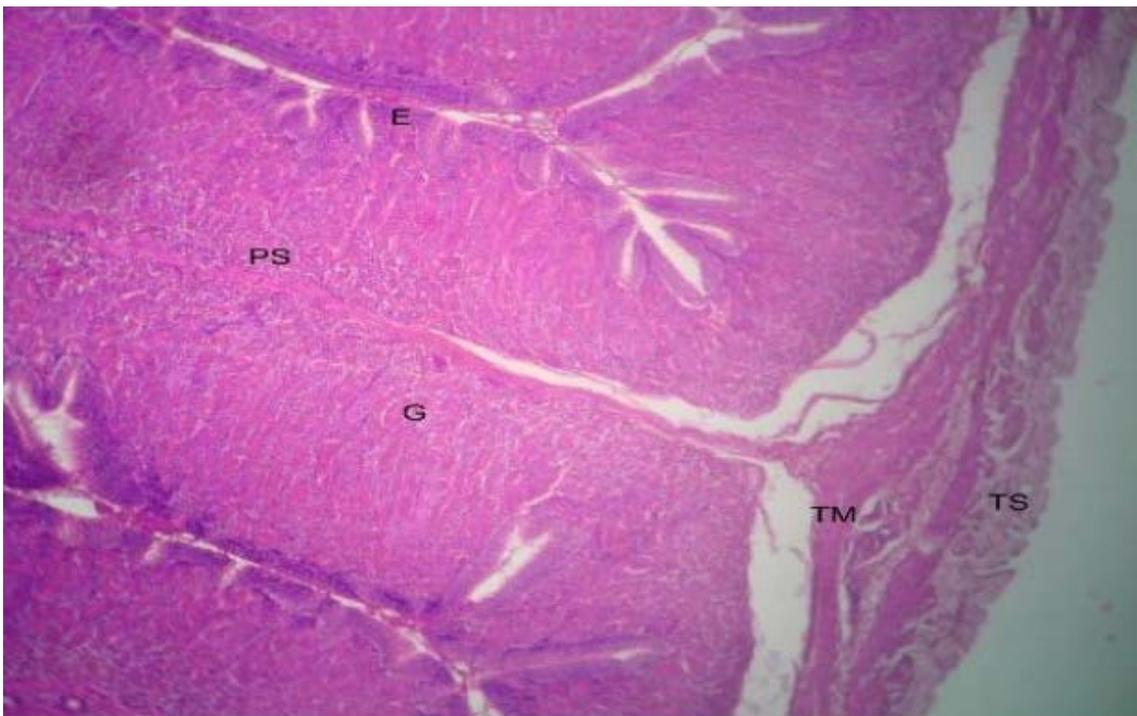


Figure 4. Photomicrograph of magnum of Naked-Neck showing epithelium (E), propria submucosa (PS), glands (G), tunica muscularis (TM) and tunica serosa (TS) (H&E, 100X).

6. Isthmus

In NF, the central part of the core of the mucosal folds was very loose as compared to the periphery. It was relatively denser in NN birds. Vertically ascending fibres and cells were noticed in the central part of the core in NN. Collagen fibres were fine, small and scattered in the central part of the core of the mucosal fold in NF, whereas they were densely distributed in propria submucosa in NN. Naragude *et al.* [23] observed that the submucosa consisted of loose connective

tissue stroma with branched tubular glands and blood vessels. Tunica muscularis was ill developed fibrocellular layer in NF and well-developed and vascular in NN. Mostly circularly oriented fibres among which several cells were observed. Collagen fibres were scattered. These findings agree with the reports of Hodges [18] and Banks [22]. The subserosa was ill developed in NF. There was a layer of squamous cells, which formed mesothelium of the serosa. Tunica serosa was ill developed in NN. The mucosal crypts were noticed which were present all along the sides of the folds (Fig. 5). Crypts were deeper in case of NN birds. Most of the mucosal folds were narrow and tapered towards the centre of lumen. Folds were wider in NN as compared to NF. The propria submucosa was made up of loose connective tissue. The core of the mucosal folds was occupied by the glandular units. The central part of the core of the mucosal folds had vertically oriented collagen fibre strand which must be supporting the fold during their movement.

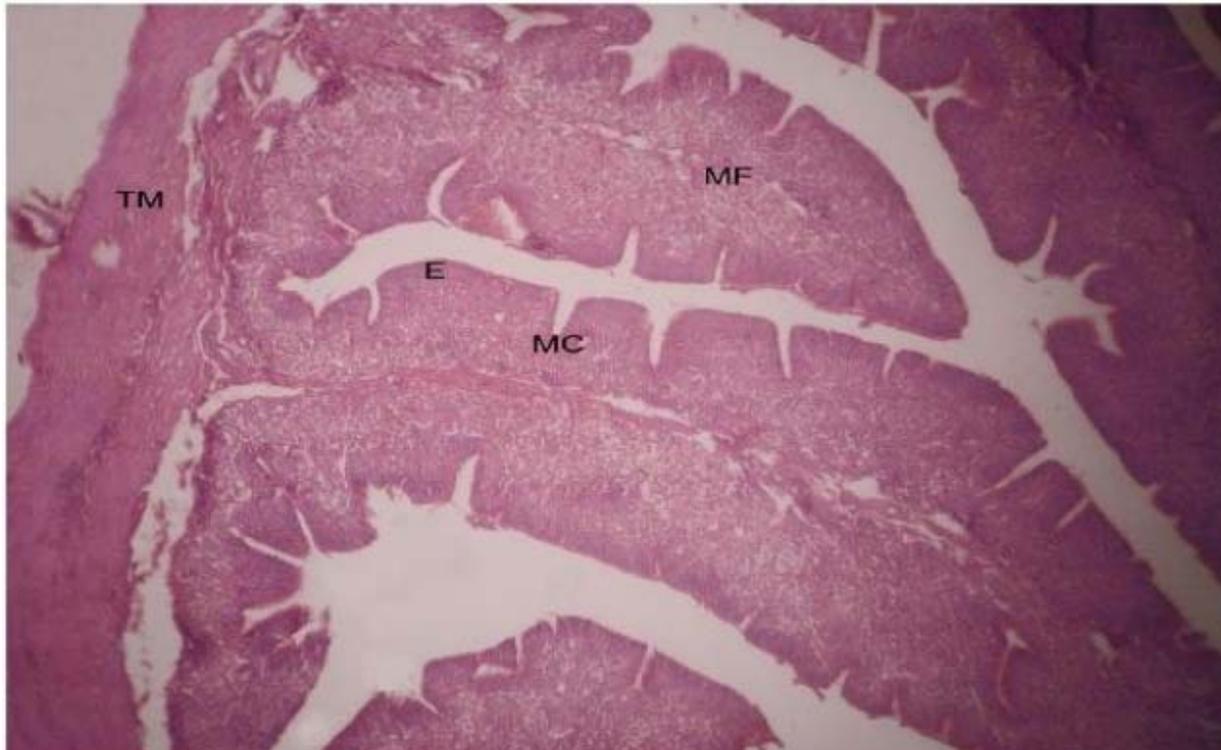


Figure 5. Photomicrograph of Isthmus of Normal feathered chicken, showing epithelium (E), leaf shaped mucosal folds (MF), mucosal crypts (MC) and tunica muscularis (TM) (H&E, 100X).

7. Shell Gland

The mucous membrane was studded with folds of lesser height as compared to other region. The epithelium was simple columnar with elongated oval nucleus of different size (Fig. 6). At places, there were proliferative changes to which the epithelium became pseudostratified. Secretory material was noticed in the epithelium of NF. However, Ingole [20] observed that the epithelium was initially cuboidal and later changed to low columnar and pseudostratified with ciliation in patches. Bacha and Bacha [25], Aughey and Frye [26] and Mehta *et al.* [9] observed pseudostratified ciliated columnar epithelium. Banerjee *et al.* [15] reported it as simple ciliated columnar. The propria submucosa forming the core of the folds was densely packed with cells. Fibres were sparsely distributed among cells. Collagen fibres were thinner and longer in the core of the folds in NF and were denser in NN birds. The smooth muscle fibres of the inner circularly oriented layer were loosely arranged and formed a thin layer in NF and fibres were more sparsely distributed in NN. Blood vessels were marked in this layer and in between it and outer longitudinally oriented smooth muscle bundles. The latter was more developed as compared to earlier regions of oviduct and more uniformly arranged in NN birds as compared to NF. The mucosa showed tall folds with secondary branching and in 2 birdstertiary branching was seen also. Mucosal folds were narrow and taller in NN birds with more number of secondary (Fig. 6) and tertiary. Bradley and Grahame [16], Hodges [18] and Nickel *et al.* [11] observed flat, discontinuous, leaf shaped and longitudinally oriented mucosal folds. Mehta *et al.* [9] described them as pillar like, Garg [6] reported them as tall leaf like. The circularly arranged smooth muscle fibre layer was thicker and compact in NF (Fig. 7). In NN birds, the circular and longitudinally oriented muscle fibres layers were of equal width but less compact. In between these two layers' large blood vessel was recorded. Vascularity was highest in this region as compared to infundibulum, magnum and Isthmus.

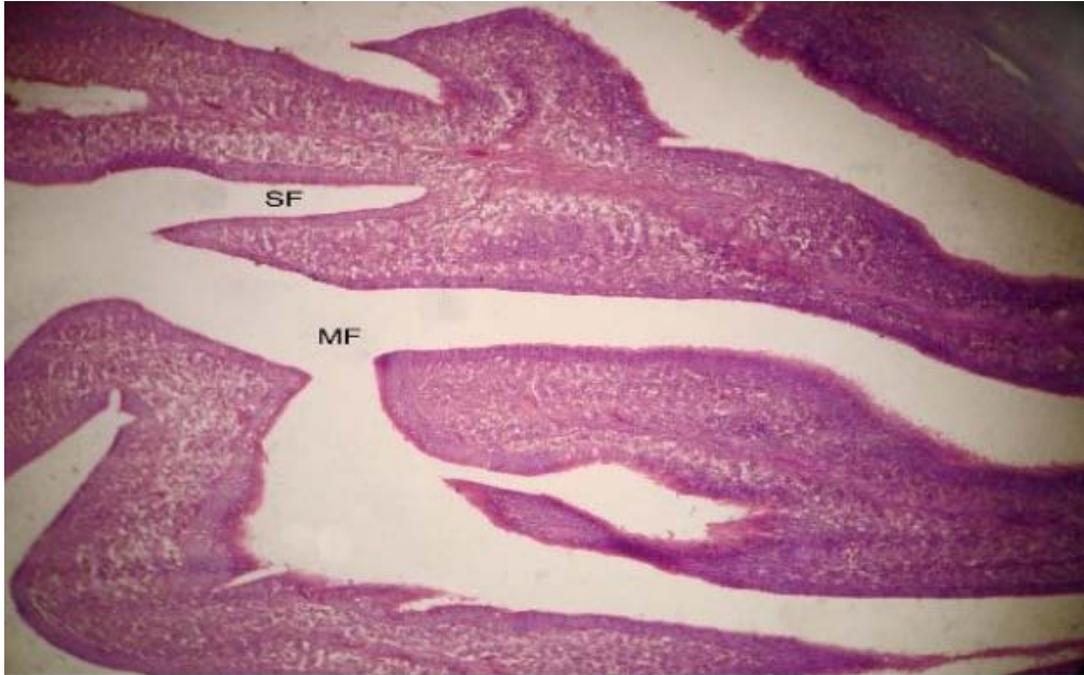


Figure 6. Photomicrograph of shell gland of Naked-Neck chicken showing mucosal folds (MF), and secondary fold (SF) (H & E, 100X).

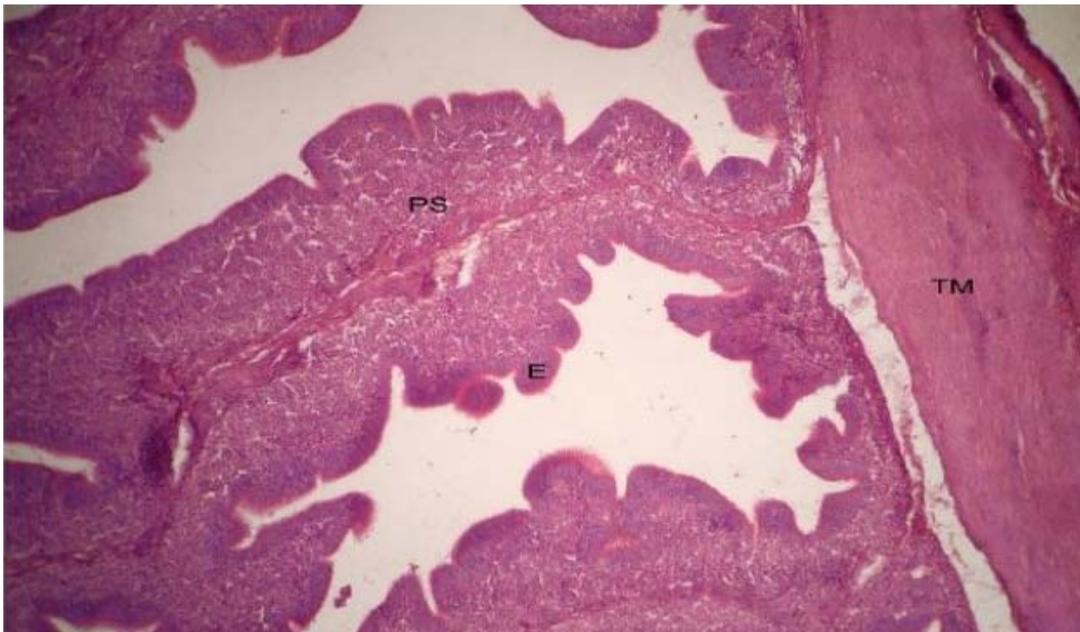


Figure 7. Photomicrograph of shell gland of Normal feathered chicken, showing pseudostratified ciliated columnar epithelium (E), propria submucosa (PS) and tunica muscularis (TM), (H&E, 100X).

8. Vagina

The mucosa exhibited short folds of uniform height (Fig. 8&9). The circular smooth muscle fibre layer was ranged in bundles. The outer bundles had obliquely oriented fibres at several locations. Whereas in NN, tunica muscularis was thicker, it showed circular oblique and longitudinally oriented muscle fibres. Various connective tissue cells, few scattered elastic and collagen fibres were present between the muscle bundles. Tunica adventitia was composed of loose connective tissue. However, Garg [6] reported more developed inner circular layer than the outer. He has described a tunica serosa made up of single layer of mesothelial cells overlying subserous connective tissue. Differences with the observations of past workers can be attributed to age, genetic potential, environment and management.

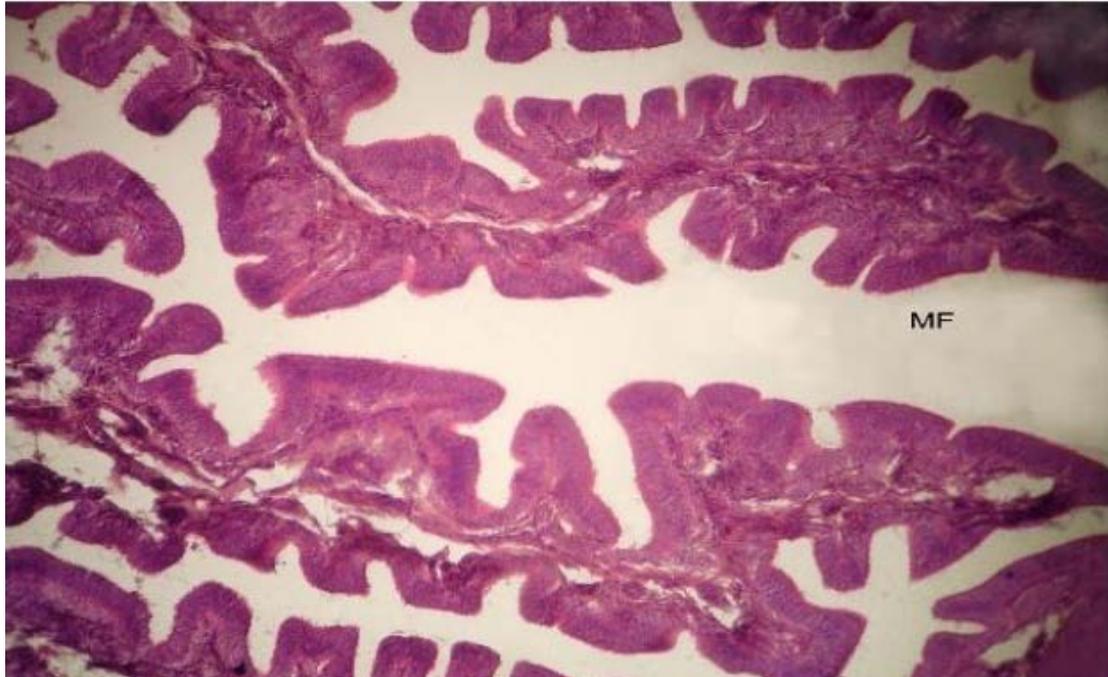


Figure 8. Photomicrograph of vagina of Normal feathered chicken, showing pine shaped mucosal folds (MF) (H & E, 100X).

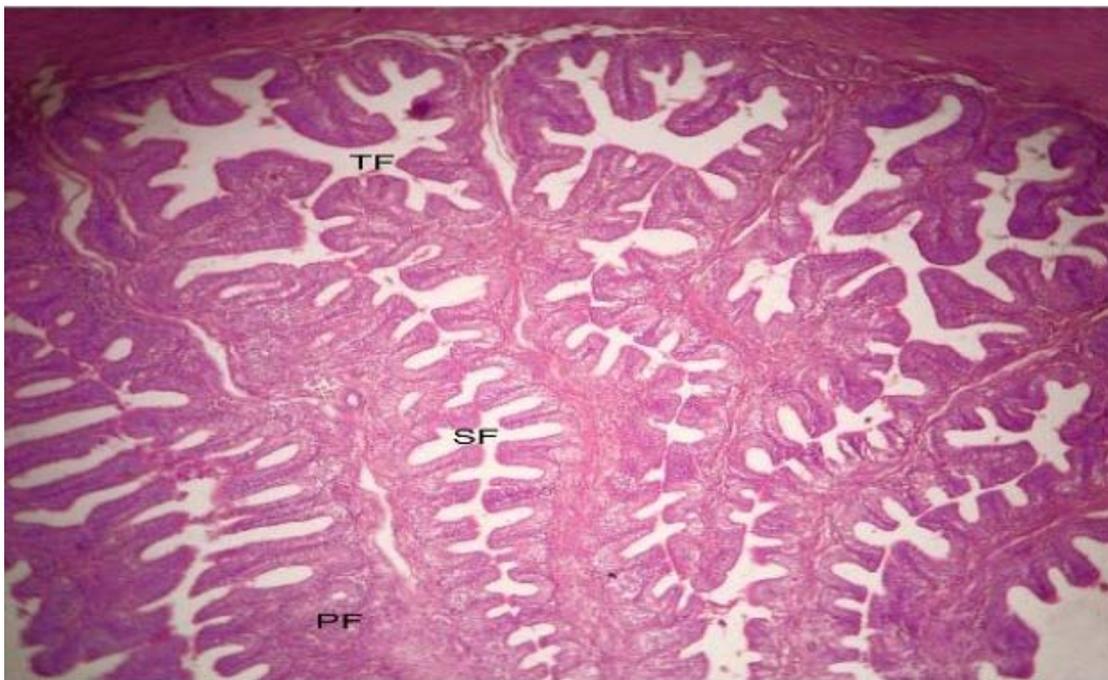


Figure 9. Photomicrograph of vagina of Naked-neck chicken showing primary fold (PF), secondary fold (SF) and tertiary fold (TF) (H & E, 100X).

9. Conclusion

Histologically, left oviduct was comprised of 4 layers namely tunica mucosa, submucosa, tunica muscularis and tunica serosa. The mucosal folds were mostly primary and secondary, however in rare instances tertiary branching was also seen in the infundibulum, shell gland and vagina. The magnum showed mostly primary sessile folds. In isthmus leaf shaped mucosal folds were seen. In vagina of both breeds folds appeared to be as pinetree like. Outer longitudinal layer was relatively more developed in shell gland and vagina of Naked-Neck birds as compared to Normal feathered ones.

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