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Histological studies on the ovary of white leghorn and Kadaknath hens

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Abstract

Histologically, the left ovary consisted of outer cortex and inner medulla with surface epithelium lined by single layer of cuboidal cells. The cortical stroma revealed various follicles at different stages of development and surrounded by connective tissue with collagen and reticular fibers. The mature follicles were surrounded by cuboidal shaped granulosa cells. The medulla was comprised of loose connective tissue with smooth muscles, blood vessels, lacunar channels and nerve fibers. Mast cells were present in both cortical and medullary region. Hemosiderin pigment was evident in cortex and medulla of both Kadaknath and White Leghorn hens whereas; fibromelanin was present in cortex and medullary region of Kadaknath only.

Keywords: Histology, ovary, white leghorn, Kadaknath

Introduction

The process of reproduction in poultry differs from other domestic animals. Avian reproductive system is a complex biological system that undergoes a series of hormonal, neural, biochemical and cellular changes during the formation of an egg. In almost all avian species, only the left ovary and oviduct are functional. Although, the female embryo has 2 ovaries, only the left one develops. The right one typically regresses during development and is non-functional in the adult bird.

The reproductive organs of hen i.e. left ovary and oviduct play a major role in production of egg. The ovary is attached to the abdominal cavity wall by meso-ovarian ligament. The left ovary consists of a mass of yellowish, rounded objects called follicles, each containing an ovum or yolk. The mature ova are released from the ovary after completing various hierarchical cycles and are picked up by infundibulum. The oviduct is suspended within the peritoneal cavity by dorsal and ventral ligaments. Although, the research work have been conducted on the oviduct of domestic fowl and Japanese quail, comparative studies on the developmental stages of oviduct of chicken, guinea fowl, turkey, duck, Japanese quail, goose were performed previously (Sellier *et al.*, 2006) ^[16]. Comparative study on pre-hatch development of Kadaknath and White Leghorn was done by Tekam (2015) ^[20]; similar study on post-hatch period up to 20 weeks of age was conducted by Kumar (2016) ^[9]. Studies on the ovaries of Aseel and Rhode Island Red fowl aged from 2 weeks to 13 months was also conducted by Shyam *et al.* (2015) ^[19].

Paucity of available literature on the mature female reproductive tract of Kadaknath and White Leghorn hens has prompted the present research work.

Materials and Methods

This study was conducted on 50 mature female birds comprising of 25 Kadaknath and 25 White Leghorn hens procured from Poultry Farm of College of Veterinary and Animal Science, Bikaner and were investigated in the Department of Veterinary Anatomy, College of Veterinary and Animal Science, Bikaner. After procurement of birds, their live weight (kg) was recorded. Later, the birds were sacrificed by cervical fracture. After dissection, the ovaries and oviduct were collected and fixed in 10% neutral buffered formalin (Luna, 1968) ^[10].

Representative samples of female reproductive tract of both the breeds were collected from identical sites and fixed in 10% formalin and Bouin's fluid for 48 hours and then processed by standard alcohol-xylene method for preparation of block (Luna, 1968) ^[10]. Then, 5 to 6 μ thick sections were cut by using semi-automatic rotary microtome stained for general histomorphological studies.

Results and Discussion

The left ovary was comprised of outer cortex and inner medulla but the area between cortex and medulla was not easily distinguishable. This was in conformity with the findings of Rao and Vijayaragvan (1999) ^[14] in domestic duck and Deka *et al.* (2015) ^[5] in Pati and Chara-Chemballi ducks. Similar findings were reported by Pollock and Orosz (2002) ^[13] according to which, the growth of ovary resulted in outer definable cortex with an inner medulla but as ovary matured, the demarcation between cortex and medulla was lost. Furthermore, Moran (2011) ^[11] observed that in 1 week old chick, there was clear demarcation between cortex and medulla but in 4 week old chicken, the left ovary did not show any more separation of the cortex and medulla. The ovary showed an external layer of epithelium which was composed of single layer of cuboidal cells in both the breeds. This finding resembled with the reports of Hodges (1974) ^[7] in fowl and Bharti (2017) ^[3] in White Leghorn and Kadaknath hens whereas, Rao and Vijayaragvan (1999) ^[14] observed that the germinal epithelium in domestic duck consisted of simple cuboidal to squamous cells. Tunica albugenia which separated the cortex and medulla was not well marked which simulated to the finding of Moran (2011) ^[11], that in pre-hatch stage, the tunica albugenia was well defined and started regressing in 1 week old chicks. According to Shokry *et al.* (2016) ^[17], in day-old chick, a thin layer of primary tunica albuginea separated the well differentiated cortex and medulla whereas, in 1 week old chick, the left ovary observed with a thick cortex and narrow medulla without clear tunica albuginea in between. The parenchyma of left ovary showed numerous interstitial cells arranged singly or in pairs, which was in close agreement with the reports of Pollock and Orosz (2002) ^[13] in avian species whereas, Kimaro (2011) ^[8] observed the interstitial gland cells in both theca interna and externa of atretic vitellogenic follicles in immature ostrich and these gland cells were observed in groups and contained round nucleus surrounded by scanty cytoplasm. Proliferation was seen in the surface epithelium and cells were migrating into the cortical area. Similar finding was reported by Shyam (2007) ^[18] in Aseel and Rhode Island Red fowl.

The cortical stroma contained various ovarian follicles of different sizes just below the surface epithelium and was surrounded by connective tissue with collagen and reticular fibers. Similar finding was reported by Shyam (2007) ^[18] in Aseel and Rhode Island Red fowl. According to Hodges (1974) ^[7], the cortical stroma consisted of blood vessels, sinuses, collagen fibers and fibroblasts, eosinophils and mast cells. Pollock and Orosz (2002) ^[13] observed that the cortex consisted of a parenchymatous zone of immature follicles with centrally located medulla. Deka *et al.* (2015) ^[5] mentioned that the ovarian cortex consisted of numerous follicles of different stages and collagen, elastic and reticular as well as nerve fibers was more in the connective tissue of Chara-Chemballi ducks than in Pati ducks. Bharti (2017) ^[3] reported that the follicles were present in clusters in the outer cortical zone as well as in the deeper part of the ovary in Kadaknath at 24 weeks of age. These observations were in accordance with the present findings.

The small sized follicles were surrounded by single layer of flat to cuboidal granulosa cells, observed just below the surface epithelium. Similar findings were reported by Hodges (1974) ^[7] in fowl, Rao and Vijayaragvan (1999) ^[14] in domestic duck and Bharti (2017) ^[3] in White Leghorn. As the follicle developed, the cells proliferated and formed layer 2 or

3 cells deep which was also reported by Hodges (1974) ^[7] in fowl. Each follicle consisted of a yolk laden oocyte surrounded by several layers which was in congruence with the pronouncement by Vijayakumar *et al.* (2015) ^[21] in emu and Shokry *et al.* (2016) ^[17] in chicken, according to which, each follicle consisted of a growing oocyte with a rounded nucleus and germinal vesicle filed with enormous amount of yolk. The mature follicles were surrounded by large granulosa cell layer having an external basement membrane surrounded by single layer of follicular cells, cuboidal in form with prominent vascular nuclei and the theca layer was seen surrounding the granulosa cell layer. These findings corroborates with the reports of Bacha and Bacha (2000) ^[2]. According to them, the mature follicles were surrounded by several layers from outside to inside with relatively wider theca externa, consisted of compact layer of spindle shaped cells and narrower theca interna, composed of mainly collagen fibers and fibroblast like cells.

Golden brown hemosiderin pigment was evident in both cortical and medullary region of White Leghorn and Kadaknath hens. This finding resembled to that of observation of Aitken (1966) ^[1] in domestic fowl whereas, Bharti (2017) ^[3] reported the presence of hemosiderin pigment in post-ovulatory follicles of White Leghorn only. The cortical and medullary region of Kadaknath also showed the presence of fibromelanin pigment. Fibromelanin pigment was found in between follicles in the cortex and in the connective tissue of medulla. Similar finding was reported by Bharti (2017) ^[3] in Kadaknath hens.

The inner medullary stroma consisted of loose connective tissue with bands of smooth muscles and nerve fibers. Similar findings were reported by Bradley and Grahame (1960) ^[4]; Romanoff and Romanoff (1963) ^[15]; Pollock and Orosz (2002) ^[13]. However, Hodges (1974) ^[7] observed dense connective tissue with smooth muscle bundles in fowl. Lacunar channels were seen throughout the cortical and medullary stroma which was in uniformity with the findings of Moran (2011) ^[11], according to which, the lacunar channels reduced their lumen with the progression of age and in some cases, became obliterated. The medulla was comprised of collagen and reticular fibers with few elastic fibers which was in close agreement with the reports of Deka *et al.* (2015) ^[5]. They observed that the ovarian medulla consisted of numerous blood and lymph vessels with more amount of collagen and reticular fibers and elastic as well as nerve fibers were less in number in Pati ducks as compared to Chara-Chemballi ducks. Elastic fibers were also seen in the tunica intima layer of arteries and veins and nerve fibers were seen associated with blood vessels and smooth muscles, which simulated to the findings of Hodges (1974) ^[7] in fowl.

Mast cells were distributed both in the cortical and medullary stroma and in the theca layer of mature follicles which was in congruence with the pronouncement by Gupta and Gilbert (1988) ^[6] in *Gallus domesticus*. They found that these cells were distributed throughout the stroma of cortex and medulla as well as in the theca of normal and atretic follicles. These cells were abundant in the region of stroma just below the surface epithelium. Similar findings were reported by Parshad and Kathpalia (1993) ^[12] in chicken whereas, Wight (1970) ^[22] reported that the mast cells were found in the theca folliculi of small and medium sized follicles but they were not associated with the walls of either larger and mature or atretic follicles.

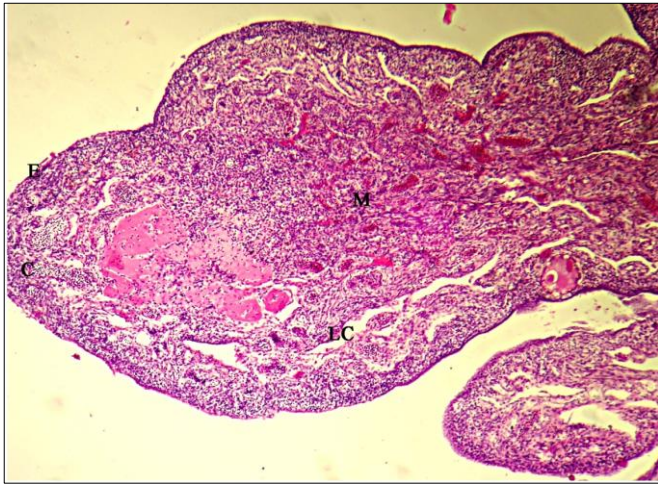


Fig 1: Photomicrograph of ovary of White Leghorn showing E-Epithelium, C-Cortex, M-Medulla, LC-Lacunar Channels. (H&E stain, 100X)

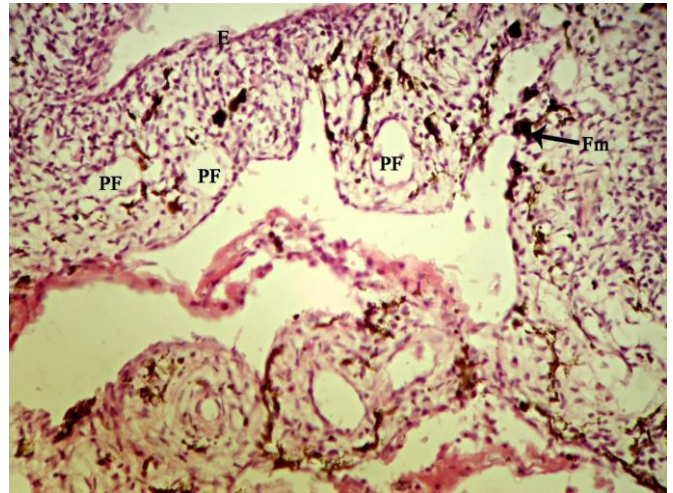


Fig 4: Photomicrograph of ovary of Kadaknath showing E-Epithelium, PF-Primary follicles and Fm-Fibromelanin pigment. (H&E stain, 400X)

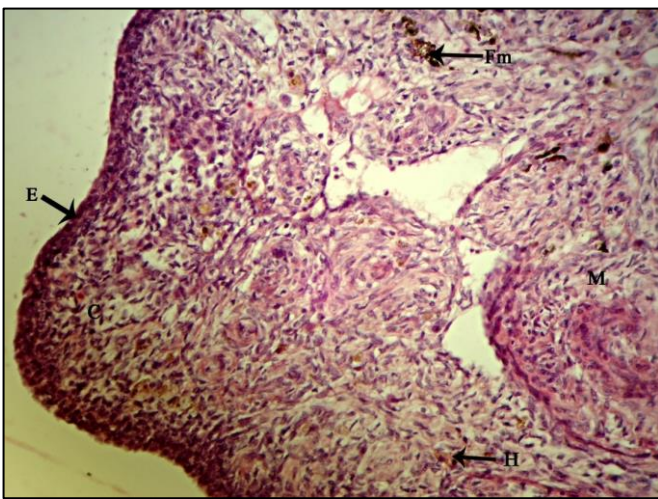


Fig 2: Photomicrograph of ovary of Kadaknath showing E-Epithelium, C-Cortex, M-Medulla, H-Hemosiderin and Fm-Fibromelanin pigment. (H&E stain, 400X)

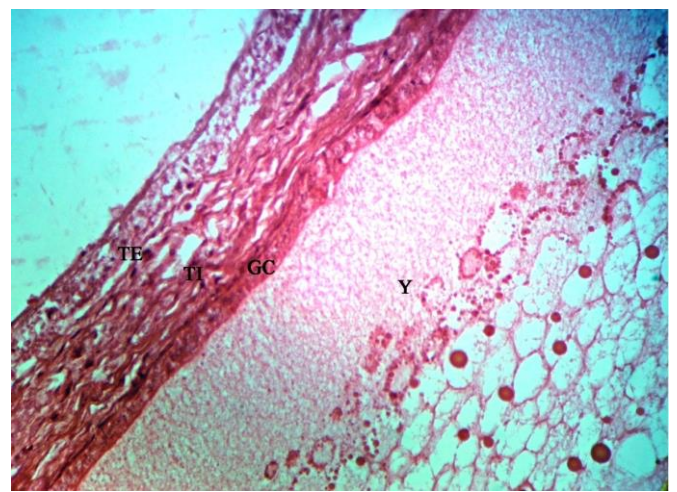


Fig 5: Photomicrograph of ovary of White Leghorn showing GC-Granulosa cells, TI-Theca interna, TE-Theca externa. (H&E stain, 400X)

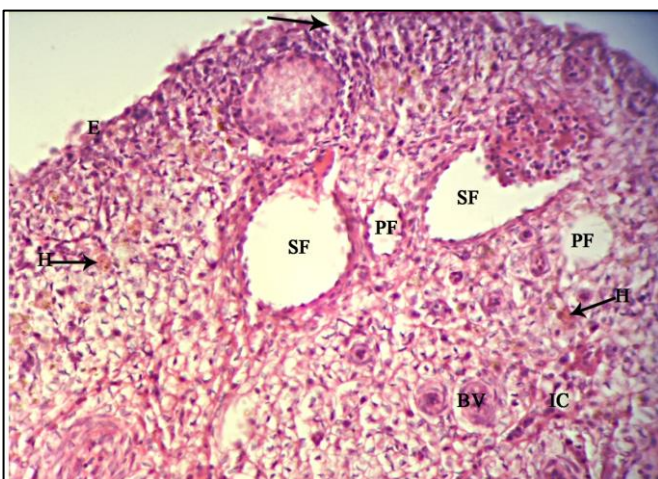


Fig 3: Photomicrograph of ovary of White Leghorn showing E-Epithelium, PF- Primary follicles, SF-Secondary follicles, IC-Interstitial cells, H-Hemosiderin, BV- Blood vessels and migration of epithelial cells (arrow). (H&E stain, 400X)

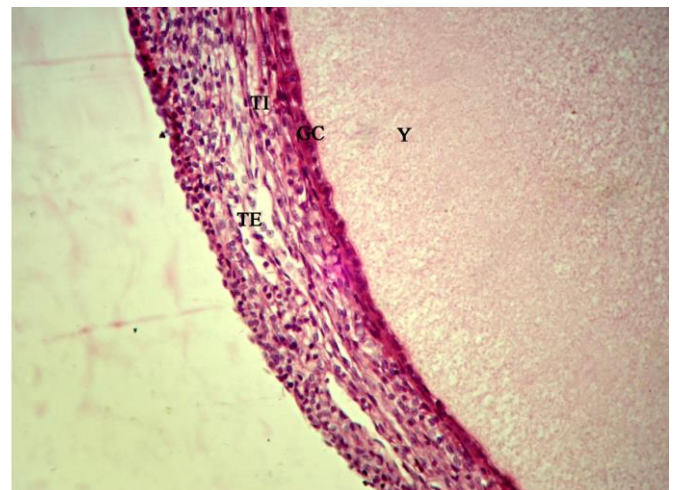


Fig 6: Photomicrograph of ovary of Kadaknath showing GC-Granulosa cells, TI-Theca interna, TE-Theca externa. (H&E stain, 400X)

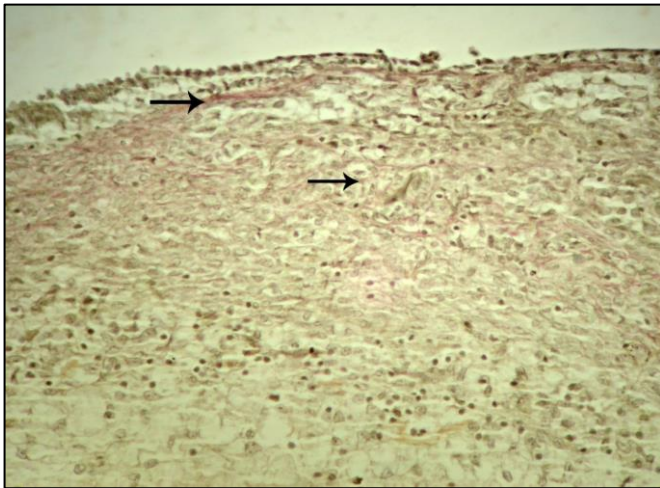


Fig 7: Photomicrograph of ovary of Kadaknath showing collagen fibers (arrows) in the connective tissue around follicles. (Van Gieson's stain, 400X)

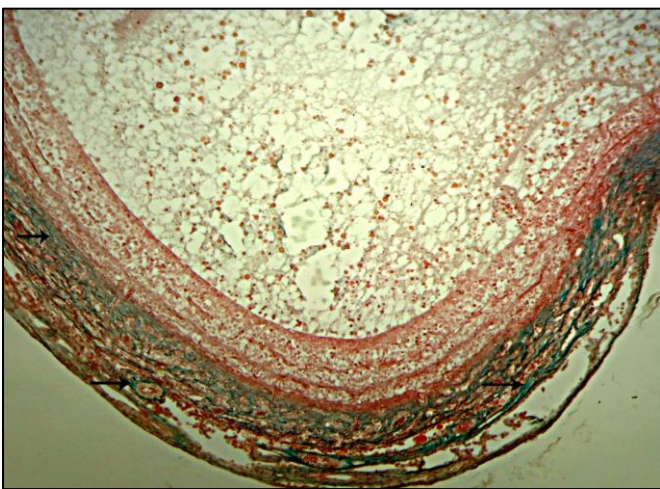


Fig 8: Photomicrograph of ovary of White Leghorn showing collagen fibers (arrows) in the theca layer of mature follicle. (Masson's trichrome stain, 100X)

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