

Histological Changes In The Adrenal Gland Of Indian Female Mongoose, *Herpestes edwardsii edwardsii* (Geoffroy) During Estrus And Pregnancy

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Abstract: Present histological study was conduct to correlate changes which occurs in adrenal gland during the estrus and gestation in female Indian mongoose *Herpestes edwardsii edwardsii*. During the gestation, diameter of three zones of adrenal cortex and medulla increases and variation in cellular structure relates with the histological synthesis of hormones for matching the environment to support foetal growth and also to maintain maternal and foetal homeostasis.

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Key words: Adrenal gland, Herpestes, Cortex, Medulla.

INTRODUCTION

Adrenal gland is a key for hibernation. and It plays an important role towards metabolism and homeostasis of mammal's .The life saver and life protecting hormones secreted by adrenal gland helps to withstand the stress and trauma during pregnancy. Mammalian adrenal gland is unique among the vertebrate where the steroidogenesis and chromaffin secreting cells are separated as cortex and medulla respectively. Gross morphology and weight characteristics for adrenal gland in population of small Indian mongoose , *Herpestes auropunctatus* are anatomically similar to those in cat, dog and typical in those carnivore .The minor adrenal response to seasonal fecundity, environmental characteristic and variation in population density may be a characteristic of carnivora quite in contrast observed in highly sensitive rodent (Tomich,P,1965).However in order carnivora, environmental stress and seasonal variations induced pathological alterations in the adrenal gland which was observed in common seals, *Phoca vitulina vitulina* and in Mink respectively (Bragulla, H,*et,al* ,2004; Ramos, A. S *et,al* 1972).

Distinct trizonations of the adrenal cortex are zona glomerulosa, zona fasciculata and zona reticularis which are well marked in seals *Phoca vitulina* (Richard) (Sucheston, M.E.*et.al*,1980), bottlenose dolphin and striped dolphin of Atlantic sea(Vukovi,S, *et.al*,1961). However the cytological structure of adrenal cortex and medulla was studied in ferret *Mustela putoris* [Holmes, R. L,1961] and Indian grey mongoose *Herpestes edwardsii edwardsii* (Raju, P.V.P *et.al*, 1982) and ultrasonographic visualization in ferret (Kuijten,A.M,*et.al*, 2007). As per the available data the knowledge of the carnivore mammals is merge in this paper and attempt has been made to show the histological changes in adrenal

gland of female mongoose *Herpestes edwardsii edwardsii* (Geoffroy) which occur during estrus and pregnancy.

MATERIAL AND METHOD

For the present study the animals were captured alive as per breeding cycle [8] from rice field and nearby areas in Bramhapuri, District Chandrapur (Maharashtra),in a cage type traps which were baited with fish as a food and acclimatized to the laboratory conditions for a period prior to their use and animals maintained on diet containing fish and chicken pieces with ample of water .After a period of acclimatization adrenal gland was immediately dissected out and fixed for 24 hrs in alcoholic Bouin's fixative. After fixation adrenals were and dehydrated in different grades of alcohol, cleared in xylene and embedded in paraffin wax. Sections were cut at 5-6 µm thickness and stained with haematoxyline and eosin for routine histological observation.

RESULTS HISTOLOGICAL OBSERVATION OF ADRENAL GLAND DURING ESTRUS

During the estrus period distinct trizonations of the adrenal cortex such as zona glomerulosa, zona fasciculata and zona reticularis as well as medulla is well marked. The cellular structure of zona glomerulosa has delineated from the capsule on the outer side fallowed by zona fasciculate and zona reticularis from the inner side. In zona glomerulosa the cells are spherical, compactly arranged and appeared as acinus like group ,each one with single nucleus with marked nucleolus (Fig.1).The zona fasciculate is the major portion of the cortex with cuboidal cells, some columnar as well as polygonal in shape which are arranged in radiating columns. The

cytoplasm is homogeneous and the nucleus is spherical and centrally situated. The size of the nuclei increases progressively towards the medullary part. The cells and their nuclei are larger than those of zona glomerulosa. The cells usually display a single nucleus with a nucleolus (Fig.2). While zona reticularis is in the form of anastomosing cords of cells, which merges with zona fasciculata above and medulla below and having varying degree of shape and size. Blood spaces are also observed in the network of cell cords (Fig. 3).

During estrus the medullary zone is small and made up of small cells. Both the cell types are encircled by the blood vessels. The appeared cluster of cells, which are in the form of acini, shows small nucleus. The cytoplasm is granular, eosinophilic with few vacuolations (Fig. 4).

HISTOLOGICAL OBSERVATION OF ADRENAL GLAND DURING PREGNANCY

During pregnancy the diameter of all these zones increases and acinar structure of zona glomerulosa exhibits hypertrophy as compared to estrus. The cells are elongated and cytoplasm is more vacuolated. The nucleus is rounded and some with darkly stained nucleolus (Fig.5). In zona fasciculata cells are large spherical to polygonal. The cytoplasm is more vacuolated and foamy while nucleus is pushed to one side which shows "Ballooning" effect. It is faintly stained, and contains darkly stained eccentric nucleolus (Fig.6). However zona reticularis is hypertrophied and cells are large with less foamy cytoplasm. The faintly stained nucleus is centrally situated and shows prominent nucleolus. Blood vessels are seen in the zona reticularis (Fig.7).

However during early and mid pregnancy the medullary zone is enlarged and very well developed with an increase in the cell dimension. The compactly arranged groups of cells are darkly stained in estrus and are seen scattered during mid pregnancy. The prominent feature during pregnancy is an increase in blood supply to the medullary region (Fig. 8).

DISCUSSION

The adrenal cortex in this species differentiated into three zones viz., zona glomerulosa, and zona fasciculata and zona reticularis. A distinct zonation of the cortex is observed in *M. schreibersii* (Panel, 1961), *V. pipistrellus* (Saidapur and Nadkarni, 1976), *M. lyra lyra* (Sonwane, 2010), *Taphozous kachhensis* (Chavhan *et.al* 2011). While in female bat *Taphozous longimanus* (Nerkar, 2009) has reported that the cortex is differentiated into two zones viz., zona

glomerulosa, and zona fasciculata. Zona reticularis is absent.

Adrenal cortex during reproductive phases shows some remarkable features in respect to zone dimension, cell dimension and vacuolations of cytoplasm. Adrenal gland during estrus and pregnancy shows significant differences at structural level in respect to cortical cell. During pregnancy the zone dimension and vacuolation in zona glomerulosa, zona fasciculata and zona reticularis increases as compared to estrus. However, zona fasciculata is more hypertrophied than the other two zones. The ballooning effect is more prominent due to the large number of lipid droplets and the nucleus becomes eccentric. The hypertrophy of cortical cells seems to suggest that steroid secretion and elaboration from them must be involved with at least some aspects of gestation (Shetty, J, *et.al* 1965). The hyperactivity of adrenal during pregnancy in *Herpestes edwardsii* correlates with the findings of Wood and Barnett, 1964. They observed an increase in maternal cortisol secretion during pregnancy in many species including man and it is assumed that increased adrenal activity in *Herpestes edwardsii* may be for maintaining stress and environment to support the foetal growth and development as in other species. Because the insufficiency of which results in disturbances in the maternal and foetal homeostasis (Fadhil Al-lami, 1969). The above observations clearly show the normal synthesis of hormones in the medullary cells, which help the animal to cope up with the stress during the different reproductive period. As the stress during pregnancy is more, the cellular organelles are much more developed than the other periods of reproductive cycle.

Wood, J. C, *et.al*, 1964, have reported that the medullary zone takes part in the stress management in Syrian hamster. The medulla has more norepinephric cells during the cold stress and the depletion of the norepinephric cell occurred after the stress is over and exocytosis seem to be the mechanism involved in the released of catecholamines. Similar observations are also reported in mouse by Eranko, O, in 1955. The adrenalin and noradrenalin secretion of medulla play an important role in carbohydrate and fat metabolism. It keeps the glucose level high during stress by glucogenolysis in the liver and muscle cells so in addition to corticosteroid these hormones also assist in keeping control over the metabolic rate in the animal. Our results on medulla of *Herpestes edwardsii* are in conformity with other animals. As the stress of pregnancy increases further, the medullary cells also show further development.

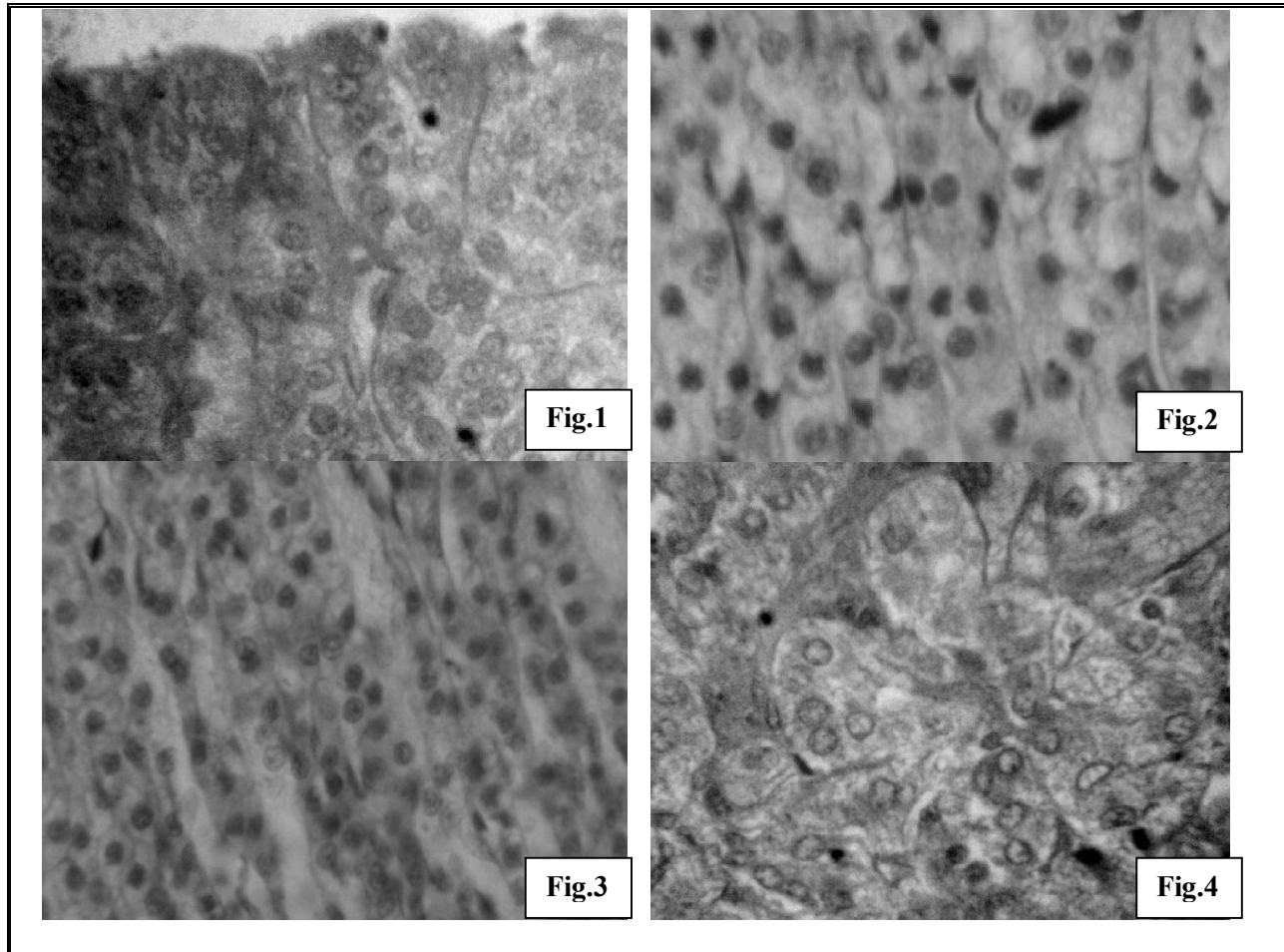


Fig 1. : Transfers section of adrenal gland during estrus period showing vacuolated cells of zona glomerulosa with darkly stained nuclei X 400.

Fig 2. : Transfers section of adrenal gland during estrus period showing elongated cell cords of zona fasciculata (ZF) with vacuolated cell cytoplasm X 400.

Fig 3. : Transfers section of adrenal gland during estrus period showing zona reticularis (ZR) are in the form of anastomosing cords and having varying degree of shape and size. Each cell has eosinophilic cytoplasm with basophilic nucleus blood spaces are observed in the network of cell cord of zona reticularis X 400.

Fig 4.: Transfers section of adrenal gland during estrus period showing medulla (MD) consist of cell arrangement in irregular stands or acinus type surrounded by blood capillaries content darkly stained nucleus. Cytoplasm of cell is basophilic and granular in some cells, vacuolation is observed X400.

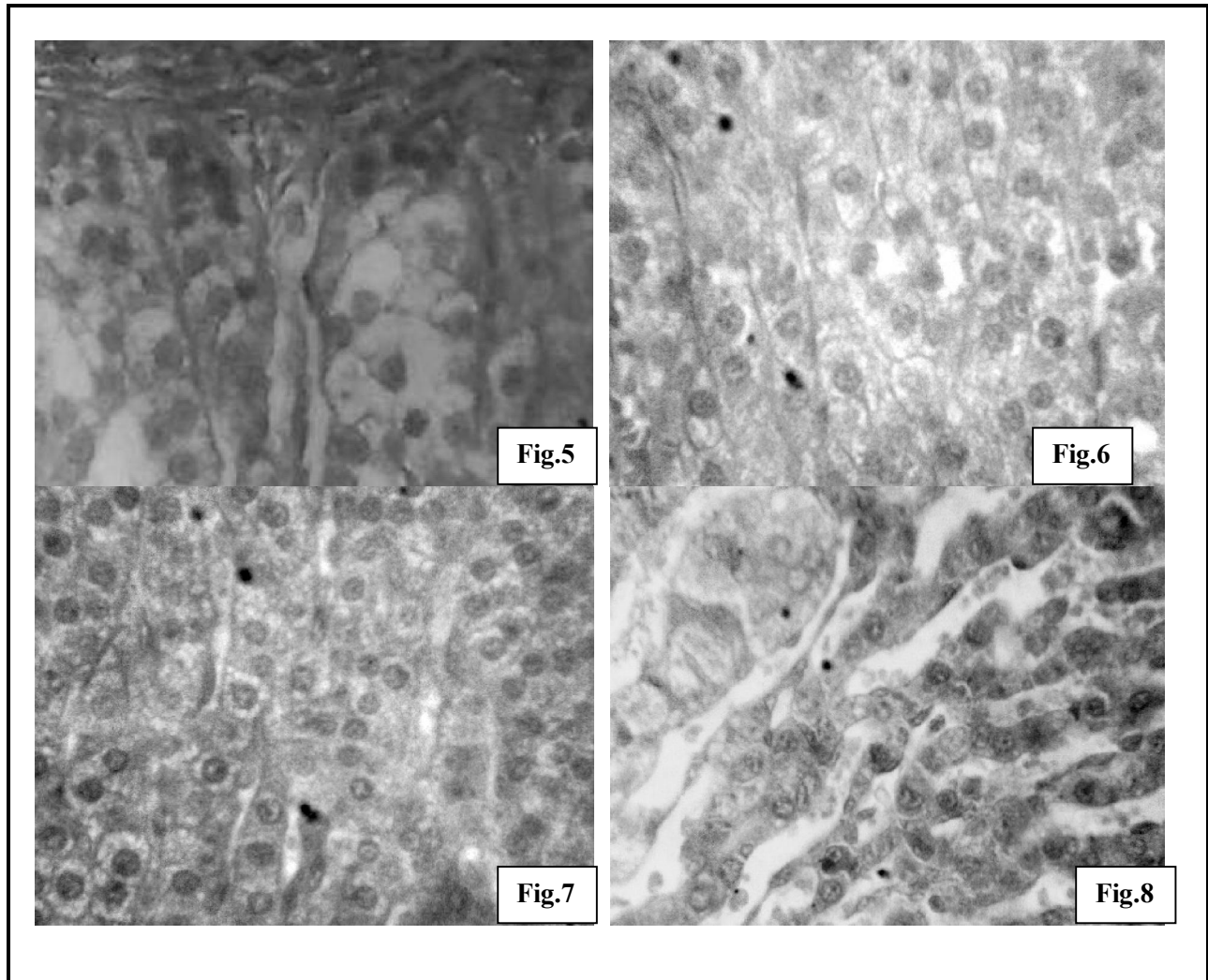


Fig 5. : Transfers section of adrenal gland during pregnancy showing elongated cells of zona glomerulosa (ZG) with darkly stained spherical elongated nuclei X 400.

Fig 6. : Transfers section of adrenal gland during pregnancy showing elongated cell cords of zona fasciculata (ZF) with cytoplasm is more vacuolated and foamy and nucleus is pushed to one side which shows "Ballooning" effect. X 400.

Fig 7. : Transfers section of adrenal gland during pregnancy showing zona reticularis (ZR) spherical shape of nucleus with prominent nucleoli X 400.

Fig 8. : Transfers section of adrenal gland during pregnancy showing medulla (MD) cells are scattered and surrounded by blood capillaries X 400.

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