

AGE RELATED CHANGES OF THE ADRENAL GLAND IN JAPANESE QUAIL (*Coturnix coturnix japonica*)

Sabiha.H.Basha¹, T.A.Kannan² and Geetha Ramesh³

Department of Veterinary Anatomy & Histology, Madras Veterinary College
TANUVAS, Chennai, Tamilnadu

ABSTRACT

The age changes in the histomorphology of the adrenal gland was recorded in different age groups of Japanese quail viz. Juvenile, immature, mature and senile birds of about 156 weeks of age. The tissues were collected from the above age groups, fixed in NBF, Bouin's fluid and Orth fluid and processed by paraffin embedding technique. The adrenal gland of juvenile age group showed a well defined interrenal tissue and the chromaffin tissue. The interrenal tissue of the adrenal gland in one week old birds formed distinct loops in the periphery and cell cords in the inner portion of the gland. In immature age groups, the two zones of the interrenal tissue were well demarcated and medullary cells formed a discontinuous subcapsular layer and also intermingled in between the interrenal tissue in the form of islets. In mature birds the differentiation of interrenal cells into four types and foamy appearance of the inner zone interrenal cells was well established. Birds at molt revealed shrinkage of the interrenal tissue due to atrophic changes while hyperplasia of the interrenal cells and ganglionic transformation of medullary cells were noticed in senile birds.

Key words: Adrenal gland, histomorphology, interrenal tissue, medulla, age changes, Japanese quail

INTRODUCTION

Birds are unique among homeothermic vertebrates, in which cortical and medullary tissues of the adrenal gland are found always intermingled. Adrenal glands are reported to be the primary source of steroid hormones for water and mineral metabolic reactions for which enzymes play a major role. It also forms the secondary source of sex steroids in addition to gonads and has various decisive function on the developmental processes. (Tanabe *et al.*,1983).The adrenal gland exhibits structural changes in accordance to age and

physiological status of the bird. Hence this study is an attempt to record the histomorphological changes of the adrenal gland in correlation with age in Japanese quail.

MATERIALS AND METHODS

The materials for the study were collected from both male and female Japanese quail of

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1- Associate Professor, Madras Veterinary College, Chennai.

2- Associate Professor 3- Professor and Head.Email:sabihahb@yahoo.com

different age groups such as juvenile (day old), immature(2-6 weeks), and mature age group(7-40 weeks).Tissues were also collected from senile birds of 156 week of age.

The tissue pieces from both the right and left adrenal gland were collected from birds of either sexes. After washing in normal saline the tissues were fixed in neutral buffered formalin, Bouin's fluid, Zenker formol (Helly's fluid), Orth fluid and Regaud's fixative and processed for routine paraffin embedding. Sections were cut at 5-6 micron thickness and used for the following routine. Haematoxylin and eosin staining and special histological techniques to differentiate the two types of medullary cells such as Eosin aniline blue method(Wood,1963) Potassium iodate method(Pearse,1972) and Formaldehyde induced fluorescence method (Kiernan,1990).For histochemical study, Periodic acid Schiff method and Oil Red 'O' method were performed for demonstrating carbohydrates and lipids.

RESULTS AND DISCUSSION

The adrenal gland of day old quail showed a thin capsule with few undifferentiated mitotic cells . Few epididymal tubules were found in the male birds beneath the capsule.The cell cords of the interrenal tissue were not organised to form the stacks as reported by Prasad (1994) in duck. The zonation of the interrenal tissue into subcapsular zone and inner zone was not evident in the adrenal of the day-old Japanese quail similar to the observations made in grey quail, parakeet and myna (Bhattacharya and Ghosh ,1972).

The interrenal columnar cells had no vacuolations. The chromaffin cells had the tendency to form smaller islets among the interrenal cells. The chromaffin cells were very few in the subcapsular zone (Fig 1). Among the two types of chromaffin cells, the noradrenaline cells were found to be more predominant than the adrenaline cells. Sinusoids were small and very few in number.

In one to three week-old birds the proportion of interrenal and medullary tissue increased. Arrangement of the interrenal cell cords formed two definite zones viz. subcapsular zone and inner zone .Aire (1980) reported the existence of two clear zones of interrenal tissue in Nigerian fowl. On the contrary Knouff and Hartmann(1951) observed three zones of interrenal tissue in Brown pelican just as in mammals.The thickness of the capsule increased with the incorporation of a rich capillary network, numerous ganglion cells and Herbst corpuscles. The interrenal tissue of the adrenal gland in one week - old bird formed distinct loops in the periphery and long irregular cords in the inner portion of the gland as observed by Bhagyashri and Nadkarni (1980) in pigeon, crow and sparrow.

In immature birds the two zones of the interrenal tissue were well appreciated in four week-old Japanese quail. The cells of the subcapsular zone were intensely fuchinophilic and pyroninophilic than that of the inner zone as in duck adrenal (Prasad,1994). Medullary cells in the form of islets were concentrated near the sinusoids in the inner zone. Medullary cells also formed a discontinuous subcapsular layer. Presence of ganglion cells were common in the medullary islets of four week-old birds. The noradrenaline cells outnumbered the adrenaline cells in the immature age groups of both the sexes studied as observed by Sivaram (1965) in fowl .

The histomorphology of the adrenal gland in the mature age groups of Japanese quail revealed characteristic structural features attributable to sexual maturity. The width of the cortical cells both in the subcapsular zone and in the inner zone increased markedly and also number of medullary cells were widely distributed. The four types of interrenal cells could be identified well of which the inner zone cells were foamy in appearance in lieu of their heavy lipid accumulation (Fig 2). The cells of the subcapsular zone had lesser lipid accumulation comparatively. Heavy lipid accumulation in the interrenal cells was marked during the active period

of egg laying (8-28 weeks of age) as reported by Hohn et al.,(1965) in mallard and George and John(1988) in Canada goose.

The adrenal gland of the birds at molt showed marked shrinkage of the interrenal tissue. Atrophic changes characterized by a decrease in the size of the interrenal cells, a depletion in their lipid content and marked pyknotic changes of their nuclear material was noticed (Fig. 3)similar to the reports of Vyas and Jacob(1976) in Indian avian species. PAS positive material was at its minimum in the cortical and medullary tissue of the adrenal gland in the molting phase in quails than the remaining phases of its physiological activity similar to chicken and Nigerian fowl (Aire,1980).

In senile birds increase in the thickness of the capsule was very characteristic. Epithelial cellular aggregation was noticed in the capsule. Hyperplastic changes was marked both in the subcapsular zone and the inner zone of the interrenal tissue in birds of both the sexes at senility (Fig 4).Interrenal tissue was sparse in PAS positive and sudanophilic

materials. Ganglionic transformation of the medullary cells was evident as explained by Jayne (1957) in old rats.

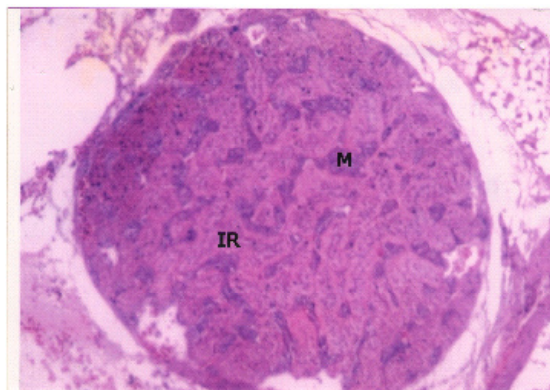
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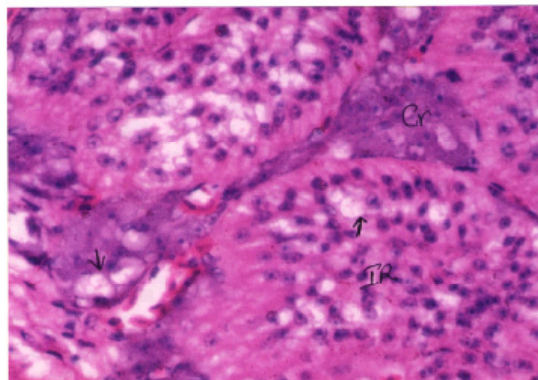
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Fig 1.
Photomicrograph of an adrenal gland from a day- old Japanese quail showing its panoramic view and the components



H&E x 25 IR- Interrenal tissue M- Medullary islets

Fig 2
Photomicrograph of an adrenal gland from a twelve week- old Japanese quail showing lipid accumulation in the cortical and medullary cells(arrows).

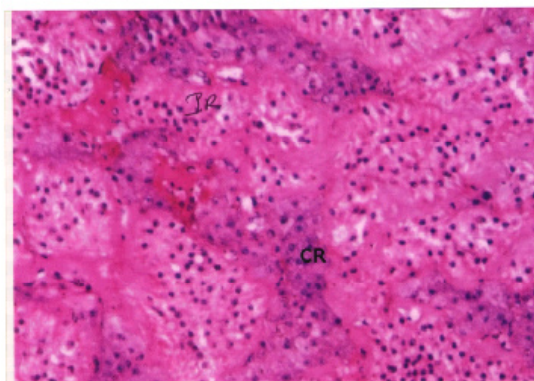


H&E x 160

IR - Interrenal cells

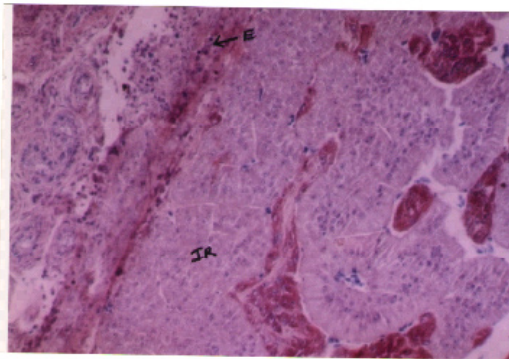
Cr - Chromaffin cells

Fig.3.
Photomicrograph of an adrenal gland from a fifty week- old Japanese quail showing atrophic changes of interrenal tissue at molting



H&E x 160 IR - Interrenal cells Cr - Chromaffin cells

Fig 4.
Photomicrograph of an adrenal gland from an one hundred and fifty six week- old Japanese quail showing senile changes



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