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ELECTRON MICROSCOPICAL STUDY OF ADRENAL GLAND IN GUINEA FOWL*

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ABSTRACT

The ultrastructure of adrenal gland of guinea fowl was recorded by using scanning and transmission electron microscopy. The parenchyma of adrenal gland constituted mainly of three components, namely cortical or interrenal tissue, medullary or chromaffin tissue and vascular sinusoids. Four types of cells viz., type-I, II, III and IV were identified in adrenal cortex by transmission electron microscopy. In scanning electron microscopy the cortical cells showed blebs, cords, globules and cord like aggregates on their surface. In transmission electron microscopical observation, three types of cells were identified in medullary tissue of adrenal gland viz., Adrenaline cells, nor adrenaline cells and stellate shaped satellite cells. In scanning electron microscopical observation, the medullary cells were granular filamentous structure and showed prominent microvillus like projection on their surface.

Key words : Electron microscopy, Adrenal gland, Guinea fowl.

INTRODUCTION

Among homeothermic vertebrates, birds are unique in which cortical and medullary tissues of the adrenal gland are found always intermingled. Though extensive work has been done to elucidate the functional significance of the components, of the adrenal gland, is very sparse in all classes of vertebrates. Hence an attempt has been made to record the ultra structures of the glandular tissue in guinea fowl.

MATERIALS AND METHODS

Tissue samples from adrenal glands of 12 week-old birds (six birds) were collected for electron microscopical studies.

Scanning electron microscopy : The samples were placed in 4% glutaraldehyde for 1 hr at 4^0C for scanning electron microscopy (SEM) studies. After two to three rinses with phosphate buffer they were placed in different gradients of alcohol (10-100%) for dehydration. The samples were air-dried, mounted on alumina stubs and coated with gold in a JEOL – JSM – 6360 vacuum-evaporator and observed under a JEOL – JSM – 6360 scanning electron microscope (Bancroft and Stevens, 1996).

Transmission electron microscopy (TEM) : Small pieces of adrenal gland (1-2 mm thickness) were collected and prefixed in 3%

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glutaraldehyde in 0.05M phosphate buffer (pH 7.2) and stored at 4^0C for 24 hours. Subsequently, the tissues were washed in cold sodium cacodylate buffer solution (pH 7.4) for 30 minutes (3 changes each) and postfixed in 1% osmium tetroxide for 2 hours at 4^0C. The samples were washed in sodium carbonate buffer two times for 15 minutes each. The tissues were then dehydrated in ascending grades of cold alcohol (50, 70, 80, 90 and 95% absolute alcohol respectively) and propylene oxide and were embedded in epoxy-araldite mixture. Semi-thin, 200-300 nm thickness sections were obtained and stained by toluidine blue. Ultrathin sections were prepared and stained with uranyl acetate (2%) and lead citrate (1%) (Bancroft and Stevens, 1996). The ultra thin sections were examined under computer augmented transmission electron microscope.

RESULTS AND DISCUSSION

The cortical cells of the adrenal parenchyma in Guinea fowl showed blebs, cords, globules and coral like aggregates on their surfaces. The cord like arrangement of cortical cells were exhibited as raised undulating masses interwoven with circumscribed granulated medullary masses (Fig-1) in scanning electron micrograph which concur with the findings of Ghosh *et al.* (2001) in woodpecker, kingfisher, parakeet and common snipe.

In transmission electron microscopy, all the four types of the cortical cells were clearly distinguished by the differences in the mitochondrial structure and the quantity of smooth endoplasmic reticulum and lipid droplets they revealed at ultrastructural level. Type-I cells of subcapsular zone displayed numerous lipid droplets and polymorphic mitochondria with less developed smooth endoplasmic reticulum (Fig-2). Type-II cells of inner zone contained large lipid

Fig 1: Scanning electron micrograph of adrenal gland of a twelve week-old male Guinea fowl showing blebs, cords, globules on the surface of the cortical cells (arrow) appearing as raised undulating masses interwoven with medullary tissue

AC-Cortical cords M-Medullary islets

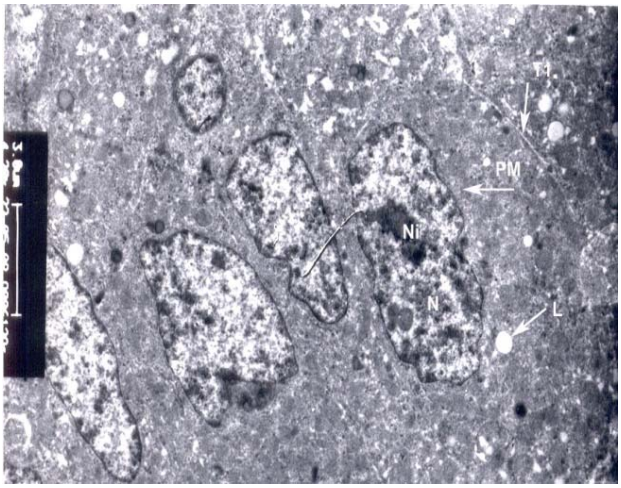

Fig 2: Transmission electron micrograph of adrenal gland from a twelve week-old male Guinea fowl showing type-I cells of subcapsular zone.

T1-Type-I cortical cell, N-Nucleus, Ni-Nucleoli, L-Lipid droplet, PM-Polymorphic mitochondria.

droplets with numerous globular mitochondria and well formed smooth endoplasmic reticulum (Fig-3).The type-III cells were clear with abundant tubular smooth endoplasmic reticulum and globular mitochondria. Type-IV cells were having pyknotic nuclei and had abundant smooth endoplasmic reticulum and small globular mitochondria and they were rarely seen. This is

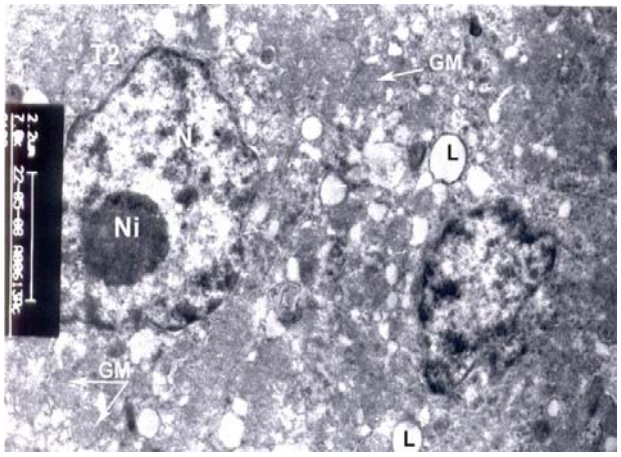

Fig 3 : Transmission electron micrograph of adrenal gland from a twelve week-old male Guinea fowl showing type-II cells of adrenal cortex.

T2-Type-II cortical cell, N-Nucleus, Ni-Nucleoli, L-Lipid droplet, GM-Globular mitochondria

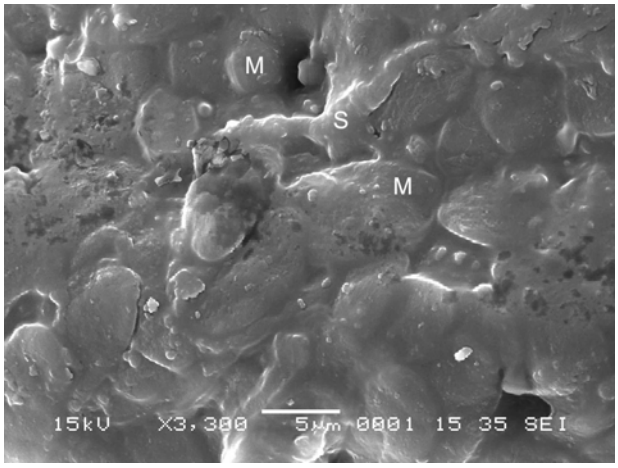

Fig 4: Scanning electron micrograph of adrenal gland of twelve week-old male Guinea fowl adrenal showing medullary cells and stellate cells with processes.

M-Medullary cells S-Satellite cells

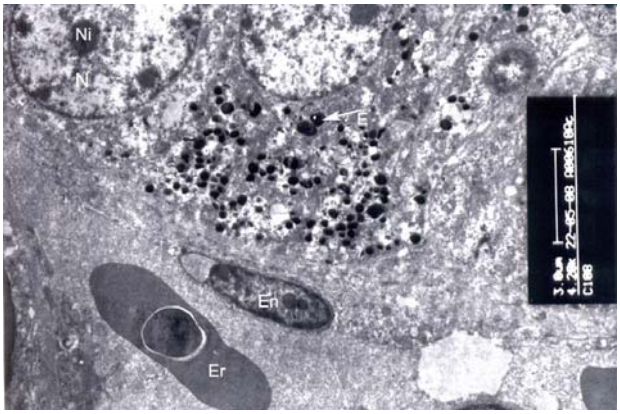

Fig 5 : Transmission electron micrograph of adrenal gland from a twelve week-old male Guinea fowl showing noradrenaline cells with electron dense cytoplasmic granules.

N-Nucleus En-Endothelial cell lining sinusoid
Ni-Nucleoli Er-Nucleated Erythrocyte
E-Electron dense granule

in total agreement with the findings of Basha *et al.* (2004) in quail.

The medullary parenchymal cells in scanning electron microscopy appeared as granular particulates, filamentous structure and showed prominent microvilli like projections on their surface (Fig-4) in the adrenal of woodpecker, kingfisher, parakeet and common snipe (Ghosh *et.al.*, 2001). Martinotti *et al.* (1991) recorded that the stellate cells with primary secondary and tertiary cytoplasmic processes were situated in perivascular and interstitial spaces and showed an ovoid and smooth surfaced cell body provided with occasional short microvilli in mammalian adrenal cortex. The similar findings were also recorded in the present study.

Based on the size of electron dense granules in the medulary cells, two types of cells were identified in transmission electron microscopic observation. The cells with large and highly electron dense granules were noradrenaline cells (Fig-5), those smaller in size and less electron dense granules were the adrenaline secreting cells (Fig-6). The cytoplasm of noradrenaline cells contained elongated mitochondria with laminated cristae and short strands of rough endoplasmic reticulum, where as the cytoplasm of adrenaline cells contained few smooth endoplasmic reticulum and mitochondria. These findings are in conformity with the report of Cuello (1970) in Gentoo penguin, Guzsal and Hassan (1976)

in goose and duck, Ali (2001) and Sabiha and Geetha Ramesh (2007) in quail.

The size of noradrenaline cells ranged from 188.87 nm to 328.2 nm while adrenaline cell granule size ranged from 157.29 nm to 269.20 nm in the twelve week-old Guinea fowl. The size of the granules of noradrenaline and adrenaline cells in transmission electron microscopic observation are in total agreement with the finding of Guzsal and Hassan (1976) in goose and duck, Ghosh *et.al.*, (2001) in avian species and Sabiha and Geetha Ramesh (2007) in quail.

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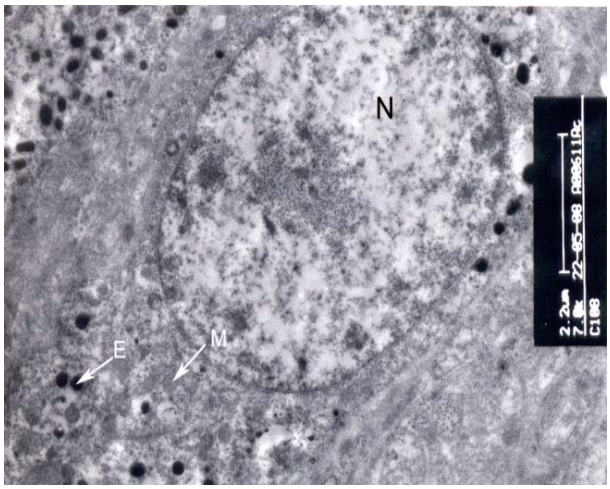

Fig 6 : Transmission electron micrograph of adrenal gland from a twelve week-old male Guinea fowl showing adrenaline cells with less electron dense granules.
N-Nucleus, M-Mitochondria,
E-Electron dense adrenaline granules

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