



Original Article

**Ultrastructural Characterization of the Somatotrophs in Pars Distalis of the Indian Wild Caught Female Bat, *Taphozous Kachhensis* (Dobson)**

Pankaj Chavhan<sup>1,\*</sup> and Amir Dhamani<sup>2</sup>

<sup>1</sup> Shri sadguru saibaba science college, Ashti, India

<sup>2</sup> Department of Zoology, N.H.College, Bramhapuri, India

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**Corresponding Author:**

Pankaj Chavhan  
panksphd@gmail.com

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**ABSTRACT**

The pituitary cells are regulated by numerous endocrine, paracrine and autocrine feed-back pathways, and their hormone secretion exerts major control over the function of several endocrine glands as well as a wide range of physiologic states. During estrus STH cells are spherical to oval in shape with the spherical nucleus. Cytoplasm of STH cell is filled with a large number of round to oval shaped secretory granules of diameter ranges from 200-400nm. STH cells during early pregnancy are polyhedral in shape with eccentric nucleus and mostly euchromatic. Mitochondria are spherical to oval in shape with lamellar cristae. The Golgi zone is observed juxtannuclear in position. Secretory granules are increases in number as compared to estrus. STH cell during lactation are polyhedral in shape. Rough endoplasmic reticulum are elongated, tubular dotted with ribosomes. Secretory granules are seen scattered in the cytoplasm. The diameter of secretory granules is about 230 nm.

**Key words:** Bat, Pars Distalis, ultrastructure, Somatotrophs.

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**INTRODUCTION**

The endocrine gland plays a vital role in the reproductive physiology of the Chiropteran species. The light and ultrastructural findings in the pituitary gland by many workers gave much more information about different cell type in pituitary gland. The different cell found in the pars distalis play very important role in the reproductive cycle of the animals. Biologists attempting to investigate central endocrine mechanisms in bats face obvious difficulties on all these fronts. Wild-caught bats, sampled at different phases of their reproductive cycles, have provided the basis for most of our current knowledge. As a result, most studies have been descriptive in nature, documenting apparent changes in hypothalamic and pituitary activity that occurs over the course of male and female reproductive cycles. However, efforts to maintain healthy captive bat colonies, in which individuals not only survive over the long

term, but also reproduce, are becoming increasingly successful. Nerkar and Gadegone (2010) have reported the structure of FSH cell in pars distalis of female bat *Taphozous longimanus* during different phases of reproductive cycle. STH cell are identified and differentiated on the basis of activity of Golgi body, and the elaboration of secretory granules, and the liberation of granules from cell membrane and morphology of mitochondria. Beside this shape and size of cell and nucleus.

In Vespertilionid bat, *Scotophilus heathi* Singh and Krishna (1994) have reported STH cell in pars distalis on the basis of specific morphological characters, staining reactions and immune characteristics. The detailed structure of STH cell in pars distalis of female bat *Hipposideros lankadiva* have been studied by Seraphim (2004). The present study was designed to elucidate the ultrastructural changes in STH cell of the pars distalis of female bat, *Taphozous kachhensis* during the physiology of reproduction.

## MATERIAL AND METHOD

*Taphozous kachhensis* (Dobson) is an exclusive Indian Emballonuridae bat found in caves, tunnels and temples. The bat selected for present study because of unique habits. The specimen of *Taphozous kachhensis* were collected from Aambai Nimbai, 45 kilometers from Bramhapuri (M.S.). Many collections were made during the breeding season so as to coincide with the time of reproductive cycle and to get an accurate pregnancy record. For the electron-microscopic study, the intermediate and posterior lobes were separated from the pituitary gland and the isolated anterior pituitary was fixed in fresh icecold 3% glutaraldehyde for three hours and then four hours in 0.1 M cacodylate buffer. The tissues were washed in buffer and then post fixed for one to two hours in 1% 0.067M cacodylate-buffered osmium tetroxide. After dehydration with graded series of alcohol, the tissues were cleared in propylene oxide solution and embedded in Araldite resin which would be polymerized at 60°C. Then, ultrathin sections from selected blocks were cut with glass knife and picked up on 400-mesh copper grids. Sections were double stained with 10% alcoholic uranyl acetate for 20 min and for 10 min in Reynold's lead citrate. The sections were examined under a JEM Jeol-100s electron microscope (Japan) at 80KV accelerating voltage and photographed.

## RESULT

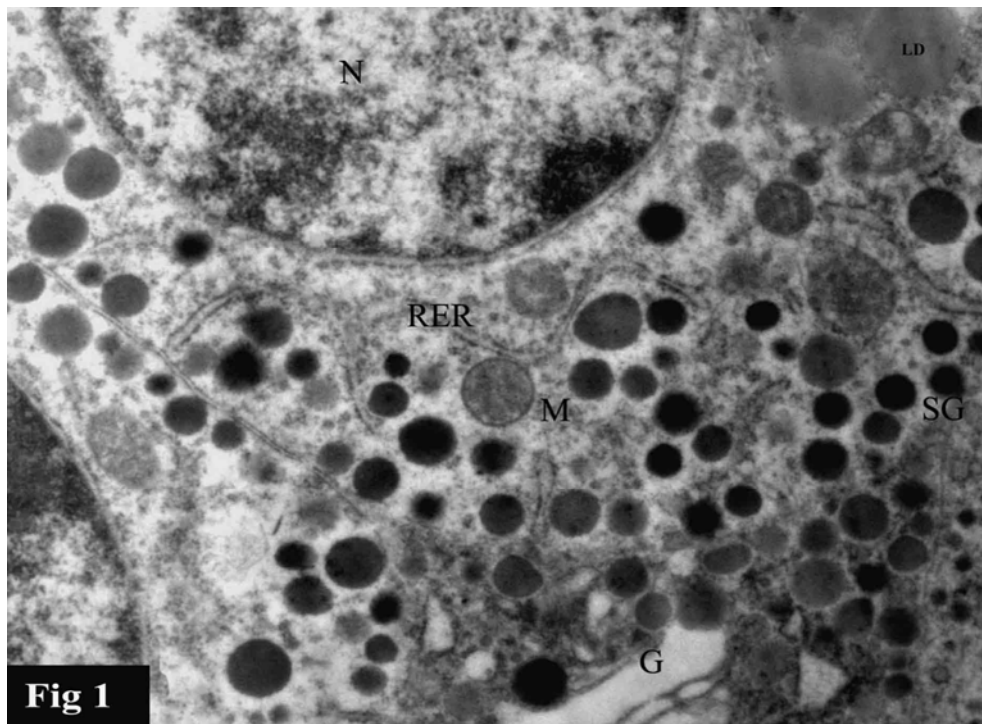
Electron microscopic study offers the advantage of revealing the state of activity of the cells and their morphological features in a precise manner, which allowing formulating criteria for their functional analysis. The current concept of cell identification and differentiation in the mammalian pituitary gland is based on the activity of the Golgi apparatus, the elaboration of secretory granules, liberation of granules from the cell membrane, development of the ergastoplasm and morphology of the mitochondria. Beside this, the shape and size of cell, nucleus and the distribution and morphological feature of secretory granules are also taken in to consideration. All these constitute visible changes which allow us to determine the state of secretory activity of each of the adenohypophysial cell. The present ultrastructural observation demonstrates the presence of six types of cells in the pars distalis of non-pregnant bat, pregnant and lactating bats of *Taphozous kachhensis*.

### **Somatotrophs (STH-cells)**

These cells are easily identified with electron microscopy. They are most prevalent cell type constituting about 40-50% of the adenohypophysial cell population. They are found through the pars distalis but especially in the lateral portion of the anterior lobe and far away from the blood capillaries.

### STH Cells During Estrus

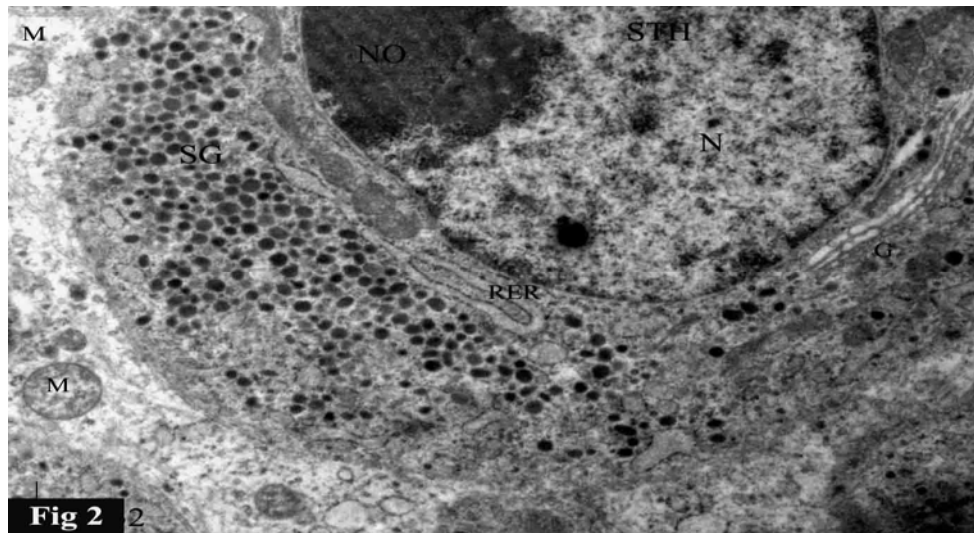
STH cells during estrus are spherical to oval in shape with the spherical to oval nucleus rather eccentric in position and contain developed nucleolus. A thin rim of chromatin material is attached to inner part of the nuclear envelope. Heterochromatin flakes are seen scattered in the nucleoplasm. The nuclear pore clearly observed. These cells have distinct limiting or plasma membrane. The electron dense cytoplasm of STH cell is filled with a large number of round to oval shaped osmophilic secretory granules of rather uniform in diameter. The diameter of granules ranges from 200-400nm. Mitochondria are spherical with lamellar cristae and are distributed in the cytoplasm. Rough endoplasmic reticulum is well developed and it is in the form of cisternae and scattered throughout the cytoplasm. Free ribosomes are seen scattered throughout the cytoplasm. Golgi apparatus consist of flatten or slightly dilated saccules (Fig. 1).



**Fig 1:** Electronmicrograph of Sth During Estrus Showing Dilated Golgi apparatus [G]. Note the Presence Of Elongated Tubules Of Rough Endoplasmic Reticulum [Rer] Dotted With Ribosomes. Note The Detaching Vesicle From Golgi Body. Note The Presence Of Lipid Droplets [Ld]. X 15000

### STH Cells During Early Pregnancy

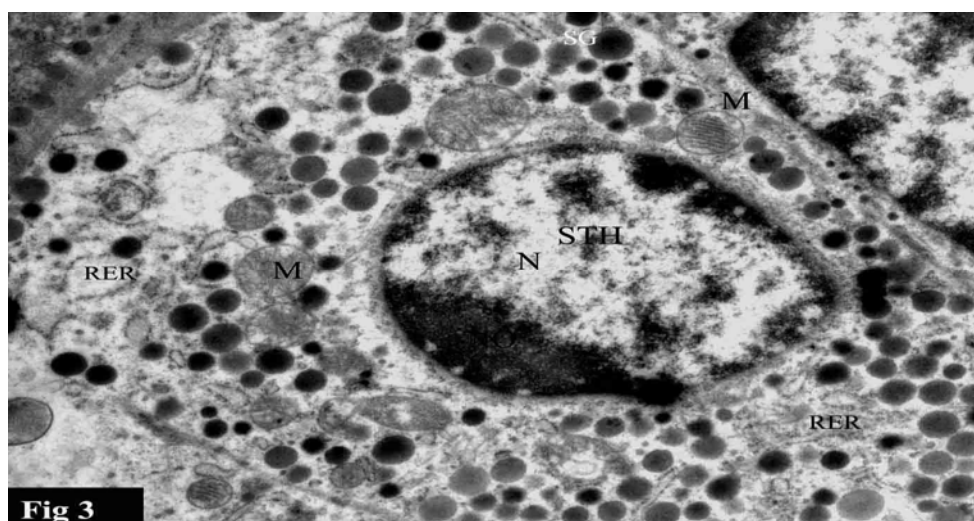
STH cells during early pregnancy are polyhedral in shape. Nucleus is eccentric and mostly euchromatic. A thin rim of chromatin material is observed below the nuclear membrane. Mitochondria are spherical to oval in shape with lamellar cristae. The Golgi zone is juxtannuclear in position. The Golgi complex consists of many flattened Golgi saccules associated with small vesicle. Rough endoplasmic reticulum consist of long tubular cisternae dotted with ribosomes are seen scattered in the cytoplasm. Some dilated cisternae of rough endoplasmic reticulum and polymorphic profiles of rough endoplasmic reticulum are also seen scattered throughout the cytoplasm. Secretory granules are increases in number as compared to estrus. They are large and small and mostly seen toward one of the poles of the cell. More secretory granules in somatotrophic cell suggest the storage state. The diameter of secretory granules ranges from 250-450nm (Fig. 2).



**Fig. 2:** Electronmicrograph of the Sth Cell in the Pars Distalis of Bat During Early Pregnancy, Showing Round to Oval Nucleus [N]. Note the Presence Of Large Number Of Secretory Granules [Sg] Mostly Seen Toward One Pole of Cell. Note The Presence Of Spherical Mitochondria [M] And Well Developed Golgi Apparatus [G]. Few Polymorphic Profile Of Rough Endoplasmic Reticulum [Rer] Are Seen. **X 6000**

### STH Cell During Lactation

STH cell during lactation are polyhedral in shape with oval to round in shape nucleus. A thin rim of chromatin material is attached to the inner rim of nuclear membrane. The nuclear pores are clearly seen. Golgi apparatus is inconspicuous. The rough endoplasmic reticulum is in the form of elongated, tubular cisternae dotted with ribosomes and some rough endoplasmic reticulums are dilated. Free ribosomes are also seen. Mitochondria are spherical with lamellar cristae. Secretory granules are seen scattered in the cytoplasm. The diameter of secretory granules is about 230 nm. In pars distalis of bat *Taphozous kachhensis* two type of STH cells are observed. One cell type corresponds to medium size cell with large Golgi area and few granules. While the other cell type observed corresponds to a large cell. The cytoplasm of which is filled with large secretory granules and contain reduced Golgi area. The first cell type represents an active cell engaged in hormone secretion, while the second cell type is in reserve state. These aspects correspond to so call functional alternate phenomenon (Fig. 3).



**Fig. 3:** Electronmicrograph Of The Sth Cell During Lactation Showing Regular Shaped Nucleus [N] With Well Developed Nucleolus [No]. Mitochondria [M] Are Spherical With Lamellar Cristae. Note The Presence Of Large Number Of Secretory Granules [Sg]. Note The Presence Of Dilated Rough Endoplasmic Reticulum [Rer]. **X 8000**

## DISCUSSION

However in the recent year by the use of electron microscope, the knowledge of pituitary cell in the pars distalis has been perceived to the greater extends. This offer the great advantage to disclose the static activity of the cell and their morphological feature in an accurate manner. By the use of electron microscope the cell identification and differentiation is possible on the cellular level.

Ultra structural characteristics of STH cells of Indian Emballonuridae female bat, *Taphozous longimanus* have been studied by Nerkar and Gadegone (2010) and they have reported that the STH cell are the most prevalent cell type in the pars distalis of bat, *Taphozous longimanus*. These are situated generally far from the capillaries. The pars distalis of estrus female shows that these cells are ovoid to polyhedral in shape and are found distributed throughout the pars distalis. The nucleus is irregular in shape with a little indentation and eccentrically placed, mostly euchromatic with varying amount of heterochromatin. A thin rim of heterochromatin is seen at the periphery of nucleus. Nucleolus is not visible. Mitochondria are spherical with lamellar cristae, distributed throughout the cytoplasm. Rough endoplasmic reticulum is not well developed and it is in the form of short tubular cisternae. Free ribosomes are seen scattered throughout the cytoplasm. Golgi complex is indistinct. The electron dense cytoplasm of these cells is filled with varying number of large, ovoid or markedly pleomorphic electron dense secretory granules. The size of granules ranges from 250-400 nm in diameter, supporting the present observation.

The Somatotrophs in the pars distalis during estrus are spherical and oval with spherical to oval nucleus. The secretory granules are dense, small, having diameter of about 200-300nm. Golgi complex is well developed. Mitochondria are spherical with collapsed cristae. The rough endoplasmic reticulum is prominent and perinuclear. During pregnancy numbers of secretory granules are increases. Endoplasmic reticulum is well developed. During lactation secretory granules and endoplasmic reticulum are reduced. This observation has been reported by Sonwane (2010) in Indian false vampire bat *Megaderma lyra lyra*.

STH cells are round to oval with eccentrically placed nucleus. The secretory granules are numerous, mostly round to oval with uniform electron density. The well developed Golgi, endoplasmic reticulum and small amount of secretory granules indicate a cell under vigorous synthetic activity while those filled with secretory granules with reduced Golgi complex suggest reserve or storage state of cells; this observation has been reported by Seraphim (2004) in *Hipposideros lankadiva* and supporting the present observations. The oval to round STH cells in pars distalis is reported in *Miniopterus schreibersii fuliginosus* by Mikami, *et al.* (1988). In general, secretory granules in the STH cells of bats are dense, membrane enclosed and from 350-400 nm in diameter (Herlant, 1963;1964; Azzali, 1971). STH cells thus, identified in the pars distalis of *Taphozous kachhensis* are comparable with STH cells identified and reported in the other species of bats confirming our observations (Bhiwgade *et al.*, 1989; Singh and Krishna, 1994; Seraphim, 2004; Sonwane, 2010; Nerkar and Gadegone, 2010).

The STH cells are round to oval in shape with centrally placed round nucleus. The secretory granules are numerous, uniform, round and very dense about 350-400nm in diameter. The Golgi apparatus is inconspicuous and mitochondria are round and scattered in the cytoplasm. This observation has been reported by Bhiwgade *et al.*, (1989) in Indian fruit bat, *R. leschenaulti*.

## CONCLUSION

In the present study, in pars distalis of bat *Taphozous kachhensis* two type of STH cells are observed. One cell type corresponds to medium size cell with large Golgi area and few granules. While the other cell type observed corresponds to a large cell. The first cell type

represents an active cell engaged in hormone secretion, while the second cell type is in reserve state. These aspects correspond to so call functional alternate phenomenon. The STH cell in the pars distalis of *T. kachhensis* during pregnancy are active, elaborating hormones which are needed for the development of embryo in one uterine horn. During lactation STH cells are active and increase milk production

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