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A Study On Hypophysis Cerebri In Slender Loris

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Abstract
Introuction: The slender Loris is a unique tiny arboreal, nocturnal primate. Steady declining of the species they are enlisted under endangered species. Many the histological studies are available pertaining to Hypophysis Cerebri of slender Loris, but histomorphometry have been poorly studied. Hence this study is carry out the histo-mophometic analysis and the anatomical aspects of Hypophysis Cerebri in slender Loris. Materials and Methods: The ten perfused brain of slender loris were embedded incelloidin and serial sections were prepared in sagittal planes at 50 micron thickness. They were stained incresyl fast violet and observed to study the histology. The surface area of pars distalis, pars intermedia, pars tuberalis, pars nervosa were calculated using histo-morphometric technique. Results and discussion: The average weights of pars distalis, pars intermedia pars tubularis and pars nervosa in slender Loris are 71 per cent, 2 per cent, 8 per cent, and 19 per cent respectively. Interestingly this data could be concomitant with data of cat those are in similar nocturnal behavior. Nocturnal behavior of this animal may have affected melanocyte production that might have resulted in pars intermedia be 3 % of the gland. As evidenced by histo-morphoetry and weight the manifestation of pars tubertalis could be depends upon photoperiodicity and animal behavior. Conclusion, In conclusion, the nature of pars intermedia and pars tuberalis could be depends upon photoperiodicity and adaptive behavior of the animal. This work recapitulates the research on neruo-anatomical aspects in this rare and forgotten species. Moreover this preliminary work might provide the opportunity to comprehend the comparative anatomy.

INTRODUCTION

The slender Loris is a unique tiny arboreal, nocturnal primate. Its scientific name is Loris tardigradus by Linnaeus in 1758. Generally called as thevangu in Tamil. Commonly found in the tropical scrub and deciduous forests as well as the dense hedgerow plantations bordering farmlands of Southern India and Sri Lanka. They are often found on tropical rain forest and also in semidecidious forest. It prefers to inhabit thick, thorny bushes and bamboo clumps where it can evade predators and also find insects, which is the main diet. These animals are about 25 cm

long and have long, thin arms. They weigh around 275 grams. They have a small, vestigial tail. Their most prominent feature is the pair of two large, closely set, brown eyes.
It is believed that the slender Loris has some medicinal or magical powers and also stealing of Loris has led to the steady decline of the species. In addition, other threats include habitat loss, electrocution on live wires, and road accidents [BBC news. 2012]. Along the western region of Tamil Nadu, there is a vigorous clampdown on illegal poaching of slender lorises. IUCN has listed them as Endangered, whereas they are listed under the Schedule I of the Wildlife (Protection) Act of India, 1972, according them the highest level of legal protection.
Previously neuro-anatomical research was carried on slender Loris other than monkeys because of close similarities of these species with human. Nowadays these animal models strictly prohibited and commonly not been considered for the research. And though there are many the histological studies are available pertaining to Hypophysis Cerebri on both these primates, the histomorphometry of these regions in slender Loris have generally not been investigated. Hence this study is designed to investigate the histo-mophometic analysis and the anatomical aspects of Hypophysis Cerebri in slender Loris.

MATERIALS AND METHOD

The study was conducted in ten adult slender lorises of both sexes. The animals were transcardially perfused. The brain tissues were carefully removed and immersed in 10% formal saline. Once the brain tissue was collected, they were post-fixated in 10% formalin minimum for a week. For histological studies the brains are dehydrated in a series of 80%, 95%, 100% ethanol and ethanol/ether . Then tissues were kept in 3% celloidin for a week followed by 12% celloidin until tissues gets hard. Tissues were embedded in celloidin sectioned using sliding microtome. Serial sections in sagittal plane were taken at 50 micron thickness. They were stained with cresyl fast violet and mounted with DPX. For histomorphometrical analysis Serial sections were used in the present study to obtain quantitative information as out lined by Elias & Hyde, (1980). The region of the hypophysis cerebri such as pars distalis, pars intermedia and pars nervosa were quantified. The surface area of these regions were calculated through, a 1-cm2 grid of square lattice –i.e. reticule, after calibrating with stage micrometer (Prakash et al.,(2008).

Observation

The hypophysis cerebri or the pituitary gland of the slender loris was enclosed in a small bony depression sella turcica or hypophyseal fossa of the sphenoid bone. The gland was partially covered by the dura matter called diaphragma sella. The shape of hypophysiscerebri appears to be oval and elongated in sagittal section.
The hypophysiscerebri was divided into three lobes 1.The adenohypophysis, 2.Neurohypophysis, 3.Intermediate lobe. The adenohypophysis and neurohypophysis in the slender loris was separated by thin intermediate lobe and intermediate cleft . The adenohypophysis was further subdivided into pars distalis, pars tuberalis and neurohypophysis as pars nervosa.
Neurohypophysis was comparatively less stained than adenohypophysis. This may be due to the abundant hormone secreting cells in a adenohypophysis . The neurohypophysis was composed of unmylineated neurons. The neurohypophysis is connected via infundibulum to the hypothalamus. The pars distalis makes up about 66 per cent of the gland. It is antero-ventral in position and surrounds the posterior lobe except posteriorly and dorsally. The pars tuberalis is located between the median eminence and the anterior lobe. The pars tuberalis formed an incomplete collar around the infundibular stalk. The pars tuberalis makes up about 6 per cent of the pituitary gland. Pars intermedia is about 3 per cent of the pituitary gland.
Based on the intensity of staining, the pars distalis of slender loris had two variety of cell type Chromophobes with less staining intensity and chromophils. The chromophils had coarse granules and a darker nucleus than the chromophobes. The chromophils include acidophils and basophils. Acidophils were distributed more to the lateral than central parts of the lobe. The basophils were numerous near the pars tuberalis and in the central area of the pars distalis.

The pars nervosa occupies about 25 per cent of the gland. The enlarged distal end projects slightly from the pars distalis to the narrow neck or infundibulum and continuous with the tuber cinereum.

Discussion

The location of hypophysiscerebri was below the brain (cerebrum) and lodged in a bony pit called hypophyseal fossa and partially covered by dural fold was constant in all primates except man were the dorsal extension of the dural sac (diaphragma sellae) was found to be complete only in man and surrounded the gland.

Wislocki (1937) investigated the meningeal relations of the hypophysis cerebri in man, the rat, the rabbit, the cat, the dog and the monkey reported covering of dural sac was also incomplete in the ox, small ruminants, the dog and the cat,. The subarachnoid space extended into the sella only a short distance and there was no subdural space in the fossa.

Herring (1908) classified mammalian pituitary glands into three groups; (1) the cat, which had a hollow posterior lobe with a complete epithelial investment; (2) the dog, which had a solid-bodied posterior lobe with an almost complete epithelial investment; (3) man, the monkey, the ox, the pig and the rabbit, with a solid posterior lobe, except a little at the neck, and an incomplete epithelial investment.

Rasmussen (1939) described the cells of the pars distalis in man as closely packed columns and irregular masses which were separated by prominent blood sinusoids and a small amount of connective tissue. Small acini with colloid could be found. The chromophobes made up 50 per cent of the cells in men and 52 per cent in women. The adenohypophysis regulates the several physiological processes like growth, reproduction, grooming, arboreal acquaintance etc., in slender loris the pars distalis occupies about 66% of neuronal population.

According to Atwell and Woodworth (1926), the pars distalis of the cat made up 75 per cent, the pars intermedia 16 per cent, and the pars tuberalis 9 per cent of the weight of the buccal portion of the hypophseal gland. Stein (1931) stated that in the adult male rat the pars glandularis or pars distalis formed 82 per cent of the gland weight, the pars intermedia 6.7 per cent, and the pars nervosa 11 per cent. In the adult female rat, the proportions were 86, 3.4 and 7*1. In the mouse Sailer (1933) gave the proportions as 70, 19 and 11 for the male, and 71, 19 and 10 for the female. Rasmussen (1939) tabulated the figures for the adult human male as 75, 2 and 23 for the pars distalis, pars intermedia and pars nervosa respectively. The average weights of pars distalis, pars intermedia pars tubularis and pars nervosa in slender Loris are 71 per cent, 2 per cent, 8 per cent, and 19 per cent respectively (Unpublished data). Interestingly this data could be concomitant with data of cat (Table 2) those are in similar nocturnal behavior.

Based on their staining characteristics Three types of cells were usually recognized in the pars distalis (1) reserve cells (chromophobes, neutrophils, chief cells); (2) oxyphils (eosinophils, acidophils, alpha cells); (3) basophilic cells (cyanophils, beta cells). The last two were often classified together as chromophils.

The neurons in pars intermedia were predominantely chromophilic in nature. The loris being nocturnal may have affected melanocyte production that might have resulted in pars intermedia be 3 % of the gland.

The pars tuberalis is located between the **median eminence and the anterior lobe**. The pars tuberalis formed an incomplete collar around the infundibular stalk. The pars tubertalis along with the suprachiasmatic nuclei and pineal gland make them responses to light and dark stimuli (photoperiodicity) and play major role in the regulation of seasonal reproduction (Olivier Kah. 2018). Corroborated with the above statements, it could be assume that the nature of pars tuberalis could be depends upon photoperiodicity and animal behavior. This was clearly evidenced by histo-morphoetry and weight of the pars tuberalis. Some authors find it difficult to determine the pars tuberalis and it was joined along with the pars distalis.

Bucy (1930) called the neuroglia-like cells of the pars nervosa of the ox "pituicytes." along with Non-myelinated nerve fibers in the pars nervosa of most animals, which was similar to our

results. The pars nervosa is an extension of hypothalamus. The pituitary stalk or infundibulum connects hypothalamus with pars nervosa.

CONCLUSION

In conclusion, the nature of pars intermedia and pars tuberalis could be depends upon photoperiodicity and adaptive behavior of the animal. Slender Loris widely used erstwhile as a common animal model in neurological research. Nowadays they are partially or completely departed in the field of research since they are enlisted in the endanger list. This work recapitulates the research on neruo-anatomical aspects in this rare and forgotten species. Importantly our current study provides the possible connection of micro-anatomical structure of hypophyesis cerebri with behavioral pattern of Slender Loris. Moreover this preliminary work might provide the opportunity to comprehend the comparative anatomy.

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Histomorphometric Analysis

Table 1. Surface area of hypophysis cerebri

Hypophsis cerebri			
Pars distalis (%)	Pars intermedia (%)	Pars tuberalis (%)	Pars nervosa (%)
66	3	6	25

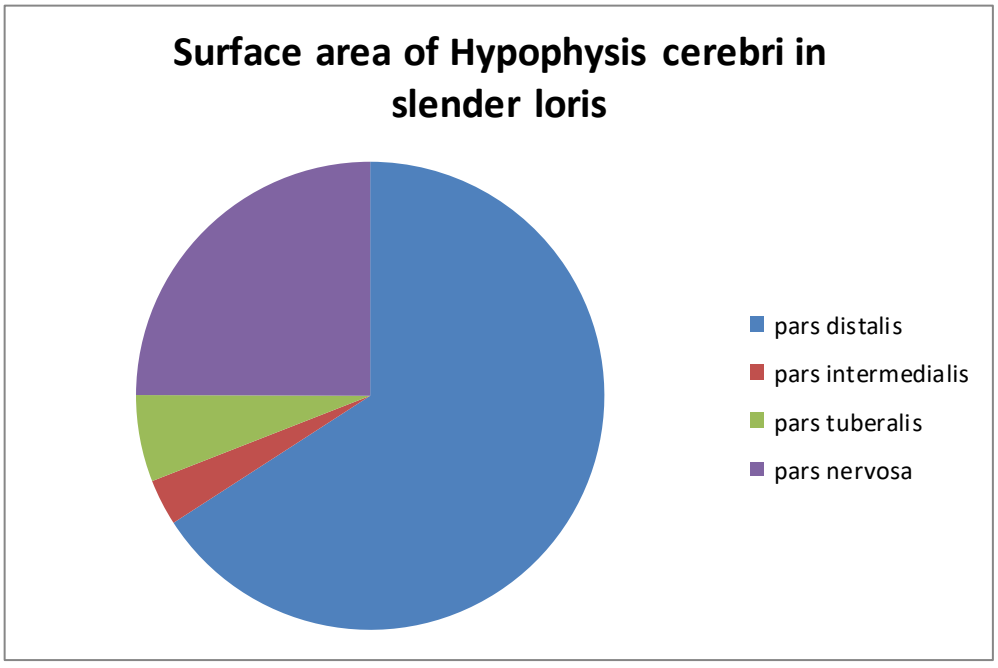

Table 1 and graph show the surface area of various regions of hypophysis cerebri. The values are expressed in percentage.
Table 2 : Comparison of weight of the hypophysis cerebri in different species from previous studies.

Worker and year	Species	Sex	Hypophysis Cerebri			
			Pars distalis (%)	Pars intermedia (%)	Pars tuberalis (%)	Pars nervosa (%)
Atwell and Woodworth (1926)	Cat	B	75	-	16	9
Stein (1931	Rat	M	82	6.7	-	11
		F	86	3.4		7.1
Sailer (1933)	Mouse	M	70	19	-	11
		F	71	19		10
Rasmussen (1939)	Adult human	B	75	2	-	23
Present study (Unpublished data)	Slender Loris	B	71	2	8	19

Table 2 illustrates weight of the hypophysis cerebri in different species from previous studies. The values of pars distalis, pars intermedia and pars nervosa are expressed in percentage. B-both, M-male, F- female.