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GRAVIMETRIC AND HISTOLOGICAL STUDY OF THE ADRENAL GLANDS OF THE INDIAN GRAY MONGOOSE, *HERPESTES EDWARDSII* GEOFFROY

JAGATHPALA SHETTY, GUNAPALA SHETTY and S. R. KANAKARAJ

Department of Zoology, University of Mysore, Manasa Gangotri, Mysore 570 006, India

ABSTRACT

The adrenals of the Indian gray mongoose grow isometrically with the body weight. The relative weights (mg %) of the glands remained more or less constant in juvenile as well as adults of both sexes. The right gland was uniformly smaller than the left in all the groups. Histologically, an outer cortex of three zones and a central medulla of chromaffin cells were seen. There was no sexual dimorphism in respect of either the histological structure or weight variations in juvenile or the adult mongoose.

INTRODUCTION

INFORMATION on the adrenal glands of wild carnivores from the Indian subcontinent is very limited. There has been, in fact, no report on the adrenals of mongooses (Family: Viveridae) though a number of species are fairly widely distributed in India. As the adrenal glands are known to play an important role both at the individual and the population level the present work was undertaken. This report deals with the gravimetric and histological aspects.

MATERIAL AND METHODS

The Indian gray mongoose, *Herpestes edwardsii edwardsii* Geoffroy trapped over a period of one year

around the city of Mysore comprising juvenile and adult animals of both sexes numbering to a total of 19 have been used. During autopsy the adrenals were removed, trimmed off adherent tissue and weighed separately. Glands fixed in Bouin's fluid were sectioned at 7 μ thickness, stained in Harris haematoxylin-eosin and Mallory's tripple for histological observations.

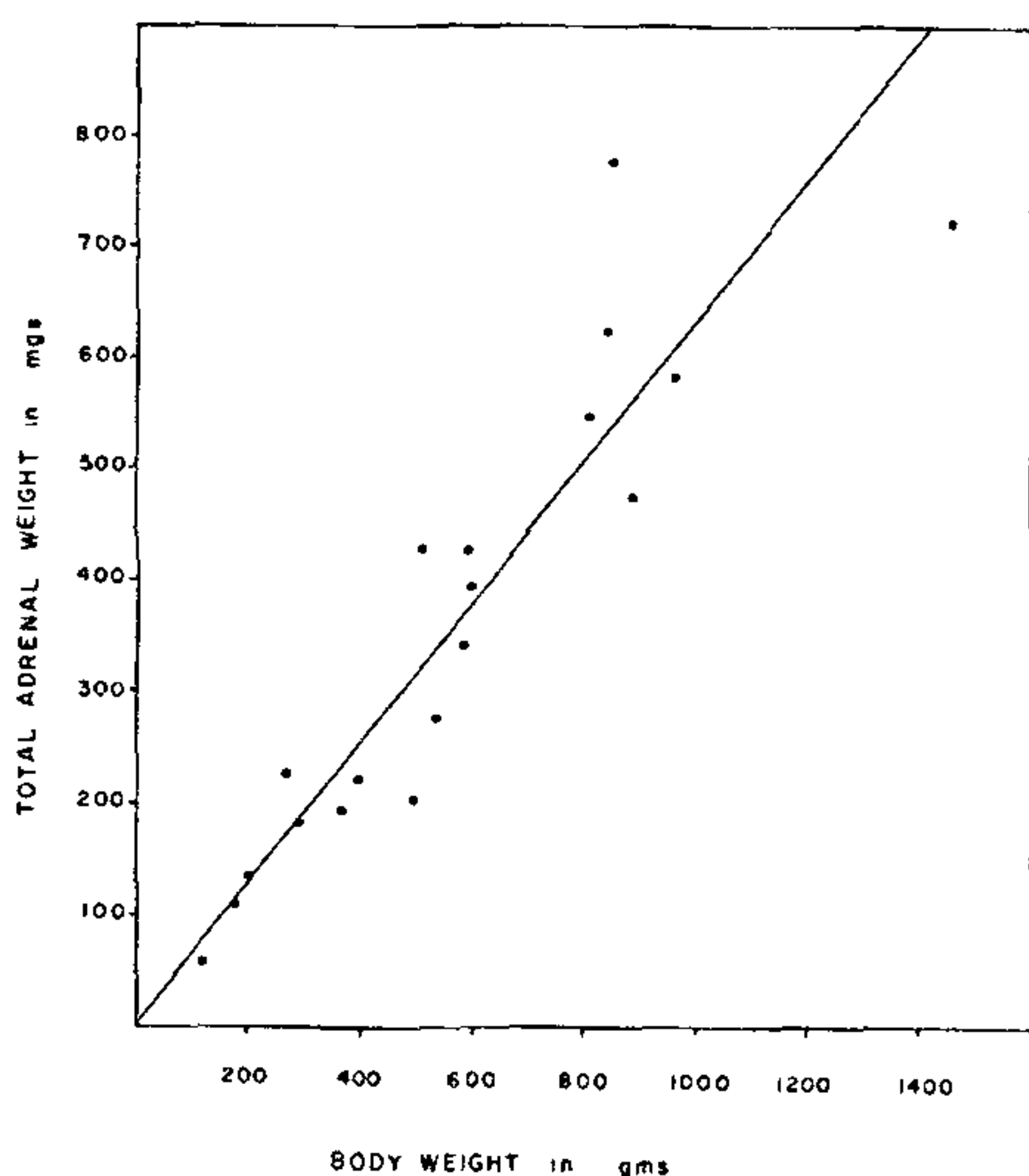
OBSERVATIONS

Weights of left and right adrenal glands have been expressed in mg/100 g of body weight in different groups (table 1) separately. Absolute weights of the paired glands of all the 19 animals have been plotted against the body weight in figure 1. Two adrenal glands

Table 1 Weights of adrenals of Indian gray mongoose, *Herpestes edwardsii edwardsii* of different sex and age groups

Group	Age and Sex	Adrenal weight (mg per 100 gm B. W.) M \pm S. E.		Percent increase in left gland over the right	Comparison between weights of left and right gland (P value)
		Left	Right		
A	Adult male	37.8 \pm 10.3	33.2 \pm 11.2	14.0	< 0.05*
B	Juvenile male	36.8 \pm 5.6	26.1 \pm 4.6	40.9	< 0.01**
C	Adult female	37.5 \pm 1.8	29.3 \pm 2.2	28.1	< 0.001***
D	Juvenile female	34.3 \pm 3.1	27.6 \pm 2.9	24.5	< 0.001***

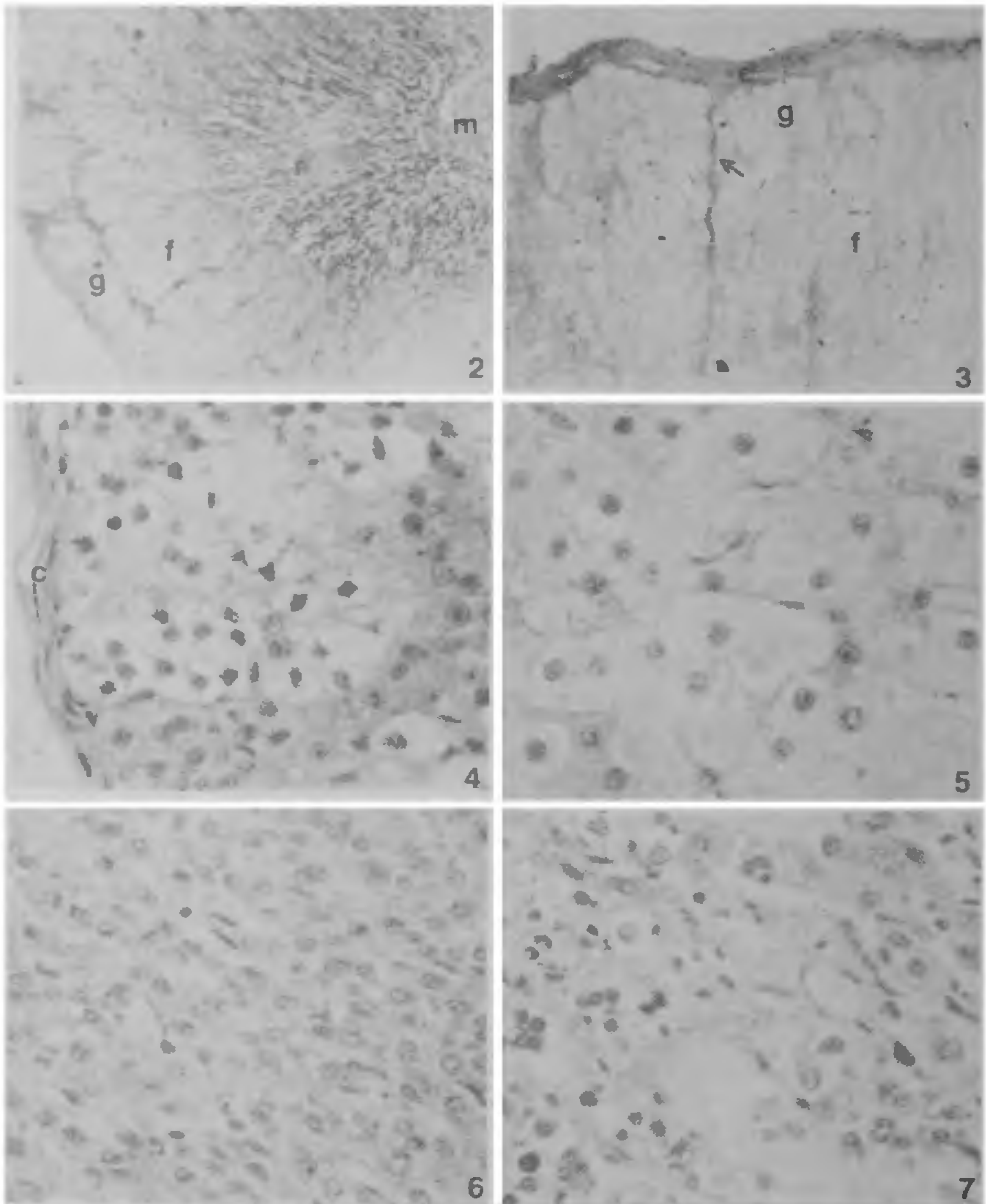
M \pm S. E. = arithmetic mean \pm standard error; * almost significant; ** significant; *** highly significant

**Figure 1.** Paired adrenal weight plotted against body weight for Indian gray mongoose (Adult and Juveniles of both sexes, total of 19 animals).

situated on the anterior borders of the corresponding kidneys, close to the dorsal body wall were noticed to be irregular in shape because of angular borders and prominent notches and gave a bilobed or a trilobed appearance in transverse sections. The left gland was usually slightly elongate and flattened while the right was blunt and thick; both tended to narrow towards the posterior tip. The right adrenal is smaller than its controlateral left partner in juveniles and adults of both the sexes (table 1).

Histologically the gland was seen to be surrounded by a connective tissue capsule consisting of fibrous cells (figures 3 and 4). The connective tissue strands from the capsule were seen to extend into the cortex (figure 3). Clearly distinguished cortex and central medulla were uniform in different sexes as well as ages. Based on the shape, size and pattern of arrangement of cells, in the cortical region, typically three zones were made out. The outer zona glomerulosa was of varying thickness showing conspicuous, densely-packed and deeply-stained acini-like cells possessing compact nuclei (figure 4). The cells of the middle zone of the cortex, zona fasciculata, were larger than those of the zona glomerulosa, irregular, polyhedral or cuboidal in shape and were arranged in parallel radiating strands (figures 2 and 5). The nuclei of these cells were round with loosely spread chromatin. The cells in the outer half of the zone in particular were seen to contain a number of lipid vacuoles. Fasciculata was the broadest zone of the cortex and in comparison the glomerulosa and the reticularis were generally seen as the outer and inner borders respectively. The reticularis consisted of ovoid or cuboidal cells arranged in anastomosing network, staining denser than the other regions, showed more homogeneous cytoplasm usually occupying a small area within the cell. The nuclei were irregularly shaped and were in various stages of degeneration. While most of the cortical region exhibited regularity in the arrangement of cells in different zones, as described above, occasionally areas with irregular arrangement were encountered.

The core of the gland was formed by the medullary region, consisting of chromaffin cells which are smaller, poor in cytoplasm and separated from the cortex allround by a row of vacuoles of varied sizes (figures 2 and 7). Unlike the cortex, there was no zonation or



Figures 2-7. T.S. of adrenal. **2.** showing the capsule, three regions of cortex and the medulla $\times 50$. **3.** Outer region showing the capsule zona glomerulosa and part of zona fasciculata. Arrow indicates penetration of strands of connective tissue from the capsule $\times 110$. **4.** Enlarged view of zona glomerulosa. (Note the acini-like cell arrangement $\times 500$). **5.** Enlarged view of zona fasciculata $\times 500$. **6.** Enlarged view of zona reticularis $\times 500$. **7.** Enlarged view of medulla $\times 500$. Haematoxylin-eosin. (C = capsule, g = glomerulosa, f = zona fasciculata, r = zona reticularis, m = medulla).

regular pattern of arrangement of cells in the medulla. The medullary cells were also found dispersed by blood vessels and sinusoids. The cortex was seen to surround the medulla except at the regions of infoldings where the latter reached a superficial position. Occasionally, islands of cortical tissue were seen in the medulla.

DISCUSSION

In Eutherian mammals the adrenals in general have been reported to grow allometrically with the body weight¹. But in the Indian gray mongoose adrenals appear to grow isometrically with the body weight (figure 1) without exhibiting sexual dimorphism in the pattern of growth. The relative adrenal weights in different age groups (juvenile and adult) in both the sexes, by and large, do not show significant differences (table 1). In this respect it differs from *Herpestes auropunctatus* from Hawaii where the relative weight has been reported to decrease with the advance in age in both the sexes⁴. There is also no sex difference with regard to the relative weights of the glands (table 1) unlike *H. auropunctatus* where they enlarge greatly in females at sexual maturity⁴. The present study, however, does not throw light on the status of adrenals during pregnancy and lactation in females of *H. edwardsii edwardsii*, since none of the females captured was in that condition. Absence of bilateral symmetry in respect of the relative weights of the left and right glands whether it is in juvenile or adult, male or female is apparent, as the weight of the left gland is uniformly and significantly higher than its contralateral right partner (table 1). In this respect the Indian gray mongoose resembles the *Herpestes auropunctatus* wherein occurrence of larger left gland has been recorded⁴. There appears to be no seasonal variation in the weight of the adrenals in the present study, as uniform relative weights have been observed in animals captured during different months over a period of one year. However, unequivocal conclusion regarding the seasonal variations cannot be arrived at, unless the study is extended over several years.

Histologically, the adrenals of *H. edwardsii edwardsii* is in conformity with the typical mammalian pattern in showing not only distinct cortex and medulla but also three clear zones of the cortex. The central medulla of chromaffin cells as well as the zonation of the cortical region has been observed uniformly in both the sexes of both age groups. In this respect the Indian gray mongoose differs from *H. mungo* and *H. auropunctatus*, the only other available

information on adrenals of mongooses. While Kolmer² has reported very poorly differentiated medullary substance in *H. mungo*, McKeever and Tomich³ have found the absence of zona fasciculata in males and juveniles of *H. auropunctatus*. In fact, the latter investigators attribute the absence of this zone to be responsible for the reduced weight of the glands in adult males. In the present study the adrenal glands of *H. edwardsii edwardsii* have however not shown the existence of sexual dimorphism neither in respect of the histological structure nor the relative weights in juvenile or adult stage.

At this point of investigation it is rather difficult to comment on the functional significance of the different zones of the gland. This is more so in the case of the adult female because of the reported variations in the cortical zones associated with pregnancy and lactation^{3, 4} in *H. auropunctatus* and not encountering pregnant or lactating females during the course of the present investigation.

There has been stability in the relative weights of glands in the different age groups and sexes. At the level of the population this might mean that the mongooses in the study area have not been subjected to greater environmental and sociological effects. Besides, the area of study is situated adjoining the urban area and not under extreme wild conditions. It could also mean that the mongoose is refractory in the nature of its pituitary-adreno-cortical-gonadal system, to effects commonly measurable in rodents as suggested by Tomich⁴.

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