

## The functional demography of adrenal glands in *Rattus melta* *pallidior* in Indian desert

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**Abstract.** In this paper, the seasonal fluctuations in adrenal glands and its relationship with their body weights, reproduction activity and population density of soft-furred field rat, *Rattus melta pallidior* in the Indian desert has been discussed. Results of the present study revealed that the left adrenal gland in both the sexes of rodents was found to be significantly heavier ( $P < 0.01$ ) than the right one. The paired adrenal of female rats was significantly heavier ( $P < 0.001$ ) than those of males. The seasonal variations in adrenal weights of pregnant females were found to be significantly heavier ( $P < 0.01$ ) than those of nonparous females. The adrenal weights of male, pregnant and non-pregnant female rats were found to be significantly correlated with their body weights. Results of this study further revealed that changes in adrenal weights in *Rattus m. pallidior* are functions of body weights which are regulated by the availability of food and its nutritional level.

**Keywords.** *Rattus melta pallidior* ; adrenal glands ; body weight ; pregnant females ; reproduction activity ; population density.

### 1. Introduction

It has been postulated that adrenal weight is the function of population density in Albino rats and in wild house mice of confined density (Christian 1955 ; 1956 ; Christian and Davis 1955). Clarke (1953) , Christian (1962) and Southwick (1963) stated that fighting and social-interactions enhance adrenal weights. Contrarily, Southwick (1958) and Rudd and Muthen (1963) did not observe adrenal enlargements due to fighting in house mice (*Mus musculus*) and Pocket gophers (*Thomomys umbrinus*) respectively.

In view of the confirmity, the present study on relationship of adrenal gland with their body weights, reproduction activity and population density was undertaken in the free living population of soft-furred field rat, *Rattus melta pallidior* in Thar desert.

## 2. Materials and methods

The *Rattus meltda pallidior* (45 ♂♂ and 43 ♀♀) were captured during January 1978 to December 1978 from Bisalpur (25° 7' N-73° 10' E) in Western Rajasthan. Later on, the rats were weighed, sexed, dissected and both right and left adrenal glands were preserved in 10% formaldehyde. The preserved adrenal glands were weighed on semimicro balance to the nearest 0.001 g.

## 3. Results

### 3.1. Difference between right and left adrenal gland

The left adrenal gland was found to be significantly heavier than the right one in both the sexes of rats (table 1).

### 3.2. Difference between sexes

The right and left adrenal gland of female rats were found to be heavier than those of the males, but the significant ( $P < 0.001$ ) difference was noticed in case of left ones (table 1). Similarly, on an average the paired adrenal weights of female rats were significantly ( $P < 0.01$ ) heavier than those of male rodents. The mean monthly paired adrenal weights of females were found to be significantly heavier ( $P < 0.05$ ,  $P < 0.01$ ) than those of male rats, almost throughout the year. However, the male adrenals were recorded significantly heavier ( $P < 0.01$ ) during July and October (table 2). The relative as well as absolute adrenal weights of pregnant females were observed significantly heavier ( $P < 0.01$ ) than those of nonparous females (table 3).

### 3.3. Seasonal trend through the year

The fluctuations in adrenal weights of both male and female exhibit a peak during February, July and October in former sex and February-March and September-

Table 1. Absolute adrenal weights (mean  $\pm$  S.E.) of *Rattus meltda pallidior*.

Sex	No.	Average adrenal weights (mg)			
		Right	Left	Paired	't' between
Male	45	6.98+0.63 (1)	8.52+0.71 (3)	13.46+1.05 (5)	1 and 3 = 2.65 ( $P < 0.01$ )
Female	43	7.79+0.42 (2)	9.55+0.47 (4)	16.48+2.41 (6)	2 and 4 = 3.74 ( $P < 0.001$ ) 3 and 4 = 2.03 ( $P < 0.05$ ) 1 and 2 = 1.44 5 and 6 = 5.74 ( $P < 0.001$ )

Table 2. Seasonal fluctuations in adrenal weight of *Rattus meltdada pallidior*.

Months	Paired adrenal weights Mean ± S.E.		't' between males and females
	Males (n = 45)	Females (n = 43)	
January	10.12 ± 5.95	9.22 ± 5.30	0.39
February	18.65 ± 0.46	17.53 ± 8.04	0.44
March	10.00 ± 0.00	18.55 ± 0.75	5.09**
April	9.44 ± 2.05	13.10 ± 2.06	4.93**
May	9.00 ± 0.00	13.00 ± 1.00	2.85*
June	12.36 ± 2.58	14.96 ± 3.58	2.27*
July	23.18 ± 2.58	14.96 ± 3.58	2.27*
August	10.90 ± 1.35	16.55 ± 2.08	2.09*
September	11.00 ± 0.00	19.90 ± 0.07	5.83**
October	18.55 ± 1.50	16.50 ± 1.50	2.13*
November	15.83 ± 0.58	22.25 ± 2.20	3.02*
December	12.51 ± 3.51	18.05 ± 1.88	3.40*

\* = P < 0.05 ; \*\* = P < 0.01

November in latter sex (table 2). Thereafter, in females, they remained almost constant throughout the year. Whereas, in case of males remarkable decrease from March to June was observed. The lowest adrenal weights were found during August to September in case of males (table 2).

Table 3. Adrenal weight in relation to prevalence of pregnancy.

Adrenal weight	Adult females		't' between
	Pregnant (n = 28)	Nonparous (n = 15)	
Absolute	18.35 ± 1.32 (1)	16.52 ± 0.60 (2)	1 and 2 = 3.21**
Relative	42.14 ± 0.93 (3)	38.48 ± 1.38 (4)	3 and 4 = 5.94**

\*\* = P < 0.01

### 3.4. Adrenal weight in relation to body weight

The adrenal weights of male, pregnant and not pregnant female metads were found to be significantly correlated ( $r = +0.592$ ,  $P < 0.01$ ,  $r = +0.609$ ,  $P < 0.01$  and  $r = +0.890$ ,  $P < 0.01$ ) respectively with their body weights. The fluctuations in the changes of male and female adrenal weights were found to be almost in similar pattern throughout the year (figures 1 and 2), which suggests that weight of adrenal gland in *Rattus melstada pallidior* is influenced by body weight.

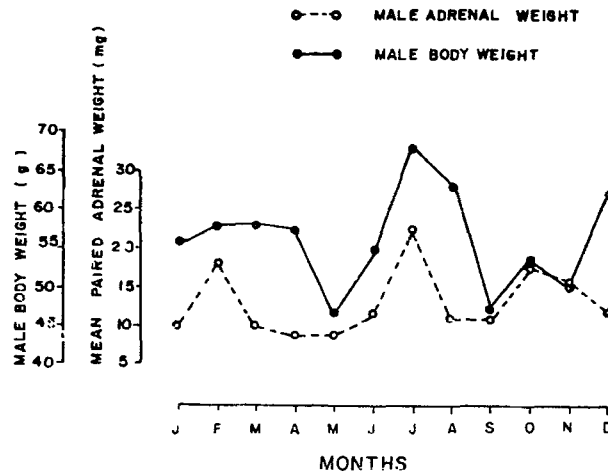


Figure 1. Paired adrenal weights of male *Rattus m. pallidior* in relation to their body weight.

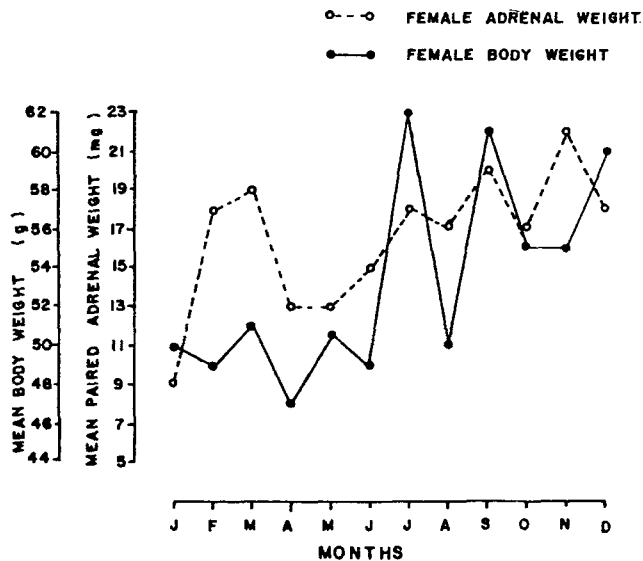


Figure 2. Paired adrenal weights of female *Rattus m. pallidior* in relation to female body weight.

3.5. Adrenal weight in relation to reproduction activity

The females *R. m. pallidior* litter throughout the year with two peaks one in March to April and another in July to November (Rana and Prakash 1981). The adrenal weights of females *R. m. pallidior* show a parallel fluctuation trend with the prevalence of pregnancy (figure 3), suggesting an increase in adrenal weights with the enhanced female fertility. The adrenal weights are influenced by pregnancy stress is further confirmed by the data presented in table 3, where both the absolute as well as relative adrenal weights of pregnant female rodents are significantly heavier ( $P < 0.01$ ) than those of nonparous females (table 3).

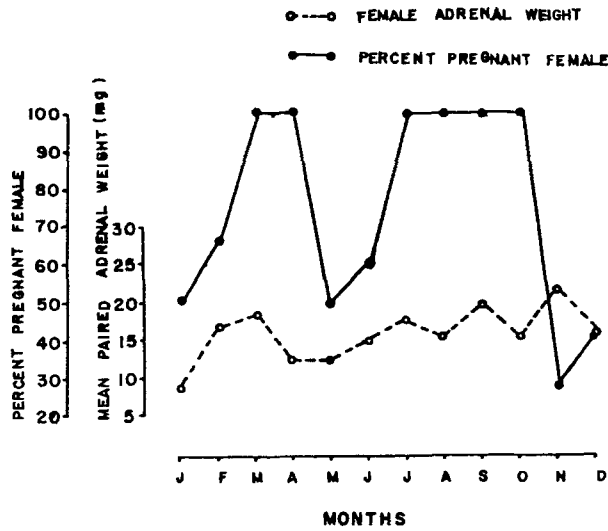


Figure 3. Paired adrenal weights of *Rattus m. pallidior* in relation to female fertility.

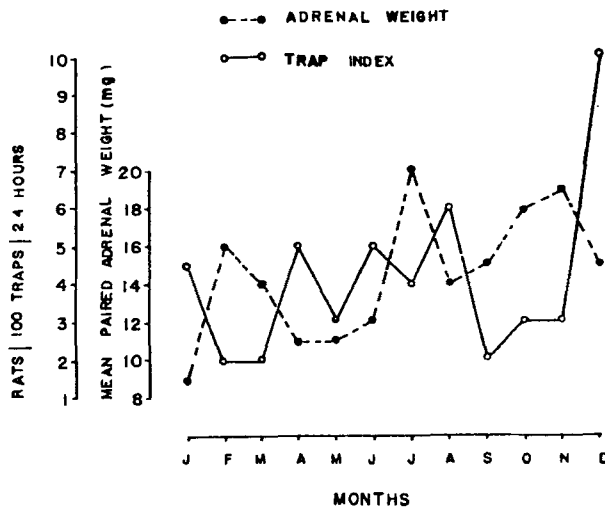


Figure 4. Variation in paired adrenal weights of *Rattus m. pallidior* in relation to their population density.

### 3.6. Adrenal weight in relation to population density

The pooled adrenal weights of both male and female rats showed three peaks in July, November and February, whereas, the population density was found to be low during these peak levels, indicating reverse pattern (figure 4). This may be explained by the facts that their numbers do not influence the seasonal variations among adrenal gland. The trap indices exhibited two peaks, one in December and the second in April–June and August. These peaks do not have any relationship with their adrenal weights.

## 4. Discussion

A striking similarity in the fluctuations of adrenal weight and body weight in adult male and female indicate that changes in variations among them are influenced by body weights which are regulated by the availability of food and its nutritional level. Similar observations were made among other species of Indian mammals (Prakash *et al* 1969 ; Jain 1971 ; Rana *et al* 1975 ; Rana 1981).

Selye (1936) argued that an increase in adrenal weight is due to the pregnancy stress, on the other hand, Christian (1962), Christian and Davis (1964) suggested that this enhancement is a reflection of the social-interactions, the frequency of which usually exhibited an increase during breeding season. Similarly, in the present study the significant differences in the adrenal weights of pregnant and non-parous *R. m. pallidior* points out that physiological processes of reproduction might have an impact on the adrenal weights. Similar observations were made in *R. c. cutchicus* (Rana *et al* 1975), *T. indica* (Jain 1971) and Jack-Rabbit, *Lepus californicus melanotis* (Herrick 1965). Whereas no relationship was found between male fecundity and adrenal weights decreased (figure 5), however, percent

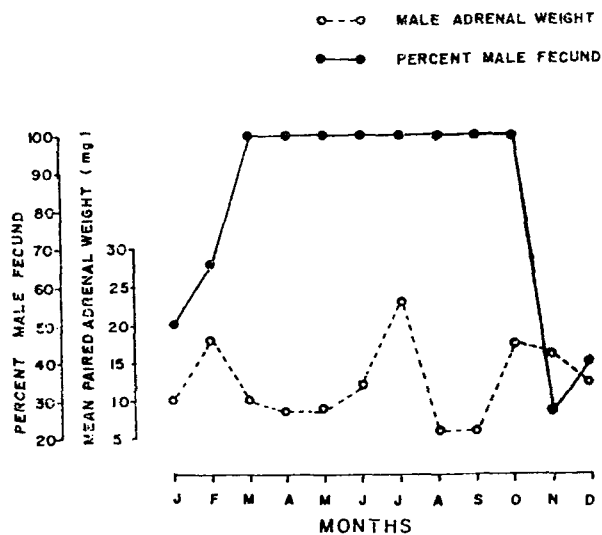


Figure 5. Paired adrenal weights of *Rattus m. pallidior* in relation to male fecundity.

male fecund rats showed a decline trend during November. The adrenal glands did not reflect much change in their seasonal trend. During summer season when breeding activity in male metad had ceased, a second minor peak in adrenal weights was exhibited.

The average number and the adrenal weights of Woodchucks, *Marmota monax*, are closely associated and fluctuations found among them follow a parallel trend throughout the year which tends to indicate that weight of adrenal glands is influenced by population density (Christian 1962). Whereas, the results of present study on free living population of *R. meltada* suggest that the increase in population density decreased the weight of adrenal gland.

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