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ALTERATIONS IN FEEDING AND SEXUAL BEHAVIOUR DURING REPRODUCTIVE CYCLE IN FEMALE RATS

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Abstract: Alterations in feeding and sexual behaviour were studied in adult female rats. During estrous phase there was decrease in food intake and increased sexual behaviour, as manifested by increased lordosis quotient. During met-and diestrous phases, increase in food intake and depressed sexual behaviour were observed, indicating inverse relationship between these two behaviours. Multisensory hypothalamic neurons may explain interactions among regulatory systems.

Key words: food intake lordosis quotient estrogen

INTRODUCTION

Behaviour can be considered as the outcome of interactions between inborn and environmental factors. Among the many types of behaviour in which the animals engage, two in particular stand out-feeding and mating. Feeding is necessary for survival of the individual, and mating is necessary for reproduction and propagation of species (1). Food intake of several mammalian species shows systematic variations across ovarian cycle and interrelationship between feeding and ovarian hormones has been well documented in estrous cycle of rats (2). Food intake is low around the time of ovulation when estrogen levels are high, while it is increased when estrogen levels are low. In female rats estrogen promotes lordosis response, increased locomotor activity and decreased food intake. Estrogen acts on target sites in the hypothalamus to prime sexual behavior of female rats (3). Even though studies on variations of food intake and body weight during estrous cycle in rats are available, the interrelationship of food intake and body weight with the different reproductory stages have not been systematically studied. The present study was, therefore, planned to observe alterations of food intake and body weight in adult female rats during estrous cycle and pregnancy. Alteratons in food intake were also recorded in overiectomized animals and after treating such animals with estrogen and progesterone.

METHODS

The study was conducted in adult female albino rats (Haffkine Strain), weighing around 170-200 gms. Dry feeding was preferred in order to find out exact food intake, while water was provided *ad libitum*. Special arrangements were made to avoid spillage of food. Daily food intake and vaginal smears were studied for four cycles. These animals were then divided into two groups of 15 animals each. The experimental group was ovariectomised while the control group was subjected to sham operation. After recovery from operative trauma, body weight, food intake and vaginal smears were again studied. The experimental animals were later on given intramuscular injections of estradiol benzoate 2 µg/day for 3 successive days followed by progesterone 0.5 mg on the 4th day. Control animals were injected sterile groundnut oil on these days. Food intake, body weight and vaginal smears were studied in all these animals. Sexual behaviour was quantified in terms of lordosis quotient (L.Q.).

In second set of 10 animals, similar studies were carried out on body weight, food intake and vaginal smears while these animals were kept for mating with male rats during their expected estrous period. Pregnancy was allowed to occur in them and the food intake was closely observed during their entire period of gestation till delivery.

RESULTS

The results obtained indicate that the changes in food intake were cyclic exhibiting low intake during estrus and significantly high intake at met and diestrus. Table I shows food intake during different phases of estrus cycle.

TABLE I : Food intake during different phases of estrus cycle in female rats.

Phase	*Food intake (g) (Mean ± SD)*
Estrus	9.82 ± 1.80
Proestrus	11.97 ± 2.66*
Metestrus	15.46 ± 3.41*
Diestrus	14.78 ± 2.12*

*P < 0.001 (as compared to estrus); n = 30

Sexual behaviour meausre as L.Q. was above 80 in all animals during estrus phase and markedly low during other phases of cycle (Fig. 1). Thus inverse relationship probably exists between these two behaviors.

Ovariectomy removes the effect of ovarian hormones. Ovariectomized animals consumed more food, became obese and sexual receptivity in them was markedly decreased. Table II shows the food intake of ovariectomized and control animals.

TABLE II : Food intake of ovariectomized and control animals.

Animals	*Food intake (gms)*	*Animals*	*Food intake (gms)*
Ovariectomized n=15	17.49±2.47	Ovariectomized	17.49±2.47
Control group during estrus n=15	10.38±1.35	Control group during diestrus n=15	14.7±1.70
'P' value	P<0.001	'P' value	P<0.001

There was a significant increase in food intake after ovariectomy (P<0.001).

Estrogen injection to these animals stimulated sexual activity and caused a decrease in food intake (Fig.2). The differece in food intake of ovariectomized animals before and after priming with estrogen was highly significant (Table III).

TABLE III : Food intake of ovariectomized female rats before and after estrogen priming. (n=15).

Animals	*Food intake (gms)*
Ovariectomized before estrogen	17.49 ± 2.47
After estrogen priming	9.48 ± 1.84
'P' value	P<0.001

The food intake and body weight is markedly increasing during pregnancy (Fig. 1) and mating behavior is depressed (Fig. 2).

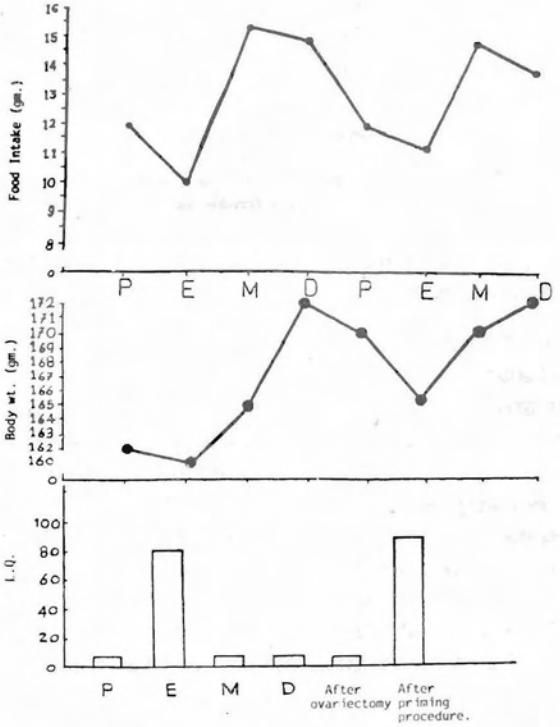

Fig. 1 : Mean readings of food intake, body weight and lordosis quotient during different phase of estrous cycle in female rats in two consecutive cycles.
P—Prosestrous phase E—Estrous phase.
M—Metestrous phase. D—Diestrous phase
L.Q.—Lordosis quotient

DISCUSSION

The present results clearly indicate the role of female sex hormones in modulating food intake. Estradiol has a variety of central and peripheral effects.

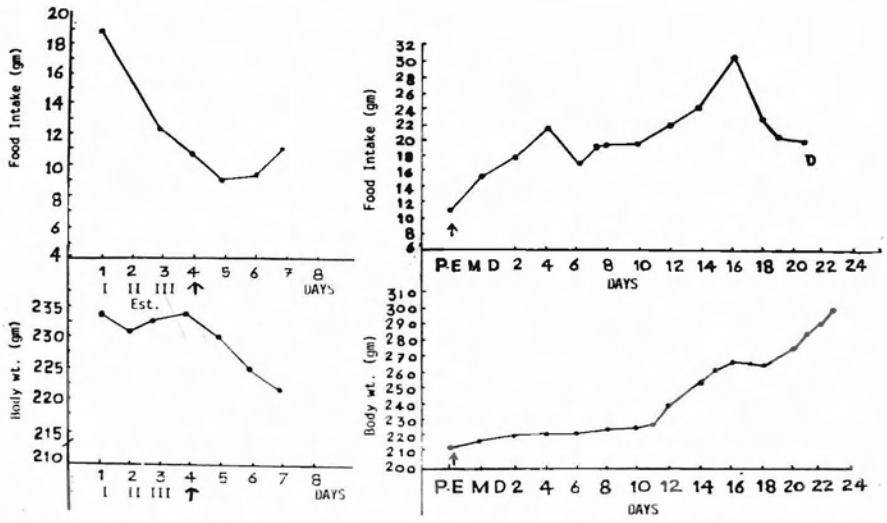

Fig. 2 : Alterations in food intake and body weight, mean readings in—
A) Ovariectomized animals treated with estrogen for 3 days shown as I, II, III and progesterone on 4 days indicated by an arrow.
B) Pregnant female rats from day of conception till delivery. Abbreviations as in Fig. 1.

The central effect may be mediated by multisensory hypothalamic neurons (2).

Peripherally, in states of high plasma estradiol concentration, insulin is degraded more rapidly (4). Other investigators have reported estrogen related decrease in gluconeogenesis, increased glycogen storage, and increased extrahepatic peripheral metabolism. Estradiol may be influencing glucose metabolism and so promoting systemic conditions that inhibit food intake (5). Food intake however goes on increasing during pregnancy when both estrogen and progesterone are increased. Single injection of progesterone marginally increases food intake in ovariectomized estrogen pre-treated animals. The concentration of plasma progesterone in rats is doubled between days 7-13 of pregnancy but recedes 2-3 days before parturition. In presence of estradiol, progesterone causes increased food intake, body weight and fat content. These hormonal interactions could explain the increase in food intake during pregnancy and decrease which occurs 2 days before parturition (6).

Though sexual behavior correlates well with blood levels of estrogen, the interactions of other hormones with estrogen, such as progesterone or placental hormones during pregnancy, in modulating feeding and sexual behaviour needs to be studied further.

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