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The adjustment of *Calomys callosus* (Rodentia, Cricetidae) to food deprivation.

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ABSTRACT

The adjustment of **Calomys callosus** *(Rodentia, Cricetidae) to intermittent food deprivation was investigated. Animals subjected either to 24-hr or to 48-hr repeated periods of deprivation successfully compensated, showing (1) increases in post-fast intake relatively to the intake by control animals; (2) rapid recovery of the baseline levels of body wieght. The regulatory ability of* **C. callosus** *is comparable, in such respects, to the ability of the common rat and some other rodents but it is remarkably different from the hamster's.*

Rodents are not all equally able to compensate for food deprivation by increasing food intake when rats and some other species of rodents are submitted to limited daily access to food, they show post-fast hyperphagia and generally maintain their weight not far below baseline levels (KUTSCHER, 1969; SILVERMAN and SUCKER, 1976). In contrast, golden hamsters are drastically limited in their ability to adjust to intermittent feeding: if they placed are an alternating schedule, being fed on one day, and starving on the next, they do not eat more than the usual when food is available, and they lose substantial portions of their body weight during the treatment (SILVERMAN and SUCKER, 1976).

A single period of deprivation (6 hr or 24 hr, OTTA and ADES, 1984; 72 hr, ROWLAND, 1982) is not followed, in hamsters, by substancial increments in eating. Otta's results show that hamsters can be quite low in regaining body weight after a novelty-induced period of anorexia. Transported from their collective colony cage to individual cages, old (7 months) but not young (75 days) hamsters did not recover their previous body weight, even after a 4-week period of unlimited access to food (OTTA, 1984). Such inter-species differences in behavioral and physiological adjustment emphasizes the relevance of comparative studies of ingestion patterns in rodents.

The objective of the present study was to test the adjustment of *Calomys callosus* (a cricetid rodent, native in Brazil) to different periods of deprivation. Behavioral studies on *C. callosus* are scarce. We know, from laboratory studies

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(BAUMGARDNER, WARD and DEWSBURY, 1980) that this rodent is strongly nocturnal in most of its activities (locomotion, grooming, eating, drinking, etc.). *C. callosus* differs significantly from *Mus musculus* in its pattern of reaction to a novel environment, with or without shelter (ALBERTS and ADES, 1987).

Information about the regulation of intake under starvation seems relevant as a prerequisite to further experimental use of *C. callosus*, and as a contribution to the comparative study of motivational systems in rodents. Is *C. callosus* rat-like or hamster-like in its food regulation strategies?

METHOD

Subjects. The subjects were male and female *Calomys callosus* bred in the Department of Experimental Psychology from a stock obtained from animals captured near Brasilia, DF. All animals were between 90 and 100 days at the beginning of the study. They were housed individually in standard plastic cages (15 x 26 x 12 cm) and were given tap water and Purina rodent chow pellets ad lib, unless otherwise stated. Pellets were available from a feeder in the lid of the cage. The colony room was maintained at about 16:8 light/dark photoperiod, with light onset at 0800.

Procedure. The animals remained in their homecages during the experiment. Baseline daily records of the intake of pellets and of body weight were taken for 5 weeks. (1) 48-hr deprivation. The animals in Group I (n = 7) were then deprived of food for two 48-hr periods, the first beginning at day 37, the second at day 44. Group II (n = 7) remained on ad lib conditions all the time. (2) 24-hr deprivation. From day 58 on, animals in Group II were submitted to 24-hr periods of deprivation, twice a week, on Tuesdays and Thursdays (Days 59, 61, 66, 68, 73, 75, 80 83). The animals of Group I, with continuous access to food, served as controls.

RESULTS

48-hr deprivation. Body weight of animals in Group I decreased with deprivation, reaching about 85% of the baseline level at the end of the each test (from 31.1g to 26,2g mean body weight during the first deprivation period; from 30.4g to 25.5g mean body weight during the second one). Recovery was rapid: in approximately 5 days, after both the first and the second deprivation periods, the animal regained body weight levels comparable to their own baseline weights and to those of Group II (Fig. 1)

Groups did not differ in intake on the day before deprivation (Day 36, df 12, $t = .821, p > .05$; Day 43, $t = .886$, df 12, $p > .05$). Group I, however, had a significantly higher intake on the first day after deprivation, on both occasions (Day 39, $t = 2.310$, df 12, $p < .05$; day 46, $t = 3.406$, df 12, $p < 0.01$).

24-hr deprivation. The same pattern of results was obtained with shorter (24-hr) recurrent periods of deprivation. Body weight of animals in Group II decreased after each deprivation period, significantly more after the second weekly deprivation (body weight in percentage of baseline: 84.0%) than after

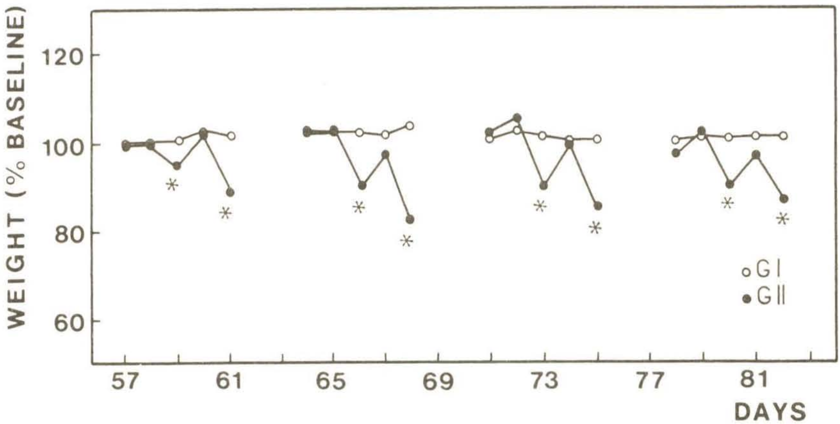

FIG. 1. Mean body weights as a percentage of weight on baseline (day 29), for Group I (deprived during two 48-hr periods) and Group II (ad lib control). * indicate days of deprivation.

the first (body weight in percentage of baseline: 89,6%) Return to baseline levels occurred some 3 to 4 days after the second weekly deprivation (Fig. 2).

Intakes on the day preceding and the day following the first weekly deprivation period were submitted to analysis. Differences in mean intake on pre-deprivation days for Groups II and I failed to reach statistical significance in any occasion (day 58, $t = .223$; day 65, $t = .612$; day 72, $t = 1.282$; day 79, $t = 1.137$, df 12, $p > .05$). Group II had, however, significantly higher levels of intake than Group I on three out of four post-deprivation days

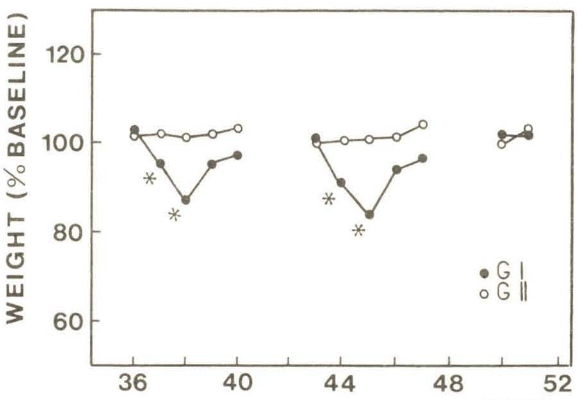

FIG. 2. Mean body weights as a percentage of weight on baseline (day 54) for Group II (deprived during 24 hours, twice a week), and Group I (ad lib control). * indicate days of deprivation.

(day 60, t = 2.706; day 67, t = 3.200; day 74, t = 3.456; df 12, $p < .05$) but not on the fourth (day 81, t = 1.230, df 12, $p > .05$). The lack of significance on day 81 may be due to a very low intake of one of Group II animals. Analysis of individual records shows that deprivation sometimes failed to increase the amount ingested relatively to predeprivation levels.

DISCUSSION

The results favor the view that *C. callosus* can adjust efficiently to intermittent periods of food shortage, by (1) increasing ingestion of food, soon after the termination of the fast; (2) showing a relatively rapid return of body weight to baseline levels. Compensation occurred both at short (24 hr) and long (48 hr) deprivation levels, and it was maintained even under a schedule of repreated deprivation periods. With available food only on alternate days, Silverman and Sucker's rats stabilized their weight below baseline level (1976). The reason why our animals efficiently defended their pre-deprivation weight in the second experimental condition (Fig. 2) was probably related to the fact that they fasted only twice a week.

It is interesting to note that *C. callosus's* successful compensation makes it similar to the common rat, *Rattus norvegicus*, which belongs to the family Muridae, and remarkably different from the hamster, which belongs to the same family Cricetidae. Complex physiological mechanisms, such as those involved in food regulation, can be better seen as **adaptive specializations**, shaped by selection to solve problems posed by an animal's natural environment. The stocking of large hoards, and the semi-fossorial habits of the hamster may be adaptive strategies that make less stringent the need of compensation by post-fast hyperphagia (SILVERMAN and SUCKER, 1976). *C. callosus's* short-term responsiveness to deprivation may represent an adjustment to environments in which food is not continually available, neither in external sources nor in hoards. It may also be taken as indicating that the animal feeds preferentially during foraging episodes, not from a hoard.

It would, indeed, be interesting to get information about *C. callosus's* behavior in the field, in several regions of Brazil where it lives, an information about its use of nests and hoards, its foraging habits, its natural foods and its adjustments to abundance and shortage of sources. An ecological approach to the analysis of motivational systems is clearly desirable (ADES, 1985).

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