The relation between differences in level of food deprivation and dominance in food getting in the rat

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Two experiments investigated the contradictory results obtained by Ruskin & Corman (1971) and Hsaio & Schreiber (1968) concerning the effect of different motivation levels on measures of food-getting dominance in the laboratory rat. Using the dominance tube, Hsaio and Schreiber found that decreasing motivation of dominant animals affected competitive performance, whereas Ruskin and Corman found no change in dominance relationships in the limited access situation when increasing the motivation of subordinates. Measurement of time spent at a food trough and the amount of food eaten showed that experimental conditions equivalent to those used by Ruskin and Corman did not change feeding behavior significantly. When these changes were effected, the measurement of food dominance by the limited access measure supported Hsaio and Schreiber's finding that dominance relationships in the rat are stable only while deprivation levels are held constant.

Stable food dominance relationships have been demonstrated between pairs of rats maintained at equal levels of deprivation in a variety of competitive situations (Schumsky & Jones, 1966; Becker & Flaherty, 1968; Hoyenga & Rowe, 1969). But the evidence on the effects of varying the deprivation condition of one partner in such a relationship is contradictory. Using the dominance tube, Hsaio & Schreiber (1968) manipulated the motivational level of their submissive animals by (1) not feeding them when they lost a competition, (2) prefeeding the dominant animal 8 g of food and the submissive animal 3 g, and (3) placing the dominant animal on ad lib feeding while continuing to deprive the submissive animal. Their results showed that a relative increase in deprivation in the submissive animals was followed by a substantial improvement in competitive performance. Ruskin & Corman (1971), however, using a limited access food hopper, found no improvement in the performance of submissive

animals when they were deprived for up to 72 h and dominant animals were maintained on a 24-h deprivation schedule.

There are two possible explanations for the discrepancy. Either the different levels of food deprivation affected competitive behavior in the dominance tube but not in the limited access situation or the differences in level of food deprivation used by Ruskin and Corman were not large enough for any change in competitive behavior to be recorded. The first alternative would suggest that motivational factors are important in the dominance tube but not in the equally popular limited access measure. If this is the case, further analysis of each method is required if both situations are to be regarded as interchangeable measures of food dominance in the rat. If the second explanation is valid, it would demonstrate that alterations in deprivation should be accompanied by quantitative data reflecting the change in feeding behavior associated with the

motivational changes. Neither Hsaio and Schreiber nor Ruskin and Corman provide such data. The present study was designed to test the second hypothesis.

In order to increase the motivation of their submissive Ss, Ruskin and Corman extended deprivation from 24 to 72 h, while Hsaio and Schreiber provided ad lib food; but neither study presented data to show the degree to which feeding behavior was altered by these manipulations. Experiment 1 was designed to provide this information. In Experiment 2, feeding behavior in a noncompetitive situation was related to competitive behavior in the limited access situation.

EXPERIMENT 1

Subjects and Apparatus

The Ss were 8 naive male hooded rats (Otogo strain N.Z.B.W.S.), 120 days old at the beginning of the experiment. Ss were housed together in a cage measuring 0.75 x 0.33 x 0.45 m high for 2 weeks before the experiment began and were maintained on a reversed light-dark schedule throughout. The apparatus consisted of a wooden box measuring 0.33 x 0.33 x 0.33 m, with illumination provided by a 40-W fluorescent lamp through a Plexiglas roof. A Plexiglas door formed one side of the box and allowed direct observation. A raised mesh steel floor allowed spilled food to fall out of reach of Ss. The remainder of the apparatus was painted in white semigloss. A food trough measuring 2.50 x 8.75 x 3.10 cm was attached at floor level to a side wall.

Procedure

A 24-h food-deprivation schedule was imposed, and Ss were habituated to the apparatus in pairs for 15 min per day for 10 days. By this time, all Ss were approaching the food trough and taking wet mash within 10 sec of being placed in the apparatus. Individual measures were then taken of the time spent at the food trough, and the amount eaten was measured by weight gain over the 15-min test

Table 1
Amount of Food (Grams) Eaten by Eight Rats Under Three Levels of Food Deprivation

S	Hours of Food Deprivation		
	0	24	72
1	3.5	5.9	13.9
2	3.7	8.1	12.6
3	1.6	8.1	8.1
4	2.5	8.6	6.8
5	2.8	8.1	14.3
6	2.0	5.9	4.2
7	5.9	9.5	14.5
8	2.5	7.9	7.9
Mean	3.1	7.8	10.4
SD	1.3	1.2	3.7

Table 2
Amount of Time Spent at Food Trough (Seconds) by Eight Rats Under Three Levels of Food Deprivation

S	Hours of Food Deprivation		
	0	24	72
1	570	706	840
2	589	520	781
3	267	784	817
4	425	753	799
5	666	861	849
6	653	816	810
7	746	790	854
8	785	810	797
Mean	587.4	754.8	818.3
SD	159.9	98.6	24.9

Table 3
Amount of Food (Grams) Eaten in
Competition Under Two Levels
of Food Deprivation*

S	Hours of Food Deprivation	
	0	24
1	2.9	6.9
[2	2.8	10.9
3	3.4	7.9
[4	2.3	3.9
5	2.1	12.1
[6	0.7	2.0
7	2.4	16.3
[8	2.3	7.9
Mean	2.4	8.5
SD	0.7	4.3

*Brackets indicate competition pairs.

period. These measures were taken once for each of three deprivation conditions in the following order: (1) after 24 h food deprivation, (2) after 24 h ad lib food, (3) after 72 h food deprivation. To control for effects of social facilitation on eating behavior (Harlow, 1932), Ss were fed in pairs, the members of which remained constant throughout the experiments.

Results and Discussion

The amount of food eaten and the time spent at the food trough by each S are shown in Tables 1 and 2. The Wilcoxon matched-pairs signed-ranks test showed significant differences between the amounts eaten in the ad lib and 24-h conditions ($d = 0$, $p < .01$) and between the ad lib and 72-h conditions ($d = 0$, $p < .01$), but not between the 24-h and 72-h conditions ($d = 5$, $p > .05$). The time spent at the food trough showed a similar pattern. A significant difference was found between the ad lib and 24-h conditions ($d = 3$, $p < .05$) and between the ad lib and 72-h conditions, but not between the 24-h and 72-h conditions ($d = 6$, $p > .05$).

These results suggest that Ruskin and Corman did not succeed in

producing a significant alteration in feeding behavior, and consequently it is not surprising that their manipulation of deprivation level was not followed by a change in dominance relationships.

EXPERIMENT 2

Subjects and Apparatus

The food trough was removed from the apparatus previously used to expose a 3.43-cm hole in the same wall at floor level; this food hole gave access to a trough mounted outside the apparatus. The Ss used in the first experiment served as Ss for Experiment 2.

Procedure

The Ss were given 2 days ad lib feeding to let them recover from the 72-h deprivation period and were then habituated to the modified apparatus for 15 min per day for 10 days. By this time, all Ss were reaching through the hole to eat food from the trough within 10 sec of being placed in the apparatus. During the adaptation period, they were maintained on a 24-h deprivation schedule and were not fed in the home cage. One S from each pair was then placed in a cage in which food was provided ad lib for 24 h prior to competitive testing. The other S was maintained on a 24-h deprivation schedule. For competitive testing, both members of a pair were placed in the apparatus for 15 min and the time spent in command of the food trough was measured. The amount eaten was determined by weight gain over the 15-min period. The deprivation conditions of the members of each pair were then reversed, and each pair was tested again in the competitive situation.

Results and Discussion

The amounts eaten and the times spent in command of the food trough under the two levels of deprivation are shown in Tables 3 and 4. All Ss gained higher scores on both measures of competitive performance under the 24-h deprivation condition than they did under the ad lib condition. In both cases, the difference was found to be

Table 4
Amount of Time Spent in Command of
Food Trough (Seconds) Under Two
Levels of Food Deprivation*

S	Hours of Food Deprivation	
	0	24
1	143	598
[2	273	638
3	305	546
[4	321	534
5	212	526
[6	248	490
7	342	786
[8	55	550
Mean	237.3	583.4
SD	91.4	87.5

*Brackets indicate competition pairs.

significant using the Wilcoxon matched-pairs signed-ranks test ($d = 0$, $p < .01$). These results confirm the claim of Hsiao and Schreiber that a relative increase in the deprivation level of the submissive animals is followed by an improvement in competitive performance and enable us to generalize this statement to the limited access situation.

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