AMOUNT OF OPEN-FIELD DEFECATION, HOME CAGE DEFECATION AND FOOD AND WATER INTAKE IN MAUDSLEY REACTIVE AND NONREACTIVE STRAINS OF RATS

HIROSHI IMADA*

Department of Psychology, Kwansei Gakuin University

In many of the unpublished studies done in the present writer's laboratory, Hall's open-field (OF) test of emotionality has failed to show predictive validity. This lack of predictive validity of the test then raised two questions. The first is related to the possibility of predicting individual differences in emotional reactivity using a single-item test, depending mainly upon rats' defecation score. This question is specifically related to the problem of the sensitivity of defecation as a reliable index of emotional disturbance or fear. It has been shown that defecation could serve as an index of fear to some extent but it did not reflect degrees of emotional disturbance sensitively [HUNT & OTIS (3); IMADA (4, 5)]. The second question is concerned with the possibility that OF defecation may be confounded with a general defecatory tendency of rats. If the high defecators in the OF situation (a mildly stressful situation) were the high defecators in the home cage (HC, nonstressful situation), or vice versa, the OF defecation measure could not be regarded as an independent measure of emotional reactivity to stress. In the present writer's laboratory, TAMAKI (7), using 37 unselected strain of rats, obtained a significant positive correlation between the OF defecation and HC defecation ($r = .37$, $p < 0.5$).

In the present study the relationship between the OF defecation and

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the HC defecation was studied using Maudsley Reactive (MR) and Nonreactive (MNR) strains of rats which are known to be different in emotional elimination [BROADHURST(1)]. Other HC measures (e. g., amount of food and water intake) as well as OF measures were recorded.

METHOD

Subjects: Six males and six females from the 36th generations of the MR and MNR strains were used as subjects. Their age range and body weight are shown in rows 1 and 2 of Table 1. In row 1, alphabet letters are used for the litter identification, the animals from the same litter being represented by the same letter.

Apparatus: The ordinary cages for housing rats and the standard OF [BROADHURST (1)] were used. The OF consisted of a plywood arena 32 $\frac{3}{4}$ in. in diameter with white-painted walls 12 $\frac{1}{2}$ in. high. The floor was divided into segments by lines so that one could measure the activity of rats in terms of number of segments traversed in a unit of time. The illumination at the floor level was approximately 165 fc and the white noise of 78 db was continuously sounded during the testing.

Procedure: Eight days before the measurement in the HC began, all Ss were transferred from group cages, in which they had been housed in groups of three, and housed singly. Under each cage, two sheets of brown paper towel were placed in a tray and the paper towels were changed every twenty four hours. Food and water were available *ad libitum*. Twenty four hours before the first measurement in the HC took place, food hoppers and water bottles were filled and the amount of each was recorded. Every twenty four hours, the paper towels were removed from the tray and the number and weight of fecal boluses and the amount of food spillage were measured. The procedure was repeated for four days in order to include one estrous cycle. After four days, the total amount of food and water consumed in four days was measured. With regard to the amount of food intake measure, the net amount was obtained by subtracting the total amount of spillage over four days from the total amount of food lost from the hopper in four days.

Four days after the last day of recording of the HC measures, the OF test was given in the standardized manner. The procedure for the standardized OF testing have been described in detail elsewhere [BROADHURST (1)]. Briefly, it consisted of

Table 1. Summary of the Results

			Males			Females		
			MR	MNR	signif.	MR	MNR	signif.
1) Age and litter			162-172 AABCCD	155-165 EEFFGG		162-169 ABBCDD	155 HHHHHH	
2) Body weight			294.50* (14.78)	227.67 (11.95)	$p<.001$	181.67 (8.83)	163.50 (8.16)	$p<.01$
HC Measures	Food	3) Amount of intake per day	27.01 (2.46)	23.53 (0.78)	$p<.05$	19.47 (0.48)	21.51 (1.33)	$p<.001$
		4) $3)/2) \times 100$	9.17 (0.64)	10.34 (0.69)	$p<.05$	10.71 (0.78)	13.16 (0.65)	$p<.001$
	Water	5) Amount of intake per day	43.00 (7.10)	38.96 (4.65)	n. s.	30.63 (2.85)	43.08 (3.58)	$p<.001$
		6) $5)/2) \times 100$	14.67 (2.78)	17.18 (2.48)	n. s.	16.90 (1.87)	26.44 (2.77)	$p<.001$
	Defecation	7) Number of boluses per day	53.58 (2.55)	58.83 (6.67)	n. s.	47.58 (3.99)	58.25 (4.59)	$p<.01$
		8) Weight of boluses per day in grams	10.84 (0.56)	10.20 (1.11)	n. s.	7.27 (0.76)	8.65 (0.42)	$p<.01$
		9) $8)/2) \times 100$	3.68 (0.17)	4.51 (0.72)	$p<.05$	4.00 (0.38)	5.30 (0.37)	$p<.001$
OF Measures	Defecation	10) Number of boluses per day (A)**	3.92 (0.37)	0.58 (1.30)	$p=.004$	3.21 (0.88)	0.00 (0.00)	$p=.002$
		11) Number of boluses per day (B)**	4.63 (0.37)	0.58 (1.30)	$p=.002$	3.58 (0.91)	0.00 (0.00)	$p=.002$
	Ambul.	12) Number of sections traversed per day	19.29 (3.76)	32.29 (4.10)	$p<.001$ $p=.002$	35.17 (1.62)	53.25 (10.26)	$p<.01$ $p=.002$

* The number in each cell are the arithmetic mean and corresponding standard deviation, the latter being shown in parenthesis. The t tests (two-tailed) for independent groups were applied to all the data except those in rows 10 and 11. These data were subjected to Mann-Whitney U tests. For row 12, both parametric and nonparametric tests were performed.

**In the present study, the number of fecal boluses eliminated in the OF, and in the bucket used to carry rats to and from the OF, were recorded. In row 10 the defecation scores in the OF (A) are presented, and in row 11 the combined defecation scores (B) are given.

placing Ss individually in the OF for two min. per day for four days. The number of fecal boluses eliminated and the total number of sections traversed were recorded. In the present experiment the procedure was different from the standardized procedure in one respect, i.e., there was an interval of 48 hours between the first and the second trials rather than an interval of 24 hours*. The temperature of the animal colony was kept approximately at 70°F all the time.

Results and Discussion

The results are summarized in Table 1. As shown in rows 10 and 11, for both sexes the MR showed significantly more defecation in the OF than the MNR. For the MNR, when both sexes were combined, 11 out of 12 rats did not defecate at all in the OF test. As to the HC defecation, there was no evidence that the MR defecated more in the HC than the MNR (rows 7 and 8). The MNR, or the low OF defecators, rather tended to eliminate greater number of boluses than the MR. This was especially marked in females and there were significant differences between the two strains both in the number and weight of boluses eliminated in the HC. Unfortunately a generalization from this fact is limited in the light of the fact that all the females of the MNR were from a single litter.

It will be noted from rows 7 and 8 that the average weight of a single bolus was heavier in the MR males than in the MNR males ($p < .01$), due presumably to a marked difference in the body size of the two strains (see row 2). RUEGAMER *et al.* (6) have shown that weanling male albino rats with extrahandling showed significantly more body weight gain and eliminated fewer boluses in the HC than rats which were not handled at all in infancy. Although RUEGAMER *et al.* (6) interpreted this observation as indicating better food utilization in the extrahandled rats, the interpretation may not be legitimate unless the weight (rather than the number) of boluses were recorded.

The other results concerning the MR and MNR were generally in

* This was due to the noises caused by the construction of the building on the second day of the OF testing.

line with the previous findings. To summarize: 1) For both sexes, the MR were significantly heavier in body weight than the MNR [BROADHURST (1), YATKIN & EYSENCK (9)]; 2) For both sexes, the MR ambulated significantly more than the MNR in the OF situation [BROADHURST (1), BROADHURST & EYSENCK (2)]; 3) For both sexes, the metabolic rate was higher in the MNR than in the MR [WATSON (8)]. More specifically, the MNR took more food and defecated greater amount of boluses than the MR relative to the body weight (rows 4 and 9).

Summary

The number and weight of fecal boluses in the home cages (HC) of Maudsley reactive (MR) (6 males and 6 females) and nonreactive (MNR) (6 males and 6 females) strains of rats were recorded for four days. They were also given the open-field (OF) test of emotionality. The MR rats defecated significantly more in the OF situation than the MNR rats, but there was no tendency for the MR rats to defecate more in the HC than the MNR rats. The OF defecation score proved to be independent of the HC defecation score. Other HC measures and OF measures were recorded. Generally the results were in line with the previous findings.

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