

The effects of a controlled eating and drinking history on the development of schedule-induced polydipsia

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Six rats were reared under conditions in which they never had access to food and water simultaneously or in close succession. Six other rats had access to food and water together throughout the course of the experiment. Tests of differences between means for small samples showed that the two groups did not differ significantly in weight or in the amount of food and water consumed per day in the home cage. After 80 days of such rearing, the rats were reduced in weight and introduced in to a Skinner box in which water was freely available. On a fixed interval 50-sec schedule of food reinforcement, all rats displayed the characteristic behavioral aspects of schedule-induced polydipsia (SIP). This finding mitigates against explanations of SIP which relate alternation between eating and drinking in the test chamber to past feeding experience in the home cage.

The distribution of noncontingent drinking as a postpellet occurrence (Stein, 1964; Falk, 1966; Burks, Hitzing, & Schaeffer, 1967) mitigated against explanations of schedule-induced polydipsia (SIP) based on adventitious reinforcement and supported those based on dry-mouth theories of thirst (Stein, 1964). Thirst, supposedly induced by ingestion of the dry food pellet, cannot by itself account for the two most salient features of SIP: (a) the consistent alternation between eating the pellet and drinking water and (b) the excessive amount of water consumed during the test sessions.

To account for these behaviors, it was deemed necessary to consider the nature of the drinking response in rats and also the past eating and drinking history of the organism. Stein (1964) indicated that rats consume approximately the same amount of water following the ingestion of food regardless of the size or frequency of the "meals." During a 60-min session in which pellets are presented according to a fixed interval (FI) 50-sec schedule of reinforcement, rats may consume approximately 70 separate 45-mg "meals." Since rats do not vary their postmeal water intake according to the size or frequency of the meals (Stein, 1964), the total volume of fluid consumed during the test session would be much greater than that consumed if all the pellets were presented together and were consumed as one meal.

For an adequate explanation of SIP, it is necessary to explain why the rats consistently alternate between consuming the dry food pellet and drinking water. On CRF, for example, rats may consume many pellets in succession before drinking water (Falk, 1966a). Stein (1964), Schaeffer & Diehl (1966), and Falk (1967) posited an interaction between the opportunity to drink during the interpellet interval and the fact that rats had a past history of drinking water following the ingestion of food in the home cage. In order to further examine the relation between the alternating behavior exhibited in the test chamber and past feeding patterns developed in the home cage, it was necessary to rear rats under different feeding conditions and to compare their behavior in the test chamber. If such a relationship exists, one may predict that rats reared under conditions in which they never had food and water together or in close succession in the home cage would not display typical alternation between food and water in the test chamber.

METHOD

Subjects

The Ss were 12 Sprague Dawley albino rats weighing between 150 and 200 g at the time of testing (90 days). The Ss were weaned at 21 days, placed in separate cages at 48 days, and reduced to 80 per cent of their full body weight at 80 days of age. All Ss were reared in modified breeding cages so that until 15 days of age, food and water were accessible only to the mother rat. At 16 days of age, these nutrients were made available to the pups according to a set schedule.

Apparatus

The test chambers were solid state Behavior Research System equipment, multi programmer Model 2901. A water spout attached to a 100-ml graduated cylinder protruded ¼ in. into the experimental space. Food for home cage feeding consisted of regular laboratory rat chow, while food in the test chamber consisted of 45-mg Noyes pellets.

Procedure

The experimental Ss were six pups who never had access to food and water together or in close succession. Starting at 15 days of age, and continuing through 90 days of age, Ss were presented with food alone for 5 h, followed by 1 h in which neither food nor water was available, followed by 5 h in which water was available without food, followed by an hour in which neither food nor water was available, followed by 5 h of food alone and so on around the clock. A control group of six Ss had access to food and water together throughout the course of the experiment.

In the test chamber, Ss were shaped manually through successive approximations to respond to criterion on CRF. After two daily sessions on CRF, an FI 50-sec schedule of food reinforcement was gradually built up. Four daily sessions on FI 50 for 50 min were followed by four daily sessions on FI 50 for 60 min. These sessions were followed by one daily session in which the pellet dispenser was disconnected, one session in which the FI schedule was reintroduced, and one daily session in which all of the pellets were presented to Ss at one time.

RESULTS AND DISCUSSION

In studies where the E manipulates the feeding schedule of his Ss, there is always the possibility that the growth of the Ss would be impaired. Such an occurrence would have confounded the analysis of drinking behavior in the test chamber. In the present study, the data failed to show a significant difference between the groups for average weights or for homecage food and water consumption.

Differences did occur with reference to homecage drinking and eating behavior. Whereas the controls ate and drank in a normal manner over long periods of time, the experimental group consumed the food and water in a vigorous fashion, consuming their full 5-h ration of food in about 45 min and of water in about 15 min. This behavior was to be expected of rats who were alternately food and water deprived (Bolles, 1961).

Despite differences in home cage feeding patterns, all Ss alternated between food and water in the test chamber and drank excessive amounts of water when compared to baseline data for Ss at 80 per cent of their full body weight. Tests of significance between means for small samples failed to show significant differences between groups for the number of bar presses made and the amount of water consumed per session.

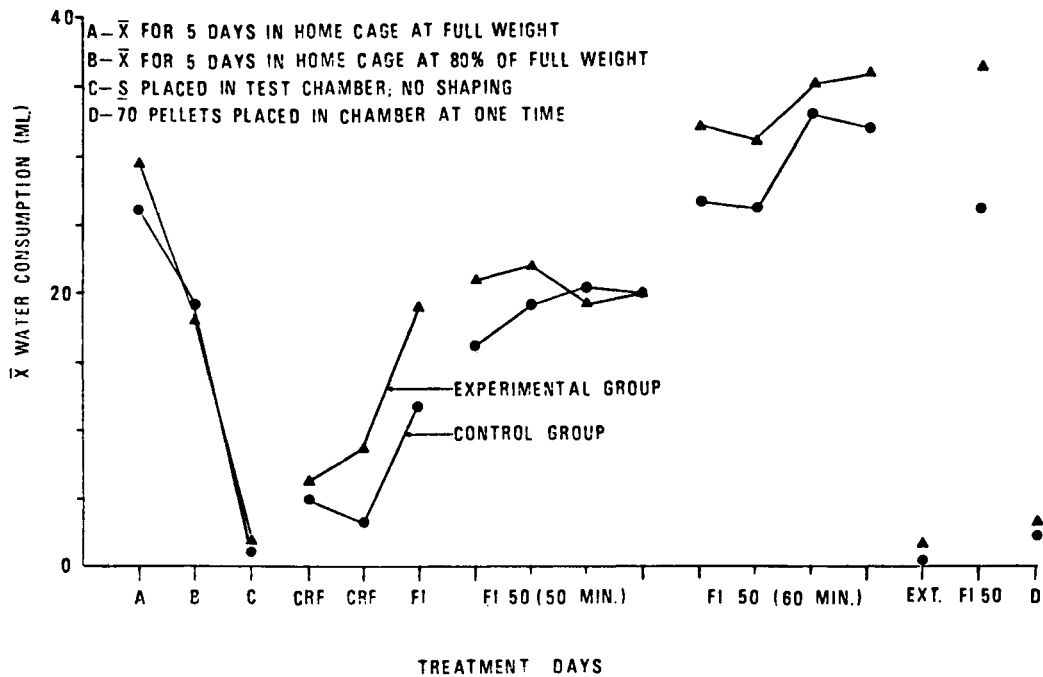


Fig. 1. Mean water consumption (ml) for each group of Ss during each experimental condition.

Fig. 1 shows the mean water consumption for each group during each condition of the experiment.

Neither group displayed excessive water consumption on CRF, average consumption being 5.3 ml and 6.5 ml for the control and experimental groups, respectively. Drinking increased for each group when the FI schedule was initiated and became excessive during the FI 50-sec schedule. During the extinction session, water consumption diminished to 1.1 ml and .25 ml for the experimental and control groups, respectively. Excessive drinking resumed when the FI 50-sec schedule was reintroduced. When 70 pellets were placed in the food magazine at one time, and the pellet dispenser was made inoperable, water consumption decreased to 4.5 ml and 3.25 ml for the experimental and the control groups, respectively. This demonstrated that the intermittent presentation of food pellets was necessary for SIP.

This study did not support theorists who attempted to relate the consistent alternation between food and water in the test chamber to past patterns of eating and drinking in the home cage. It was possible, however, that eating and drinking patterns become established early in the life of the organism. The young pups, while still with their mother during Days 16-21, may have eaten solid rat chow and then drunk milk from their mother. Also, during the first 15 days of their lives, the pups were in an environment where their mother displayed normal eating and drinking behavior. Whether or not these factors could have influenced Ss' behavior in the test chamber

to such a degree that there did not appear to be any differences between the groups is an empirical question. For the present, it should be stressed that more research is needed before one is able to accept or reject current explanations of SIP relating behavior in the test chamber to past feeding experience in the home cage.

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NOTE

1. This research was taken from an unpublished Master's thesis: The effects of a controlled eating and drinking history on the development of schedule-induced polydipsia, completed as part of the requirement leading to the Master of Arts degree at Western Michigan University, 1968.