Effects of a conditioned taste aversion on schedule-induced polydipsia

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Rats that became polydipsic on water under a FFI-60 food schedule were switched to a saccharin solution. After drinking saccharin, the Ss were exposed to ionizing radiation. Although this procedure produces a marked aversion to saccharin in thirst motivated rats following a single exposure, repeated pairings of the saccharin solution and ionizing radiation were needed to reduce the high drinking levels generated by the intermittent food schedule. These findings suggest that schedule-induced polydipsia is a strong motivational state.

The motivational properties of schedule-induced polydipsia have been demonstrated by Falk (1966). He trained rats to press a bar for food pellets on a VI 1-min schedule of reinforcement. Water was freely available to Ss in the home cages, but in the experimental chambers the delivery of 0.1 ml of water was made contingent upon bar pressing. In this situation, Ss maintained a polydipsic level of drinking even though water was contingent on reinforcement schedules that varied from FR 1 to FR 50. Since the Ss were not water-deprived in the home cages, the high rate of bar pressing for water that was maintained in the experimental chambers clearly demonstrated that the intermittent food schedule produced a strong motivation to drink.

An alternate method of demonstrating the strength of schedule-induced polydipsia would be to produce a competing motivational state in Ss, once they are polydipsic, to not drink the solution. Although quinine solutions are normally avoided, adulterating the drinking fluid with quinine fails to abolish schedule-induced polydipsia (Segal & Deadwyler, 1965). Classically conditioned aversions to distinctly flavored fluids, with ionizing radiation as the aversive motivating stimulus, can also be employed to induce aversions to normally preferred solutions. Exposing rats to X-rays or Co60 gamma rays, shortly before or after they have consumed small amounts of a 0.1% saccharin solution, reverses the normal preference of saccharin over water and dramatically reduces the amount of saccharin consumed when that is the only solution available (see Kimeldorf & Hunt, 1961). When tested 48 h after a pairing of saccharin consumption with 54 R Co60, irradiated rats drank less than 1 g of saccharin solution, while sham irradiated controls drank an average of 26 g during the same test period (Garcia & Kimeldorf, 1960).

The purpose of the present experiment was to test the effects of the conditioned saccharin aversion procedure upon schedule-induced polydipsia, when the only drinking solution available in the test chamber was saccharin. Since intermittent schedules of food delivery increase the probability of drinking, and the conditioned taste aversion procedure normally decreases the probability of drinking a particular fluid, superimposing the latter procedure on the former procedure should reveal the relative strengths of the two motivational operations.

SUBJECTS

Four female SDD/DR albino rats from the Dublin breeding laboratories were used. They were maintained at 80% of their free feeding body weight by food deprivation. Although most of the daily food ration was obtained in the experimental session, it was necessary to add about 5 g of lab chow per day in the home cages to maintain the proper body weight.

APPARATUS

The Ss were placed in standard LVE Model 1548 test chambers at the same time each day. Standard 45-ml Noyes food pellets were used as reinforcers. A water bottle was attached to the test chamber, and

![Graph](image1)

**Fig. 1.** Total liquid consumption for each session by experimental Ss under all experimental conditions.
the drinking tube was accessible through a 
½-in. diam hole placed 3 in. to the right of 
the food cup. White noise was continuously 
present to mask extraneous noises.

During irradiation or sham trials the Ss 
were placed in individual compartments of a 
wooden box with a fine copper screen 
between the source and the animal. Gamma 
radiation was produced by Co\(^{60}\) from a 
Model 150 C Gammabeam Irradiator 
(Atomic Energy of Canada). A target-to-S 
distance of 27 in. was used for all exposures, 
resulting in a dose rate of 2.1 R/sec.

PROCEDURE AND RESULTS

The first two sessions served to adapt Ss 
to the apparatus and food pellets. The Ss 
were placed in the test chamber for 2½ h 
with 150 pellets in the food cup at the 
beginning of the sessions. Water intake 
values were observed by weighing the bottles 
before and after each session. Licks on the 
water tube were monitored by standard 
drinkometer circuits, and recorded on 
counters and cumulative recorders.

On Day 3, intermittent food delivery was 
begun. One pellet was delivered each minute 
independently of S's behavior (FFI 1). Each 
session ended when 150 pellets had been 
delivered. Water rather than saccharin was 
available to the Ss for the initial develop-
ment of polydipsia behavior, because 
newness of the taste substance is critical for 
reliable conditioned taste aversion (Revusky & 
Bedarf, 1967).

Polydipsia emerged rapidly for all Ss. 
Cumulative records showed the typical 
immediate post-pellet water drinking, 
followed by a pause before delivery of the next 
pellet. When water drinking stabilized, the 
water drinking was changed from water to a 
0.1% sodium saccharin solution for the 
remainder of the experiment. Immediately 
after the first saccharin session, Ss 380 and 
382 were exposed to 100 R Co\(^{60}\). Ss 383 
and 384 were then placed in front of the 
irradiator, but were not exposed to gamma 
rays. Figure 1 shows that the saccharin-
irradiation pairing produced only a slight 
decrease in the amount of saccharin 
consumed by S 382 in later sessions, and 
drinking actually increased for S 380. After 
recovery of stable drinking levels, the 
experimental Ss were exposed to 200 R, and 
the controls were given a second sham 
exposure. Both irradiated Ss showed a slight 
drop in saccharin consumption following 
this exposure, but recovered their previous 
intake levels within six sessions.

To ensure that pairing of radiation with 
saccharin consumption could induce 
produce a taste aversion under the present 
circumstances, a more stringent conditioning 
procedure was initiated. Fifteen of the 
next 16 sessions were followed by exposure 
to 50 R Co\(^{60}\). It can be seen in Fig. 1 that 
the saccharin consumption of both experi-
mental animals was reduced to less than 20 g 
for the last three sessions of this condition. 
Cessation of radiation exposures was 
followed within 13 sessions by a level of 
water drinking only slightly below the preirradia-
tion drinking levels.

The data for control Ss 383 and 384 are 
shown in Fig. 2. Both Ss maintained a high, 
relatively stable level of drinking throughout 
the experiment, with no significant shifts 
following sham exposures. The broken line 
preceding Session 17 for S 383 indicates the 
repair of the reinforcement mechanism 
which previously did not deliver all programmed reinforcements.

DISCUSSION

The present data support Falk’s (1966) 
contention that schedule-induced poly-
dipsia has strong motivational properties. 
Rats deprived of all liquid for 48 h after a 
saccharin-radiation pairing (54 R Co\(^{60}\)) 
consume almost no saccharin in a 6-h test 
period (Garcia & Kinelndorf, 1960), and rats 
will show a strong preference for water over 
saccharin in a two-bottle preference test for 
as long as 30 days following a single pairing 
of saccharin consumption with 57 R Co\(^{60}\) 
(Garcia, Kinelndorf, & Koelling, 1955). By 
contrast, polydipsic rats in the present 
experiment showed no decrement of 
saccharin consumption in the sessions 
following their initial exposure to 100 R. It 
may be argued that the resistance to changes 
in drinking level was a result of making 
saccharin the only solution available in the 
test chamber. However, testing occurred for 
only 2.5 h each day while water was 
available in the home cage for 21.5 h daily, 
and the Ss could easily have obtained their 
total water requirements in the home cages.

The decrement of drinking with repeated 
saccharin-radiation pairings shows that the 
conditioned taste aversion is a viable 
procedure for reducing drinking levels. The 
fact that the conditioning procedure rather 
than some other factor accounted for 
diminished drinking was demonstrated by 
recovery of the experimental Ss with 
cessation of radiation exposures, and by the

Fig. 2. Total liquid consumption for each session by control Ss under all experimental 
conditions.
stability of the control Ss throughout the experiment. Radiation sickness cannot explain the decrement since both Ss ate all food pellets delivered in each session.

Since Ss that are fluid deprived avoid fluids that have been previously paired on a single occasion with ionizing radiation, even when that fluid is the only solution available, it is apparent that radiation-induced aversion produces a motivational state that overrides the thirst motivation produced by 48 h water deprivation. The fact that this same conditioned aversion procedure does not produce a decrement in the high fluid intake levels induced by intermittent food schedules, and that repeated conditioning was required to reduce drinking, clearly attests to the strength of the motivational state induced by intermittent scheduling of food.

REFERENCES

NOTE
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