Drinking response distributions associated with a 4% sucrose FFI food schedule[1]

CHARLES D. BURKS, E. WADE HITZING AND ROBERT W. SCHAEFFER
FLORIDA STATE UNIVERSITY

Polydipsia was produced in two female rats when they were exposed to a FFI 40 sec. 4% sucrose pellet food reinforcement schedule. An analysis of the inter-pellet drinking distribution of both Ss indicated that drinking followed, rather than preceded pellet delivery. This result was interpreted as further evidence for a prandial interpretation of schedule-induced polydipsia.

Food-deprived rats tested on free FI (FFI) food reinforcement schedules reliably engage in excessive collateral water drinking (e.g., Segal, 1965; Schaeffer, Diehl, & Salzberg, 1966). In both of these experiments, standard 45-mg Noyes lab rat food pellets were used. Falk (1964), however, has reported that the excessive collateral water drinking instated by standard Noyes pellets was attenuated when sucrose pellets were substituted for the standard pellets.

Since previous studies have suggested that drinking on FFI food reinforcement schedules follows, rather than precedes, pellet delivery (Stein, 1964; Schaeffer et al, 1966), the purpose of the present study was first, to determine if excessive drinking could be obtained with sucrose pellets dispensed on a FFI schedule, and second, to describe the inter-pellet interval (IPI) drinking response distribution.

Method

The Ss were two 100-day-old female Sprague-Dawley albino rats. The apparatus consisted of two standard LVE Model 1316 test chambers with a 100 ml graduated water tube installed in place of the right bar. Experimental schedules were programmed with appropriate relays and switching circuitry. Tongue-water contacts were recorded by LVE Model 1520 drinkometers. Standard 45-mg Noyes 4% sucrose pellets were used. Water was always available to the Ss in the home cages and in the test chambers.

The Ss were adapted to a 21-hr. food deprivation and a 3-hr. feeding schedule in which Purina dry laboratory mash was available in the home cages. Next, the Ss were given Noyes 4% sucrose pellets in the 3-hr. daily feeding sessions in the home cage. Third, the Ss were placed in the test chambers for daily 3.2-hr. sessions, with 288 4% sucrose pellets freely available in the food cup, and adapted to the 20.8-hr. deprivation and 3.2-hr. feeding schedule. The Ss were then tested in daily 3.2-hr. sessions under an FFI 40 sec. reinforcement schedule in which they received 288 4% sucrose pellets per session. The 288 pellets given in the baseline condition and in the FFI were the equivalent of the mean baseline sucrose pellet intake of 13 gm/3 hr. obtained in the home cage baseline period.

Total licks, and number of licks occurring in each of the four successive 10-sec. intervals of the FFI 40 sec. IPI were recorded separately. Water intake, in the home cage and in the test chamber, was recorded during all phases of the experiment.

Results

Figure 1 shows the 20.8 hr. and 3.2 hr. water intake during the last 10 days of the third baseline condition and for all FFI 40 sec. 4% sucrose pellet sessions.

As will be recalled, during the third baseline period each S was placed in a test chamber and give 3.2 hr. to consume 288 pellets which were freely available in the food cup. During this period, DB2 and DB4 had a mean 3.2-hr. water intake of 11.6 and 8.2 ml, respectively. Mean 20.8-hr. home cage water intake during this same period was 13.2 and 16.2 ml for DB2 and DB4, respectively.

As is evident from Fig. 1, both Ss showed an increase in water consumption when they were exposed to the FFI 40 sec. schedule, although the effect was neither as marked nor as consistent across daily sessions as the polydipsia obtained when non-sweetened pellets are dispensed on intermittent reinforcement schedules (cf., Falk, 1964). During the last 10 sessions of the FFI 40 sec. schedule, DB2 had a mean 3.2-hr. water intake of 55.6 ml and a mean intake of 6.8 ml during the corresponding 20.8-hr. home cage period. Similarly, DB4 consumed an average of 38.7 ml in the test chamber during the last 10 sessions of the FFI 40 sec. schedule, and averaged 5.3 ml in the corresponding 20.8-hr. home cage period. Mean 24-hr. water intake, therefore, increased from a pre-experimental baseline of 24.8 ml

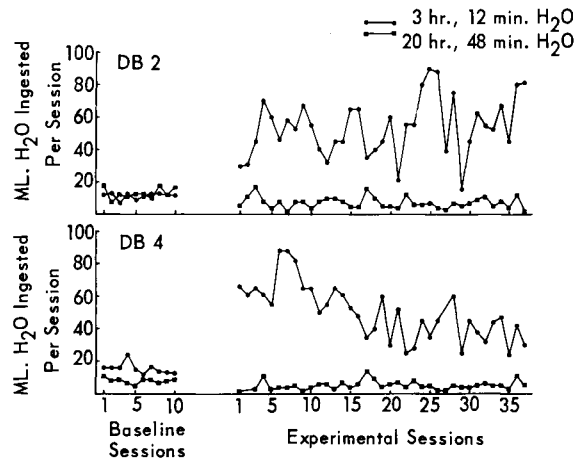

Fig. 1. Total ml of water ingested per session by Ss DB2 and DB4 in the test chamber (3.2 hr) and in the home cage (20.8 hr) during baseline and experimental (FFI 40 sec) sessions.

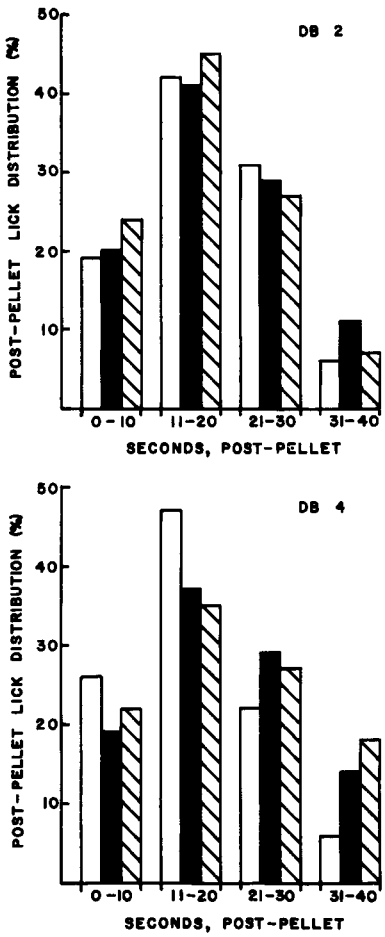

Fig. 2. Post-pellet lick distributions for Ss DB2 and DB4 in the early (days 1-12), middle (days 13-24), and last (days 25-37) sessions of the FFI 40 sec 4% sucrose pellet reinforcement schedule.

to 62.4 ml for DB2, and from 24.4 ml to 44.0 ml for DB4, when the Ss were exposed to the FFI condition.

The percent of total licking in each successive 10-sec. interval of the 40-sec. IPI is presented in Fig. 2, which summarizes the licking distribution for each S in the early (days 1-12), middle (days 13-24), and last (days 25-37) FFI 40 sec. sessions. The lick distributions were similar for both Ss, with more than half of all licking occurring in the first 20 sec. of the IPI. Specifically, 61%, 61%, and 69% of DB2's licking occurred during the first 20 sec. of the early, middle, and last sessions, respectively. Seventy-three percent of DB4's licking occurred in the first 20 sec. of the IPI during the early sessions, 56% during the middle, and 57% during the last sessions. Less than 20% of either S's licking occurred in the 10-sec. period immediately preceding pellet delivery.

For both Ss, nearly half of the IPI licking occurred during the 11-20 sec. interval. The difference in lick rate between the 0-10 sec. and 11-20 sec. intervals of the IPI was primarily attributable to the 4 to 6 sec. period required for pellet ingestion, for if an S licked following the ingestion of a pellet, licking continued with very little change in the local rate, until the lick burst was terminated.

Early, middle, and last session lick percentages are highly representative of individual sessions. As is evident from Fig. 2, the IPI lick distribution remained relatively stable throughout the experimental sessions, independently of the total number of licks/session.

Discussion

The polydipsia obtained in both Ss when 4% sucrose pellets were dispensed on the FFI 40 sec. schedule should not be interpreted as refuting Falk's (1964) findings. While the Ss in the present study were fed sucrose pellets from the outset, Falk introduced sucrose after obtaining excessive drinking with standard Noyes pellets. Changing the sucrose composition of the pellet in mid-experiment may have accounted for Falk's finding, for Premack & Hillix (1963) have shown that mid-experimental changes in sucrose concentration produce dramatic and persistent shift effects in consummatory responding.

The distribution of licking responses within the IPI tend to support a post-pellet interpretation of water drinking (e.g., Falk, 1964; Stein, 1964; Schaeffer & Diehl, 1966), for there was no consistent tendency over sessions for licking to shift from early post-pellet segments of the IPI to later pre-pellet segments.

References

Falk, J. L. Studies on schedule-induced polydipsia. In M. J. Wayner (Ed.), *Thirst*. New York: Macmillan, 1964. Pp. 95-116.

Premack, D., & Hillix, W. A. Evidence for shift effects in the consummatory response. *J. exp. Psychol.*, 1962, 63, 284-288.

Schaeffer, R. W., & Diehl, Judith C. Collateral water drinking in rats maintained on FR food reinforcement schedules. *Psychon. Sci.*, 1966, 4, 257-258.

Schaeffer, R. W., Diehl, Judith C., & Salzberg, C. L. An application of Premack's theory to behaviors associated with a FFI food schedule. *Psychon. Sci.*, 1966, 6, 405-406.

Segal, E. F. The development of water drinking on a dry-food free-reinforcement schedule. *Psychon. Sci.*, 1965, 2, 29-30.

Stein, L. Excessive drinking in the rat: Superstition or thirst? *J. comp. physiol. Psychol.*, 1964, 58, 237-242.

Note

1. This research was supported in part by Public Health Service Research Grants MH-08775 and MH-12025.