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SCHEDULE-INDUCED POLYDIPSIA AS A FUNCTION OF FIXED INTERVAL LENGTH[1]

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Rats were trained to bar-press for Noyes pellets on an FI schedule which was increased serially through several values from 2 sec to as high as 300 sec. Concurrently, water was freely available. As FI length was increased, the degree of polydipsia increased linearly to a maximum value.

Rats maintained on a food-deprivation schedule, earning most of their daily food during a 3.17-hr VI 1 min session, develop polydipsia if a source of water is concurrently available (Falk, 1961*a*). Following delivery of a food pellet (45 mg Noyes lab rat pellet), a rat typically proceeds immediately to the water spout and drinks approximately 0.5 ml. Post-pellet drinking continues throughout the session, the animal consuming about one-half its body weight in water. Polydipsia does not occur when the food schedule is continuous reinforcement nor with short fixed ratios, although with longer FRs the effect will appear (Falk, 1961*b*). Since it will also develop on noncontingent VI 1 min (pellets delivered on VI 1 independent of lever-pressing) in an untrained animal (Falk, 1961*b*), one of the major determinants of the polydipsia would seem to be inter-pellet time. To evaluate the role of inter-pellet time in producing schedule-induced polydipsia, the length of an FI schedule for food pellets was systematically varied and the effect on concurrent water intake studied.

METHOD

Subjects

Two Irish, female, littermate rats, designated I-10 and I-11, 7 months old at the start of the experiment, were used. They were a first generation (F_1) cross between two inbred strains, brother-sister mated for 46 generations: an albino line and a black, non-agouti, selfed line. They were individually housed in a temperature-controlled, constantly-illuminated room.

Procedure

The animals were maintained on Purina laboratory chow and daily water intakes were measured for 10 days. Next, the animals were trained to bar-press for 45 mg Noyes lab rat food pellets. Throughout the experiment they were maintained at 80-90% of free-feeding weight by limiting food intake. The experimental space consisted of a picnic ice chest containing a Gerbands lever, dc house lights, and a Gerbrands pellet dispenser. Water was available from a calibrated reservoir clipped to the side of the ice chest. The reservoir spout was accessible through a slot cut in a Micarta panel. Licks at the water spout were recorded electronically. All control and recording apparatus was in an adjoining room. Water was also available in the home cage, and the amounts drunk were recorded daily.

The following FI schedules for food pellets were given in an ascending order: FI 2 sec, 12 sec, 20 sec, 30 sec, 45 sec, 60 sec, 90 sec, 120 sec, 150 sec. Rat I-10 was given two additional FI values: 180 and 300 sec. Food was limited to 180 pellets per session. Daily sessions were given at a particular FI value until the session water intake stabilized. Then, four to seven sessions were run at that value before proceeding to the next FI length.

RESULTS

Figures 1 and 2 show the pre-experimental levels of water intake, the water drunk in the home cage, and the water consumed during

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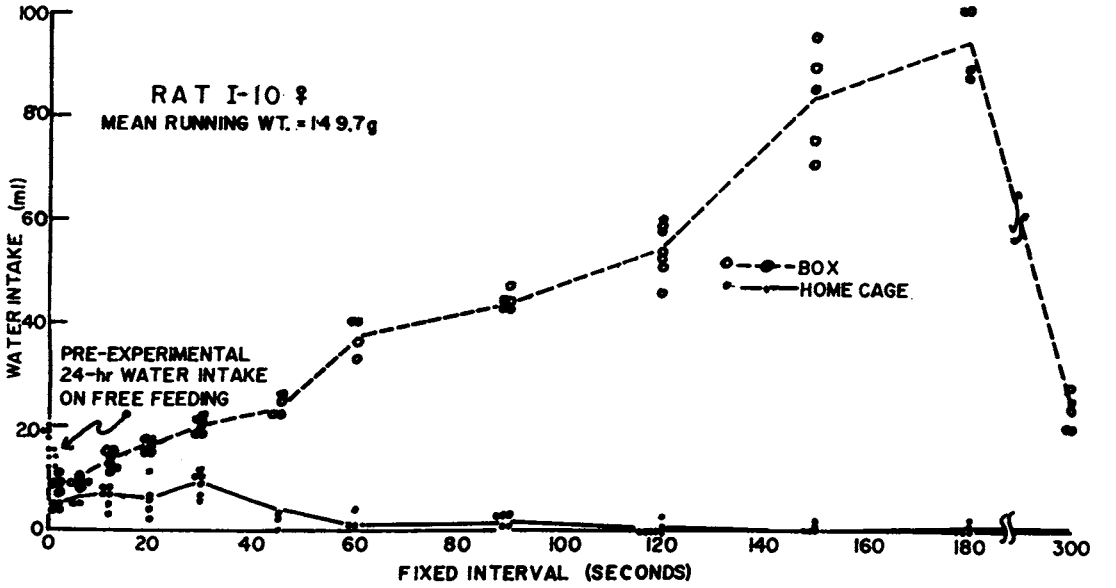

Fig. 1. Concurrent water intake as a function of length of food FI for Rat I-10.

the FI sessions. Both animals became polydipsic during the experimental sessions, although to different degrees. Rat I-10 reached its water-intake maximum at FI 180 sec, drinking six times its pre-experimental level. Rat I-11 consumed the most water at FI 90 sec, the polydipsia amounting to three times the pre-experimental level. For both animals, as FI length increased, the amount of water consumed increased linearly to a maximum. As the schedule-induced polydipsia surpassed the pre-experimental, 24-hr water-intake level, home-cage water intake became negligible.

DISCUSSION

The polydipsic effect is not explicable in terms of some metabolic change resulting from the food-deprivation regime. First, food depri-

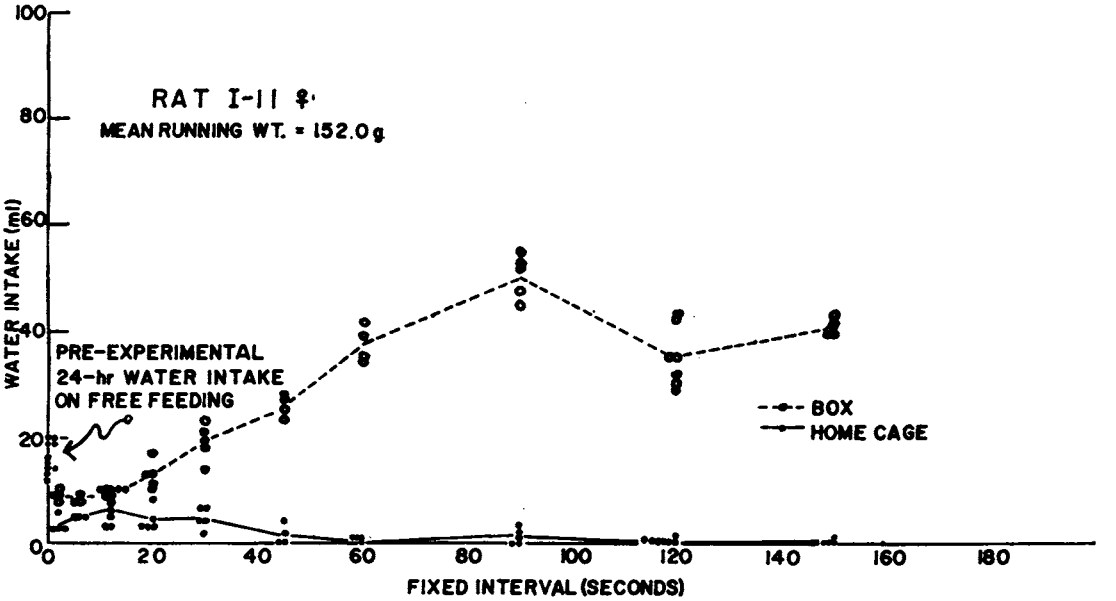

Fig. 2. Concurrent water intake as a function of length of food FI for Rat I-11.

vation in the rat produces a decrease, not an increase, in free water intake (Strominger, 1946; Falk, 1964, p. 98). Second, any metabolically-defined, obligatory increase in water intake would have been operative at the shorter FI values as well, but no polydipsia was found at those values.

Since previous work (Falk, 1961*a*, 1961*b*, 1964; Stein, 1964) has shown that water is drunk in a definite burst of licking immediately after pellet delivery, sessions were limited to a set number of pellets (180) so that fair comparisons of water intake could be made as FI length was varied. This arrangement produced session lengths from about 1 hr (FI 2 sec) to almost 16 hr (FI 300 sec). Session length *per se* does not seem to be a major contributing factor to the results since the drinking occurs as a post-pellet event and is initiated as a function of inter-pellet time, not overall session length. In similar experiments, animals given 3.5-hr sessions from 5 pm until 8:30 pm, but left in the apparatus in S^{Δ} until the following morning, do almost no drinking after the S^{D} period. Since longer FIs necessarily involve longer sessions, a relationship could be plotted between session length and intake, but in the present experiment this would be misleading.

Shortly after the initial report on schedule-induced polydipsia (Falk, 1961*a*), evidence against an explanation of the polydipsia in terms of superstitious responding or as a feature accompanying only temporally-defined schedules was presented (Falk, 1961*b*). Nonetheless, such interpretations have persisted (Clark, 1962; Segal and Holloway, 1963; Segal, 1965). Lately, additional work has continued to support a "non-superstitious responding" view of this phenomenon (Falk, 1964; Stein, 1964). In general, it is spurious to assume that any feature of behavior which appears in a predictable temporal relation to a reinforcing event, and is not a consequence of explicit programming, is necessarily being maintained by adventitious reinforcement. The notion of adventitious reinforcement can no more explain schedule-induced polydipsia than it can Azrin's (1965) observations on aggression. These phenomena are related to the environmental controls imposed by schedules. But they do not stand in either an adventitious or a chaining (Ferster and Skinner, 1957) relation to the reinforcing event. Pending more detailed explanations, such added benefits to scheduled behavior might be called "adjunctive behavior".

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