

# Extinction of alcohol drinking in rats following acquisition on a fixed-ratio schedule of reinforcement\*†

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The present study examined fixed-ratio (FR) acquisition for food reinforcement and extinction of alcohol tube licking by albino rats. The pattern of tube licking during daily sessions of FR reinforcement was indistinguishable from barpressing patterns exposed to comparable reinforcement schedules. During extinction, alcohol consumption returned to baseline levels. Control manipulations indicated that: (1) the excessive volume of alcohol consumed during sessions was primarily due to the FR reinforcement; (2) the excessive alcohol drinking that occurred in the home cage between sessions was due to the food deprivation. Alcohol drinking appears to function like other operants exposed to FR contingencies.

Recent experiments have assessed alcohol drinking as an operant response (Senter, Smith, & Lewin, 1967; Persensky, Senter, & Jones, 1968; Martin, 1971). This approach was extended in the present study, which examined the effects of fixed-ratio (FR) acquisition of alcohol tube licking for food reinforcement and extinction of tube licking in albino rats. The dependent variables were the pattern of licking during daily sessions, the volume of alcohol consumed during sessions, and the relative alcohol to water consumed in the home cage between sessions. An additional purpose was to evaluate the effects of food deprivation on ad lib alcohol consumption.

## SUBJECTS

Four male experimentally naive albino rats, with a mean starting weight of 265 g, were used. They were housed in individual cages with constant access to tap water and a 10% (v/v) ethanol solution throughout the experiment.

## APPARATUS

A standard Lehigh Valley experimental chamber for rats was used. The left-hand bar was removed, and the opening was covered with a metal plate. A glass drinking spout was wired to record licking and its tip positioned 100 mm to the right of the food tray and behind a metal shield, thereby allowing contact with the S's tongue. The spout was connected to a

100-ml graduated tube containing 10% ethanol (v/v). Licks were recorded on a Gerbrands cumulative recorder through a Grason-Stradler drinkometer. The operations were programmed by standard Lehigh Valley relay equipment.

## PROCEDURE

Two Ss (S 38 and S 42) were exposed to a series of seven steps in the acquisition and extinction of alcohol tube licking. Two additional Ss (S 14 and S 18) were housed in the home cages constantly and were utilized solely to evaluate the effects of food deprivation on ad lib alcohol consumption. Measurement of relative alcohol consumption in the home cages for all Ss was based on the three-bottle three-position method described by Myers & Holman (1967).

S 38 and S 42 were exposed to the following steps: (1) Ad lib food. Ss were given free access to food for 10 days. (2) Free operant alcohol. Ss were placed in the experimental chamber for 36 min daily in order to obtain a free operant level of alcohol consumption. This step lasted for 6 days. All daily sessions on Steps 3 through 6 inclusive lasted 36 min. (3) Food deprivation and increasing the FR. Ss were reduced to 85% of their ad lib weight over a 6-day period. Over the next 12 weeks, they were maintained at 85% of their normal growth curve (N.G.C.). The N.G.C. was obtained from weekly weighings of eight litter mates and was used because of reports that it does not produce a motivational artifact found when young rats are run on 85% of their preexperimental free feeding weights (Davenport & Goulet, 1964). The Ss were magazine trained and shaped to lick the alcohol tube on a continuous reinforcement schedule,

then FR 5, FR 15, FR 40, and FR 64. Food deprivation and increasing the FR lasted for 18 days for S 38 and 26 days for S 42. (4) FR 64. Daily sessions of an FR 64 schedule of reinforcement of alcohol drinking continued for 28 days. (5) Extinction. Ss were placed on extinction for alcohol tube licking for 14 days. (6) Ad lib 140 pellets during sessions. In order to determine if the Ss drank from thirst initiated by consuming dry pellets, the average number of pellets earned during the last week of Step 4 (140) were placed in a pan in the Skinner box during eight additional daily sessions of extinction for alcohol tube licking. (7) Ad lib food. Both rats were returned to free food in the home cage.

Sessions in the Skinner box were discontinued.

Ss 14 and 18, with water and 10% ethanol in the home cage at all times, were exposed to alternating periods of ad lib food and food deprivation according to the following schedule: first 18 days, ad lib food; next 42 days, food deprivation; next 14 days, ad lib food; next 14 days, food deprivation; next 14 days, ad lib food.

Under the food-deprivation condition, Ss were maintained at 85% of their free feeding weights.

## RESULTS AND DISCUSSION

The pattern of fluid consumption for S 38 is shown in Fig. 1. (The pattern of drinking for S 42 was very similar to that of S 38 and therefore will not be discussed.) Alcohol consumption was low for both Ss in the home cage and in the experimental chamber under the free operant condition. Alcohol intake increased steadily in both the home cage and the experimental chamber under the free operant condition. Alcohol intake increased steadily in both the home cage and the experimental chamber during magazine training and shaping. Both Ss showed relatively stable drinking patterns in the home cage and in the experimental chamber during the sessions of FR 64 (see Fig. 1). When placed on extinction, consumption in the experimental chamber dropped off rapidly in both Ss. The 140 pellets placed in the experimental chamber during Step 6 had little effect on the alcohol consumption. When the Ss were returned to free feed, alcohol drinking decreased to the original baseline level within a 4-day period in their home cages.

The pattern of drinking during sessions was typical of an FR schedule, a high steady rate with a brief pause after reinforcement. This can be seen in Fig. 2 for S 38 (again, the performance of S 42 was quite similar to that of S 38). This pattern of

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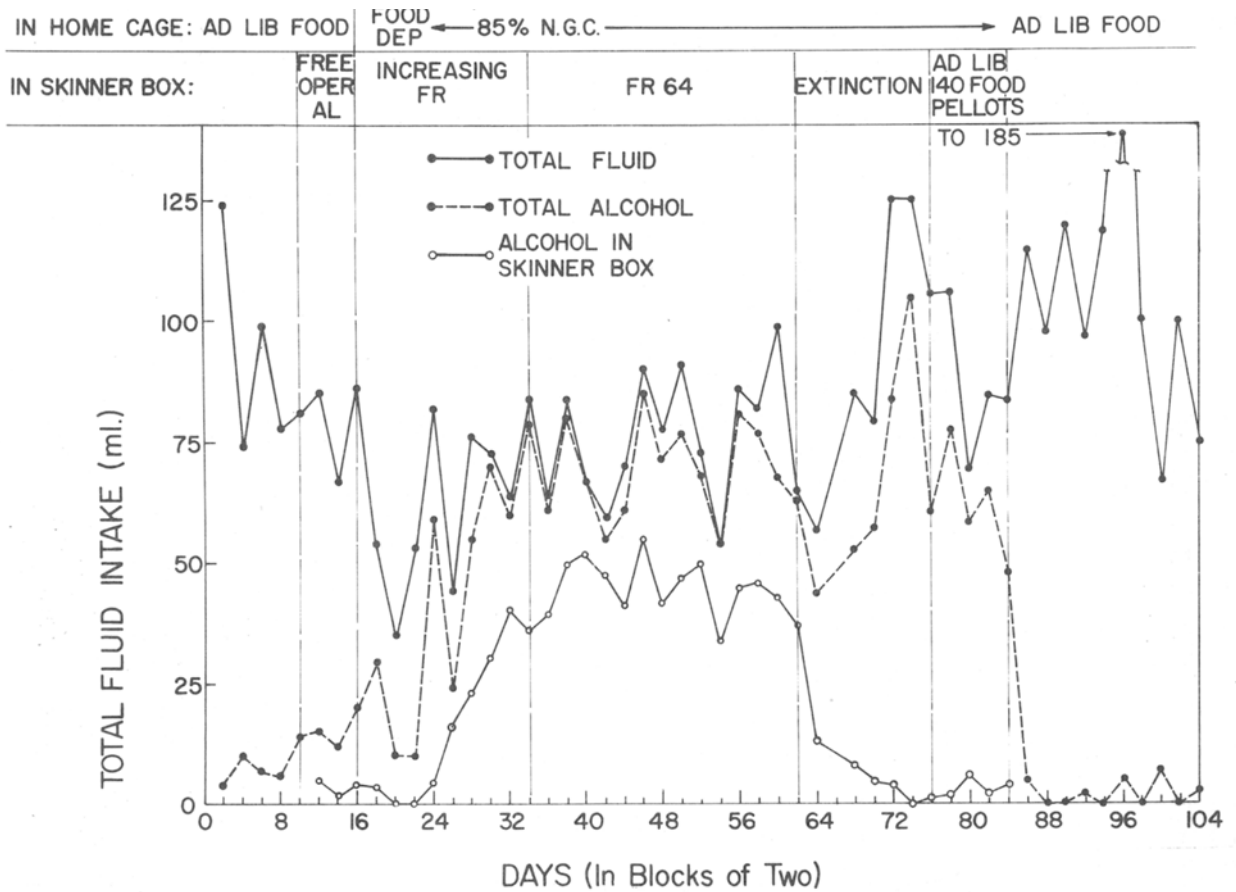


Fig. 1. Fluid consumption per 2-day intervals for S 38 over several conditions.

drinking strongly suggests that drinking was not schedule-induced in the manner described by Senter & Sinclair (1967), Holman & Myers (1968), or Martin (1971), in that schedule-induced drinking occurs immediately after food delivery with no postreinforcement pause.

Both S 14 and S 18 consumed much more alcohol when food deprived than under the ad lib food conditions. The daily drinking pattern for S 14 can be seen in Fig. 3. (Thypattern for S 18 is very similar to that of S 14.)

It seems clear from these results that ad lib alcohol consumption is influenced to a great extent by the occurrence of food deprivation. However, Ss can be induced to drink excessive volumes of alcohol in a very brief period of time by making food contingent upon alcohol drinking on a fixed ratio schedule. During the sessions of FR 64, both S 38 and S 42 exhibited behavior that might be labeled "drunkenness." During the end of the 36-min sessions, they frequently missed the bars on the bottom of the cage or fell over after picking up a pellet. They appeared unstable when attempting to groom themselves, and,

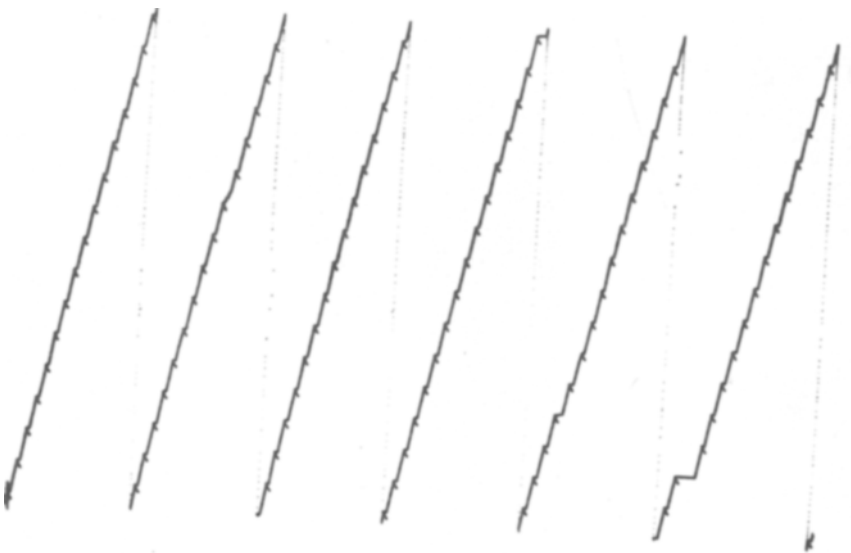


Fig. 2. Cumulative record of S 38's alcohol tube licking on an FR 64 schedule of food reinforcement.

