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BRIEF COMMUNICATION

Effects of Feeding Regimen on Ethanol Intake by Guinea Pigs[1]

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POLING, A., C. URBAIN AND T. THOMPSON. *Effects of feeding regimen on ethanol intake by guinea pigs.* PHARMAC. BIOCHEM. BEHAV. 7(4) 401–403, 1977. – During daily two-hr sessions, guinea pigs licked a drinking tube filled with either 0 (tap water), 2, 4 or 8% (v/v) ethanol solution under three feeding regimens. Consumption of each solution was highest when sufficient food to maintain subjects at 90% of free-feeding weight was provided during sessions, lower when the same food ration was provided after sessions, and lowest when ad lib access to food was provided within and between sessions. However, this decrease in consumption across feeding regimens was inversely related to ethanol concentration. Under all feeding regimens, volume of solution consumed decreased with increasing ethanol concentration while milligrams ethanol consumed increased with ethanol concentration. These results are similar in some respects to previous findings with rats and monkeys, suggesting that further studies of oral ethanol self-administration by guinea pigs may be merited.

Guinea pigs Ethanol Feeding regimen Self-administration

THE INTERACTION between food deprivation, food presentation, and liquid intake is complex and apparently differs across species [3, 11, 19]. Schedule-induced polydipsia, the persistant drinking that occurs when food-deprived animals intermittently receive dry food in small quantities, has been explored in rats [6, 7, 8, 12, 22], monkeys [17], and pigeons [18]. The effects of substituting ethanol solutions for water during schedule-induced drinking by rats have been examined [10,14]. Typically, volume of solution consumed decreases with increasing ethanol concentration while milligrams ethanol consumed varies directly with concentration. Following schedule-induced polydipsia, ethanol may serve as a reinforcer for rats tested in the absence of food (e.g. [7,11]).

When guinea pigs are food deprived, water intake may increase markedly [4]. The effects of introducing ethanol solutions during such hunger-induced drinking have not been examined. The present study determined intake of ethanol solutions of 0 (tap water), 2, 4 and 8% (v/v) concentration by food-deprived guinea pigs tested in the presence and absence of food. Consumption of each solution by guinea pigs given ad lib access to food was also examined.

METHOD

Animals

Three adult male Hartley-derived guinea pigs were individually housed in a constantly-illuminated room with an ambient temperature of 24°C. Water was constantly available in home cages.

Apparatus

Three sound-attenuated Gerbrands operant conditioning chambers were modified by the addition of a drinking tube and a food cup to one side wall. The drinking tube was mounted 5 cm above the chamber floor and protruded 2.5 cm from the wall. The food cup was mounted 2.5 cm from the chamber floor immediately to the left of the drinking tube. A 25-W white house light provided ambient illumination. Electromechanical programming and recording equipment was located in an adjacent room.

Ethanol solutions (v/v) were prepared using 95% ethanol in tap water. Solutions were prepared at least 12 hr before use and stored in sealed flasks at room temperature.

Procedure

Sixteen two-hr sessions were run under each of three feeding regimens. In Sessions 1 through 16, a portion of Purina guinea pig chow sufficient to maintain each animal at 90% of free feeding weight was presented in the experimental chamber. Any food not consumed within the session was returned with the animal to the home cage. In Sessions 17 through 32, the same amount of chow was

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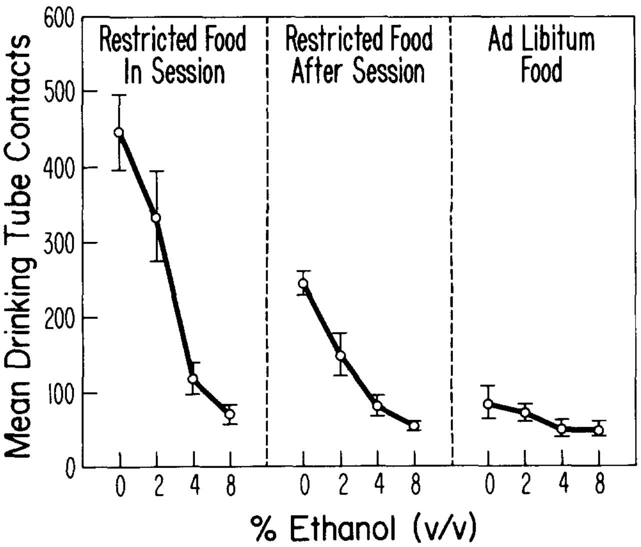

FIG. 1. Mean number of drinking tube contacts per subject during two-hr sessions. Conditions are labelled according to feeding regime. Each ethanol concentration was available during four consecutive sessions under each feeding regimen. The area within brackets represents ± 1 standard error of the mean.

presented in the home cage immediately after completion of each session. Food was not available in sessions during this period. During Sessions 33 through 48, unlimited chow was continuously available in home cages and experimental chambers. Sessions were run seven days per week, at the same time each day.

During all sessions, each lick of the drinking tube delivered either 0 (tap water) 2, 4 or 8% (v/v) ethanol solution. Under each feeding regimen, the solutions were presented in ascending order, with four consecutive sessions run at each concentration. Number of drinking tube contacts and volume of solution consumed per session were recorded. Consumption was corrected for evaporation as described by Meisch and Beardsley [14]. Drinkometer sensitivity was adjusted so that tube contacts by hair-covered portions of the body were not recorded.

RESULTS

Figure 1 shows mean number of drinking tube contacts per session at each ethanol concentration across the three feeding regimens. Under all feeding regimens, number of drinking tube contacts decreased with increasing ethanol concentration. For each concentration, mean number of drinking tube contacts was highest when restricted food was available during sessions, lower when restricted food was available after sessions, and lowest when food was available ad lib. However, the magnitude of this difference across feeding regimens varied inversely with ethanol concentration. During all sessions at all concentrations, most drinking tube contacts occurred early in the session, with very few tube contacts occurring during the second hour of the session.

The correlation (Pearson r) between number of drinking tube contacts and volume of solution consumed per session was 0.89 ($df = 142$, $p<0.01$). Like mean drinking tube contacts, mean volume of solution consumed per session decreased with increasing ethanol concentration. The relative magnitude of this decrease across concentrations was greatest when restricted food was available in sessions and least when ad lib access to food was provided. Although mean volume of solution consumed decreased with increasing ethanol concentration, mean milligrams ethanol (per 100 g body weight) consumed per session increased with increasing ethanol concentration during all feeding regimens. Table 1 shows mean volume of solution and mean mg ethanol (per 100 g body weight) consumed per session under each experimental condition.

TABLE 1

THE EFFECTS OF FEEDING REGIMEN ON LIQUID CONSUMPTION BY GUINEA PIGS

	X̄ 2-hr intake in ml (± SE)			
	Ethanol Concentration (%)			
feeding regimen	0	2	4	8
Restricted food in session	18.1 ± 1.8	12.5 ± 1.7	6.5 ± 0.7	4.2 ± 0.3
Restricted food after session	7.8 ± 0.6	6.9 ± 1.0	4.4 ± 0.3	4.0 ± 0.3
Ad lib food	4.3 ± 0.9	4.1 ± 0.7	4.0 ± 0.4	3.8 ± 0.5
X̄ 2-hr intake in mg ethanol/100 g body weight				
Restricted food in session	— —	41.6 ± 5.7	43.3 ± 4.7	55.9 ± 4.0
Restricted food after session	— —	22.9 ± 3.3	24.3 ± 2.0	44.0 ± 4.0
Ad lib food	— —	12.3 ± 2.1	24.0 ± 2.4	45.5 ± 6.0

DISCUSSION

Volume of solution consumed by guinea pigs during all feeding regimens varied inversely with ethanol concentration, while mg ethanol consumed varied directly with concentration. This relation is similar to that reported for schedule-induced drinking by rats and monkeys [15, 16, 17]. However, rats tested under conditions similar to the restricted food conditions of the present study may [1,2] drink more of low ethanol concentrations than of tap water, a relation not typically reported for rhesus monkeys [18] or found in guinea pigs during the present study. These findings parallel previous studies [15, 16, 17] in indicating that ethanol self-administration by animals given limited access to the drug is most prominent shortly after access is provided.

The relation between feeding regimens and liquid intake in the present study suggests that food deprivation increases guinea pigs' consumption of both tap water and ethanol solution. Such hunger-induced drinking has been reported previously in guinea pigs, but not rats, given access to tap water [4]. Drinking by moderately food deprived guinea pigs in the present study was increased by food availability, probably due to the development of prandial drinking. Prandial drinking by guinea pigs has been reported elsewhere [5].

Interestingly, as feeding regimens were altered so as to markedly decrease consumption of tap water, relative consumption of ethanol did not decrease proportionately. A number of studies [9,13] have demonstrated that rats tested after polydipsic exposure to an ethanol solution consume more ethanol than tap water, although the relation is reversed prior to and during schedule-induced drinking. Apparently, consuming appreciable quantities of ethanol serves to increase the reinforcing efficacy of the drug. Therefore, it is not unlikely that consumption of ethanol during the final two feeding regimens of the present study was elevated due to previous exposure to the drug.

Although the present data do not indicate that ethanol served as a reinforcer apart from the vehicle in which it was delivered under any feeding regimen, all solutions were continuously available contingent on a simple consummatory response (lick). As previous data [11] pointed out, ethanol may not seem to serve as a reinforcer apart from the vehicle (tap water) under such conditions, although it may do so when both solutions are available on an intermittent reinforcement schedule. The effects of making ethanol and tap water available on intermittent reinforcement schedules to guinea pigs with prior exposure to the drug have not been reported.

While guinea pigs are docile, long-lived animals popular for biochemical investigations, behavioral studies of the species have been few. The present study suggests that oral ethanol self-administration by guinea pigs, similar in some respects to that of rats and monkeys, may be induced. Further investigations to quantify similarities and establish ethanol as a reinforcer for guinea pigs will considerably enhance the generalizability of the non-human ethanol self-administration literature.

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