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Ethanol Reinforcement: Effects of Food Deprivation, Fixed-Ratio Size, and Concentration [1, 2]

by

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[2]Portions of these data were presented at the Fall Meeting of the American Society for Pharmacology and Experimental Therapeutics, August, 1969, in Pittsburgh, Pennsylvania; at the Tenth Annual Meeting of the Psychonomic Society, November, 1969, in St. Louis, Missouri; and at the Thirty-second Meeting of the Committee on Problems of Drug Dependence, National Academy of Sciences--National Research Council, February, 1970, in Washington, D. C.

[3]U.S.P.H.S. Postdoctoral Research Fellow 1 FO2 MH 46770-01.

ABSTRACT

In Experiment I rats having prior experience with oral ethanol self-administration were subjected to geometrically increasing fixed-ratio (FR) schedules of ethanol reinforcement (8% W/V). The animals were tested first food deprived and then food satiated. Each third day ethanol was the reinforcer (0.25 ml/reinforcement), while on other days water was the reinforcer. Food satiating the rats decreased responding approximately 50% for ethanol whereas responding for water was not systematically changed. Under both food conditions ethanol maintained FR's up to 256, with response totals exceeding water control values. As the FR size increased to intermediate values, the number of ethanol reinforcements remained constant while the number of water reinforcements decreased. Further FR increases resulted in decreases in the number of ethanol reinforcements. The pattern of FR responding was similar to that maintained by other reinforcers. Maximum ethanol responding occurred at the beginning of the 6 hour sessions, followed by a pause and then intermittent bursts of responding. Water responding was not characterized by a specific pattern. It was inferred that the odor of ethanol was a discriminative stimulus, and it was concluded that ethanol served as a reinforcer for the rat.

In Experiment II a food satiated rat, having completed Experiment I, was sequentially presented with ethanol concentrations of 2, 4, 8, 16, and 32% (W/V). Again, each third day ethanol was the reinforcer while on other days water was available. At all concentrations ethanol reinforcements and volume consumed exceeded water control values. As the concentration was increased the volume consumed decreased but the quantity (mg.) of intake increased.

Time course of responding was similar to that in Experiment I. It was concluded that ethanol served as a reinforcer over a range of concentrations.

Experiment I. Ethanol reinforcement: Effects of food deprivation on fixed-ratio performance.

Recent investigations of intravenous drug self-administration indicate drug maintained responding is subject to schedule control similar to that associated with other reinforcers (Schuster and Thompson, 1969). Though there appear to be quantitative differences between drug-maintained and food or water-maintained performances under given schedule conditions, in general intravenous "Drug reinforcement generates patterns and rates of responding which closely resemble those obtained with other reinforcers" (Thompson and Pickens, 1971).

The foregoing considerations would lead to the prediction that similar relations may hold for other routes of administration. For example, one of the more commonly used drugs, ethanol, is usually administered orally, though no reports have appeared investigating schedules of oral ethanol self-administration. Thus, a primary purpose of this investigation was to determine the degree to which ethanol reinforcement would maintain fixed-ratio schedule control across a range of schedule values. Further, since the subjects in this investigation were food deprived during initial ethanol reinforcement training, food deprivation conditions were studied as well.

METHOD

Subjects: The subjects were four male albino Sprague-Dawley rats, #856, #861, #864, and #865, with a past history of ethanol self-administration (Meisch, 1970). When maintained at 80% of their free feeding weights, they weighed 522, 508, 533, and 472 grams respectively. They were approximately 13 months old at the beginning of the experiment and were individually housed

in a temperature-controlled (22.2° C.), constantly illuminated room. Water was always available in the animals' home cages.

Apparatus: The apparatus was a standard rat operant conditioning chamber equipped with two levers, a food magazine, and a dipper for presenting liquid. The levers were separated by the reinforcement mechanisms, with the food mechanism directly above the dipper. Each operation of the dipper made available 0.25 ml. of liquid for 4 seconds. The operant conditioning chamber was housed in a ventilated sound-shielded enclosure. White masking noise was constantly present. Programming and data recording were automatic, by commercial electromechanical equipment located in an adjacent room.

Procedure: Details concerning the acquisition of ethanol drinking have been reported elsewhere (Meisch, 1970). Initially the rats were induced to orally self-administer ethanol by substituting ethanol for water during schedule-induced polydipsia. Falk (1961) used the term "schedule-induced polydipsia" to describe the excessive drinking that occurs when rats are placed on an intermittent schedule of food reinforcement and concurrently given access to water. Following establishment of a pattern of ethanol responding, food reinforcement was permanently discontinued.

In the present study the rats were placed in the operant conditioning chamber each day for 6 hours at a regular starting time. Responding on the right lever produced liquid, while responding on the left lever had no programmed consequence. At the end of the sessions, when the rats were food deprived, they were given supplementary feedings in their home cages with Purina laboratory rat chow to maintain their weights at 80% of their free feeding value. When food satiated they had free access to food in their home cages. Food was not available in the operant conditioning chamber.

Data recorded were liquid responses, liquid reinforcements, and control responses (left lever) per session. These same dependent variables were also recorded every ten minutes during each session on print-out counters as well as continuously over time on Gerbrands cumulative recorders. Volume consumed was measured at the end of each session by subtracting the volume remaining from the volume added. All volumes were corrected for evaporation.

Experimental design: Immediately preceding and succeeding each drug day was a water control day. On drug days 8% (W/V) ethanol was present for the entire 6 hour session. Each rat was exposed to drug on two or more sessions at each fixed-ratio value and was not switched to the next value until responding had stabilized. After completing a series of increasing fixed ratios, the schedule value was returned to fixed-ratio one. The rats were run first under food deprivation and then under food satiation.

RESULTS AND DISCUSSION

Effect of fixed ratio size on responses per session. Figure 1 shows liquid responses as a function of fixed-ratio size during food deprivation, and Figure 2 shows liquid responses as a function of fixed-ratio size during food satiation. Similar functions were obtained with all four rats. Under both conditions of food deprivation and satiation, a curvilinear relation was found between number of responses for ethanol and the fixed-ratio size. As the fixed-ratio value increased, there was an increase in responding, until intermediate fixed ratios were reached. Thereafter, further increases resulted in decreased responding. In all cases responding for water was substantially less than for ethanol. Across animals there was no consistent relation between fixed-ratio size and responding for water.

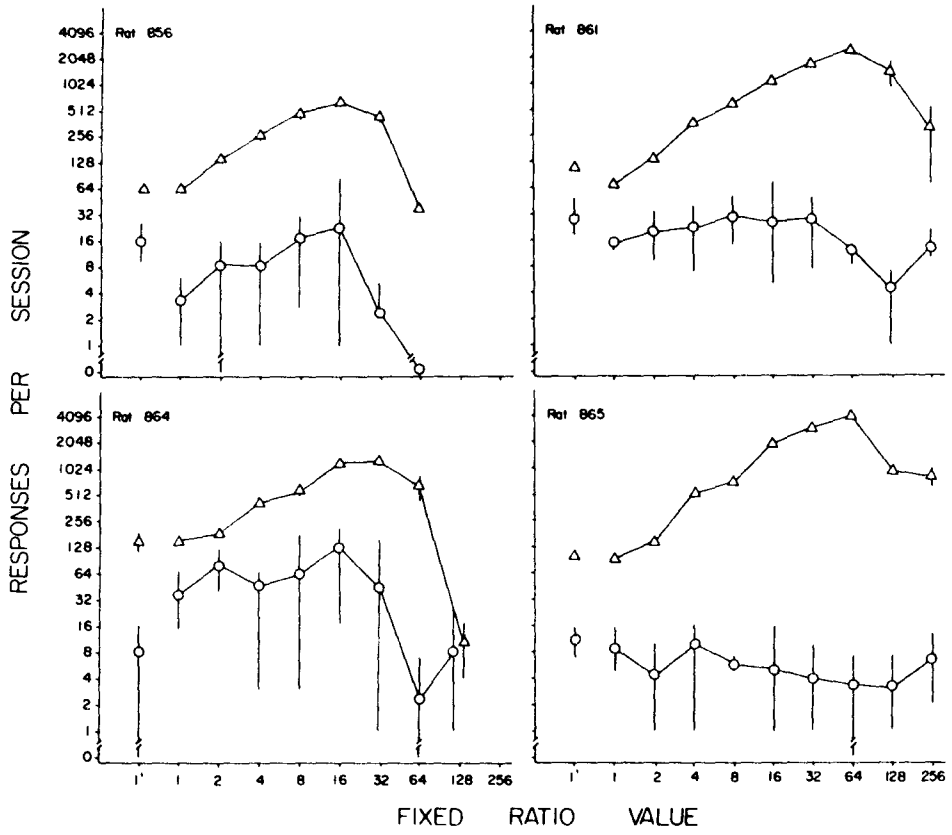

Figure 1. Effect of FR size on responses per session during food deprivation. Ordinate, responses plotted on a logarithmic scale; abscissa, FR size plotted on a logarithmic scale. Open triangles, ethanol responses during food deprivation; open circles, water responses during food deprivation. Each point on the ethanol curve is the mean of two sessions, while each point on the water curve is the mean of four sessions. The height of the vertical lines indicates the range; absence of a vertical line at a particular point indicates that the range was within the area occupied by the symbol. The results for FR 1 on the far left were obtained after completing the sequence of increasing FR values.

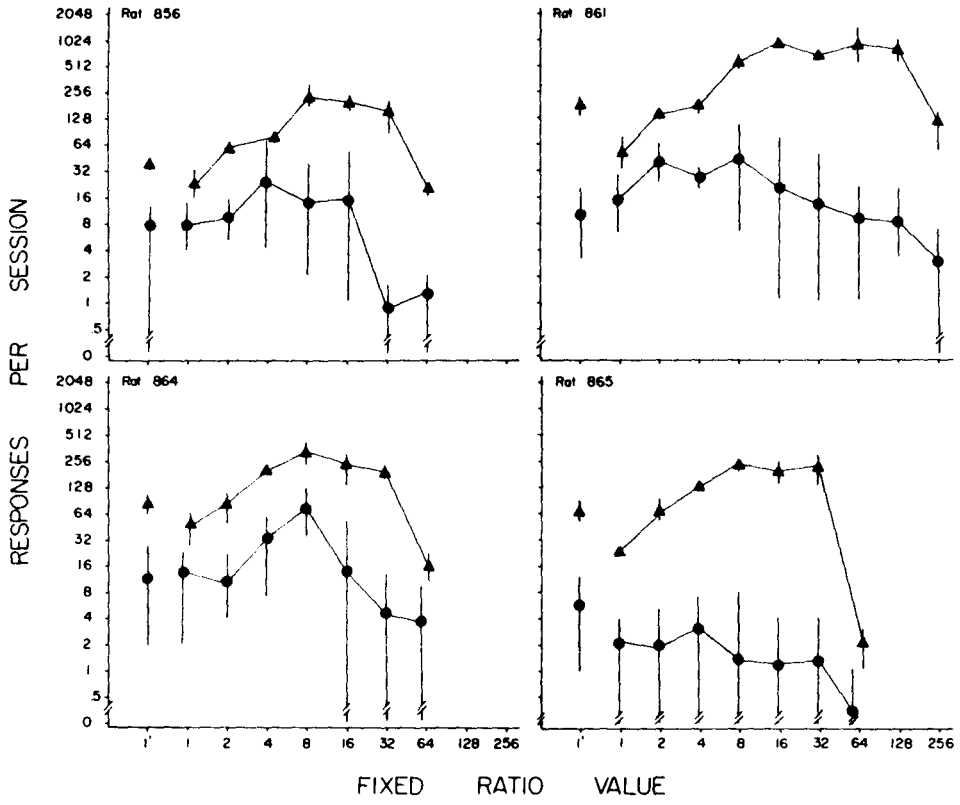

Figure 2. Effect of FR size on responses per session during food satiation. Filled triangles, ethanol responses during food satiation; filled circles, water responses during food satiation. Each point on the ethanol curve is the mean of three sessions, while each point on the water curve is the mean of six sessions. See Figure 1 legend for additional details.

The fact that ethanol responses consistently exceeded water responses confirms previous observations that under certain circumstances ethanol serves as a reinforcer for the rat (Meisch and Pickens, 1968; Meisch, 1969; Meisch, 1970). Maintenance of responding by ethanol under high fixed ratio values indicates that its strength as a reinforcer can be comparable to that of food or water.

Effect of fixed ratio size on reinforcements per session. Figure 3 shows liquid reinforcements as a function of fixed-ratio size during food deprivation, and Figure 4 shows liquid reinforcements as a function of fixed-ratio size during food satiation. Similar results were obtained with all four rats. Under both conditions of food deprivation and satiation, the number of ethanol reinforcements remained relatively constant as the fixed-ratio size was increased until intermediate fixed-ratio values were reached following which there was a progressive decline in reinforcements. With each rat there was a direct relation between the number of ethanol reinforcements and the volume consumed. The number of water reinforcements was substantially less than for ethanol, and the number decreased with increases in the fixed ratio.

At some fixed ratios the rats obtained zero water reinforcements but one or more ethanol reinforcements (e.g. Figure 4, FR 32 for Rats 856, 864 and 865; FR 64 for Rat 861). The absence of sufficient responding to complete at least one fixed ratio on water days and the presence of such responding on ethanol days suggests that the odor of ethanol is a discriminative stimulus for ethanol-reinforced lever pressing.

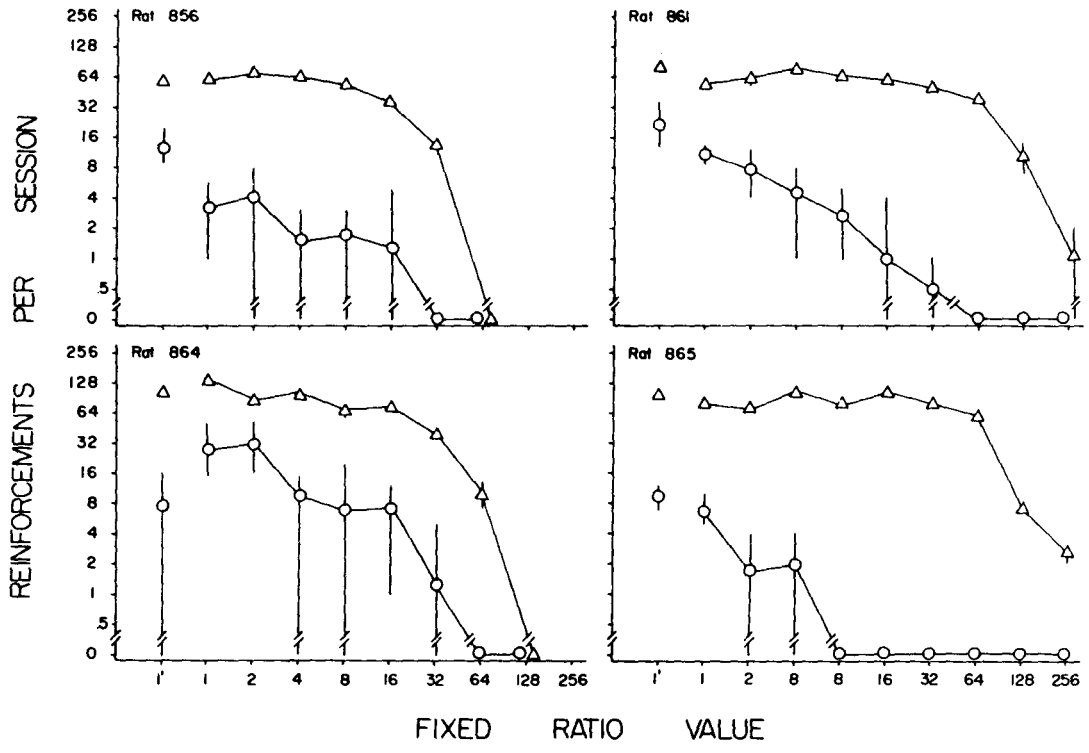

Figure 3. Effect of FR size on reinforcements per session during food deprivation. Ordinate, reinforcements plotted on a logarithmic scale; abscissa, FR size plotted on a logarithmic scale. Open triangles, ethanol reinforcements during food deprivation; open circles, water reinforcements during food deprivation. See Figure 1 legend for additional details.

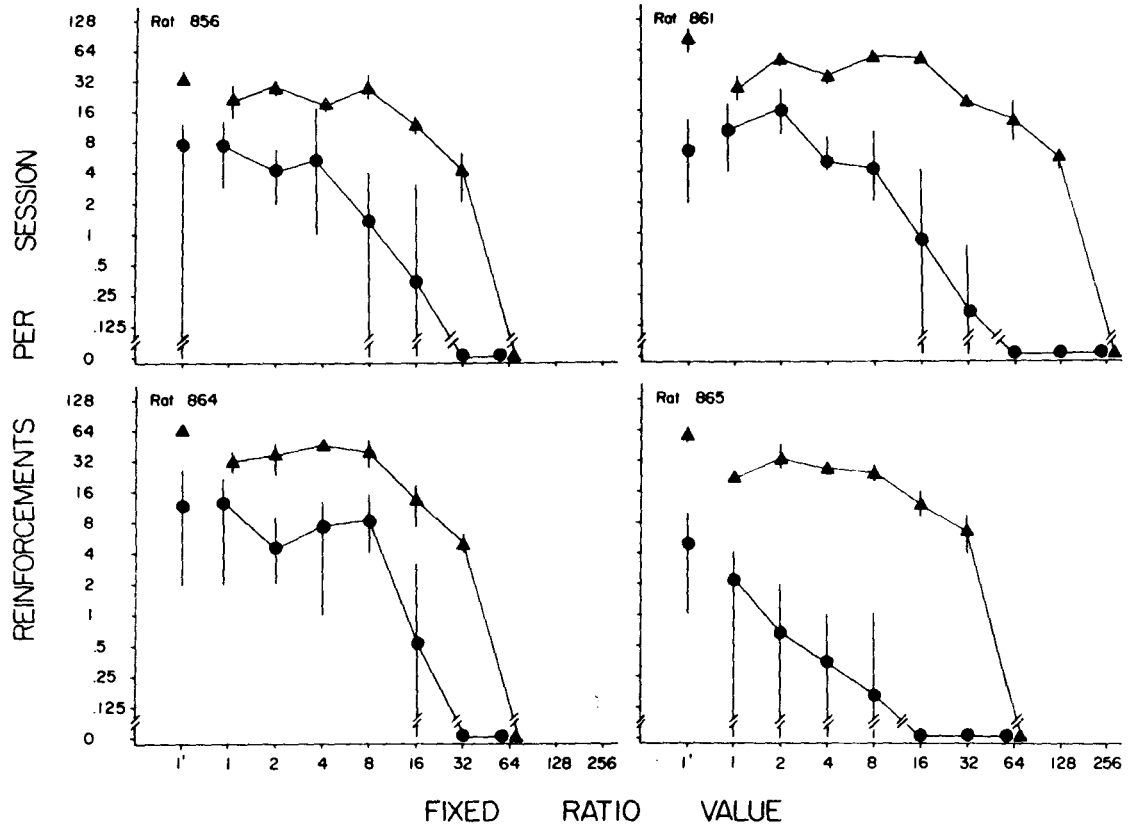

Figure 4. Effect of FR size on reinforcements per session during food satiation. Ordinate, reinforcements plotted on a logarithmic scale; abscissa, FR size plotted on a logarithmic scale. Filled triangles, ethanol reinforcements during food satiation; filled circles, water reinforcements during food satiation. Each point on the ethanol curve is the mean of three sessions, while each point on the water curve is the mean of six sessions. See Figure 1 legend for additional details.

Transition data. Following a shift from low to intermediate fixed ratios the number of ethanol reinforcements was frequently less than the number obtained after further exposure. Also, following a shift from intermediate to high fixed ratios, the number of ethanol reinforcements was frequently greater than the number obtained after subsequent exposure.

Effect of food satiation on responses per session. Figure 5 shows ethanol responses during food satiation and food deprivation as a function of fixed-ratio size, and Figure 6 shows water responses during food satiation and food deprivation as a function of fixed-ratio size. Similar functions were obtained with all four rats. Food satiation resulted in approximately a 50 percent or greater decrease in ethanol responses. Also decreases occurred in the size of ratio maintained by ethanol. Responses for water were either unaffected or decreased by food satiation. Absolute changes in water responding were small relative to changes in ethanol responding.

Effect of food satiation on reinforcements per session. Paralleling the effect on responses, ethanol reinforcements were decreased 50 percent or greater by food satiation (Figure 7). Water reinforcements were either not changed or were slightly decreased, relative to the decreases in ethanol reinforcements (Figure 8). The small or absent changes in water intake following food satiation rules out the possibility that the decrease in ethanol drinking was due to a general decrease in liquid intake.

The decrease in ethanol responses and reinforcements following food satiation is consistent with the results of other investigators (Zarrow and Rosenberg, 1953; Westerfeld and Lawrow, 1953; Purdy and Lee, 1962; Aschkenasy-Lelu, 1960, 1962a, 1962b, 1962c; Royer and La Marche, 1965),

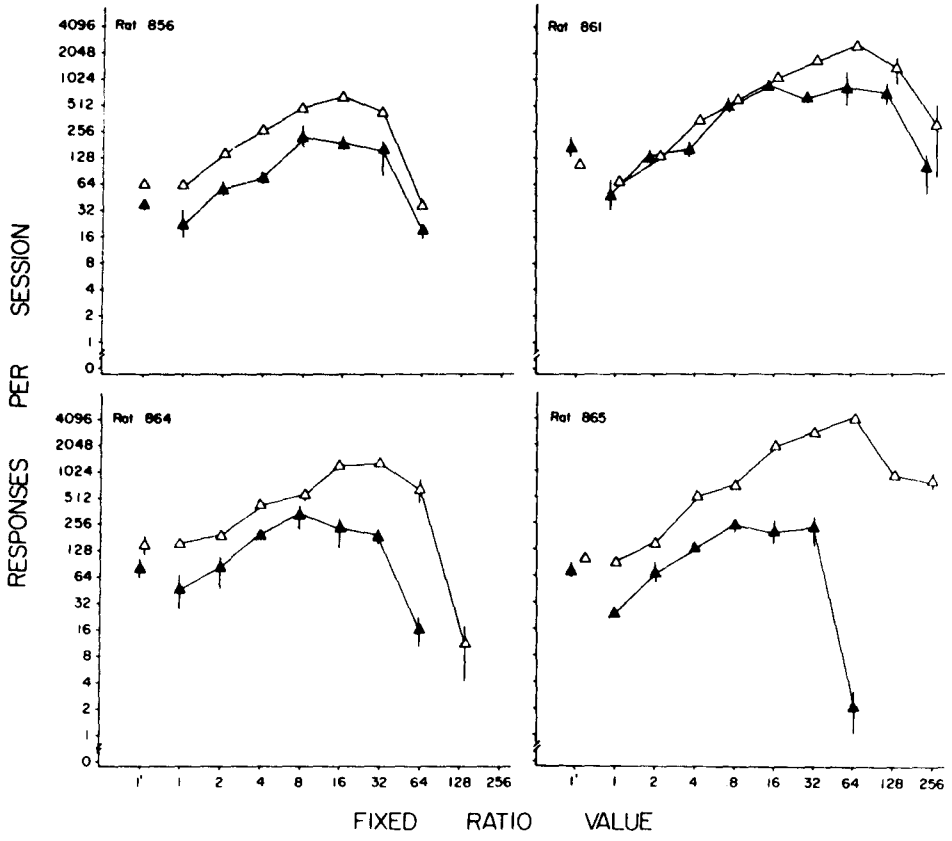

Figure 5. Effect of food satiation on ethanol responses per session. Open triangles, ethanol responses during food deprivation; filled triangles, ethanol responses during food satiation. Each point on the ethanol food deprivation curve is the mean of two sessions, while each point on the ethanol food satiation curve is the mean of three sessions. See Figure 1 for additional details.

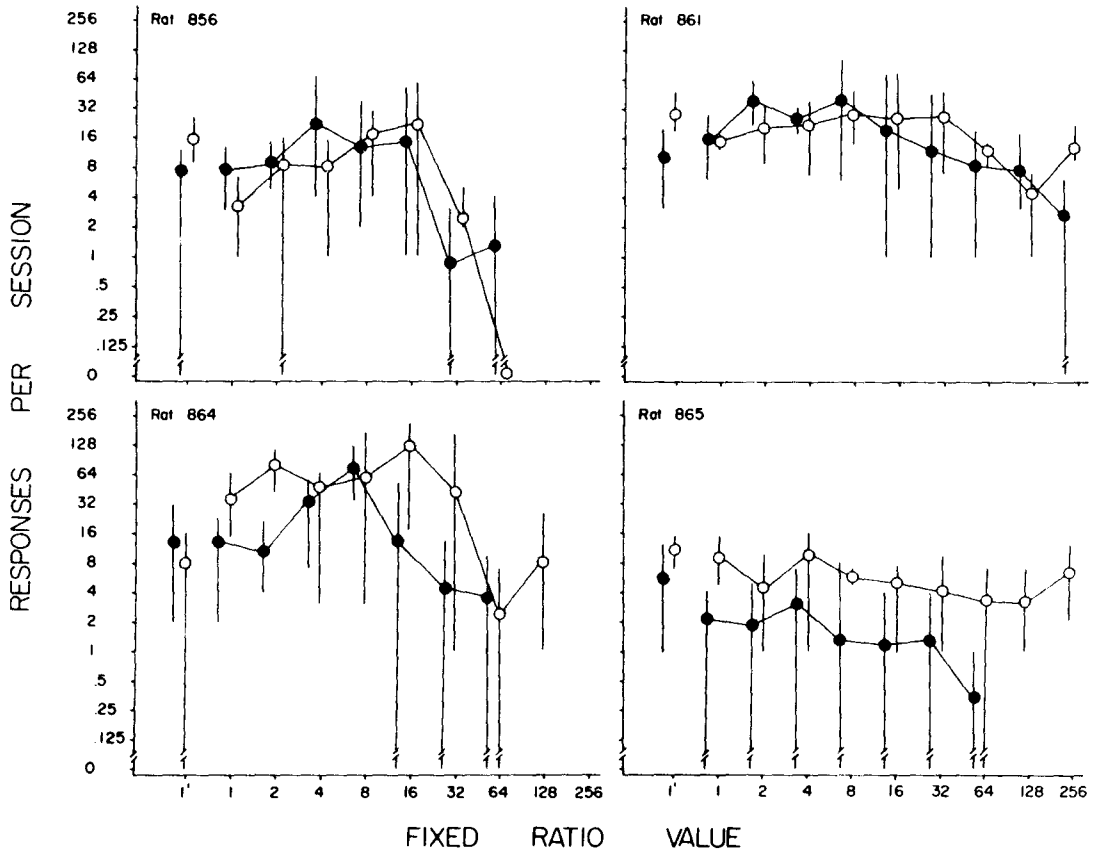

Figure 6. Effect of food satiation on water responses per session. Open circles, water responses during food deprivation; filled circles, water responses during food satiation. Each point on the water food deprivation curve is the mean of four sessions, while each point on the water food satiation curve is the mean of six sessions. See Figure 1 legend for additional details.

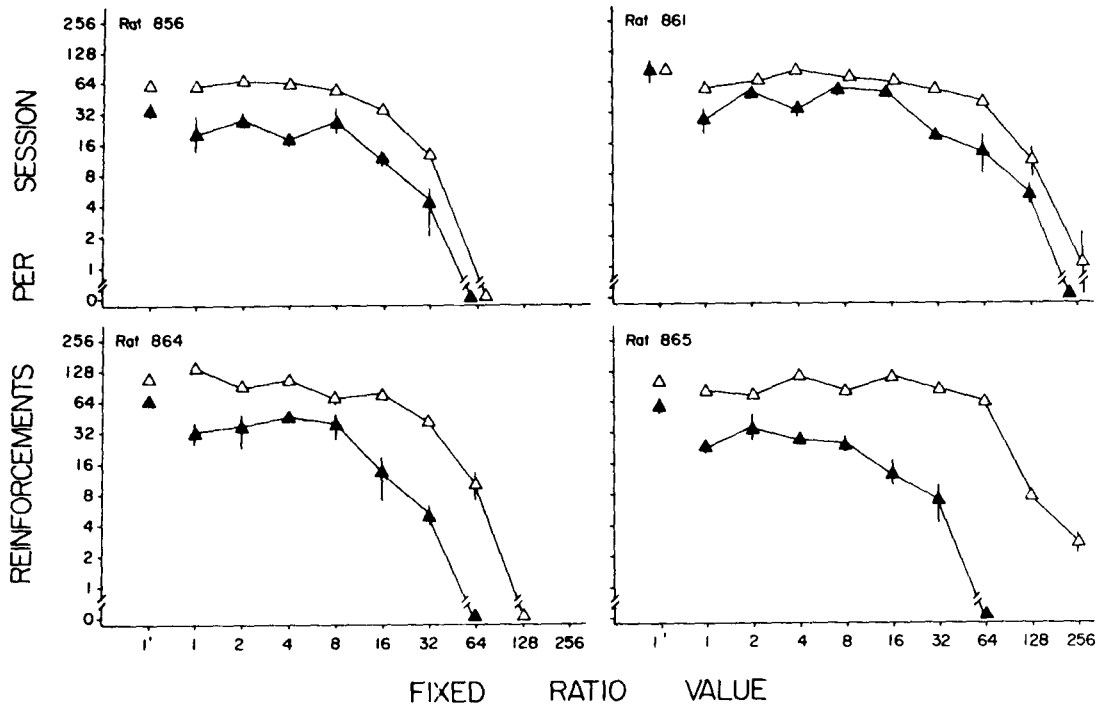

Figure 7. Effect of food satiation on ethanol reinforcements per session. Ordinate, reinforcements plotted on a logarithmic scale; abscissa, FR size plotted on a logarithmic scale. Open triangles, ethanol reinforcements during food deprivation; filled triangles, ethanol reinforcements during food satiation. Each point on the ethanol food deprivation curve is the mean of two sessions, while each point on the ethanol food satiation curve is the mean of three sessions. See Figure 1 legend for additional details.

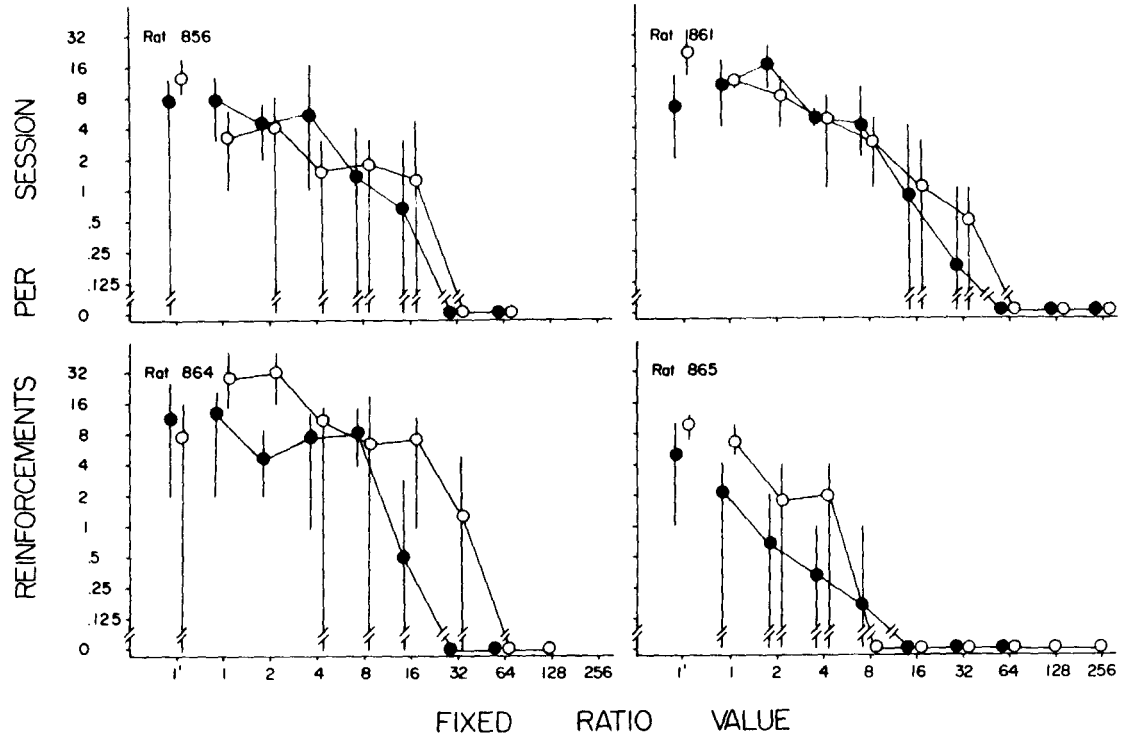

Figure 8. Effect of food satiation on water reinforcements per session. Ordinate, reinforcements plotted on a logarithmic scale; abscissa, FR size plotted on a logarithmic scale. Open circles, water reinforcements during food deprivation; filled circles, water reinforcements during food satiation. Each point on the water food deprivation curve is the mean of four sessions, while each point on the water food satiation curve is the mean of six sessions. See Figure 1 legend for additional details.

who have also found that free access to food, following food deprivation, results in less ethanol consumption. The greater intake during food deprivation may be related to several factors. For example, ethanol metabolism is reduced by 50% in fasted rats (Le Breton, 1936; Owens and Marshall, 1955). Thus, the rate of ethanol metabolism would be more comparable to that of humans. Another possibility is that the higher intake during food deprivation may be due to ethanol's caloric value. However, other interpretations are possible such as that food deprivation may increase the intake of similar drugs like the barbiturates which do not have caloric value.

Effect of returning to fixed-ratio one after completing the series of increasing fixed ratios. The results of resetting the fixed ratio to one after completing the series of increasing fixed ratios are illustrated for individual animals in Figures 1 to 4 and are summarized across animals in Figure 9. Data for single rats were similar to the grouped data. Two different findings were obtained depending upon whether the animals were food deprived or food satiated. When the animals were food deprived, ethanol responses and reinforcements increased an average of 12% and 3%, respectively, over the initial values. However, when the animals were food satiated, ethanol responses and reinforcements increased 163% and 138%, respectively. The increase in ethanol intake was not due to a general change in liquid intake, since water responses and reinforcements did not vary in a systematic way from the first to the second series at fixed-ratio one (Figure 9). Also, it is unlikely that the increase in ethanol intake during food satiation may be attributed to increased body weight since the average weight was only 13.5%.

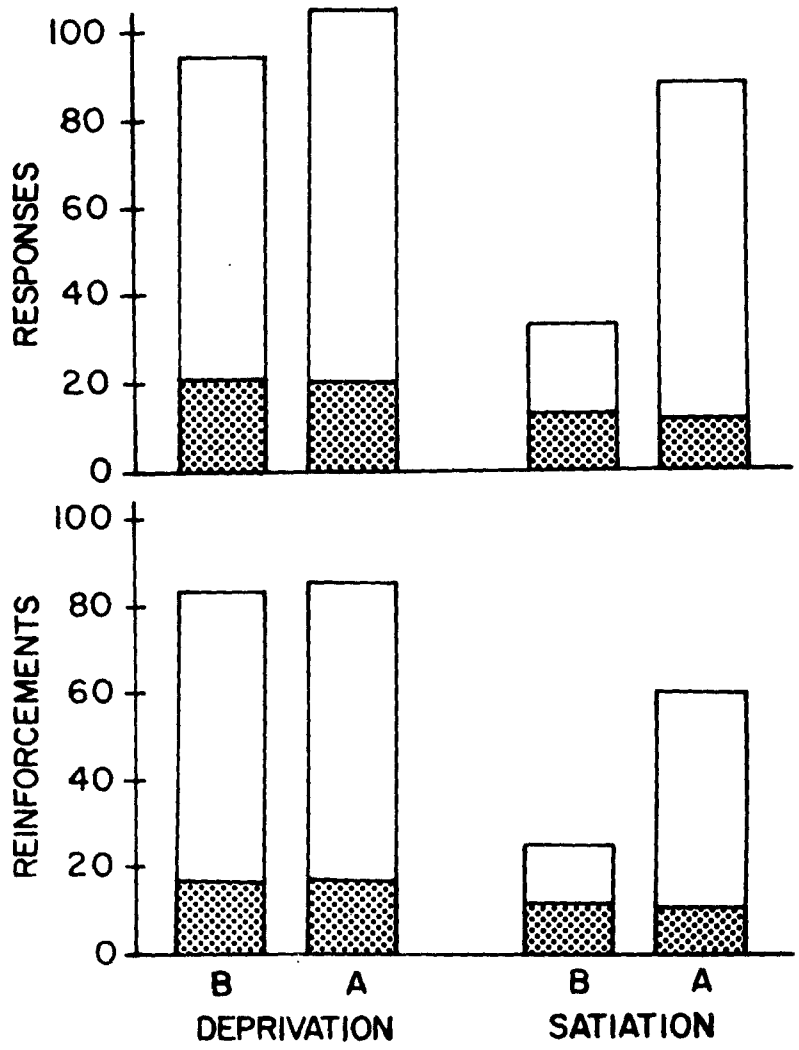

Figure 9. Effect of returning to FR 1 after completing the series of increasing FR's. B, before completing the series of increasing FR's; A, after completing the series of increasing FR's. Stippled portions of the bars represent values for water. N = 16 during food deprivation (4 animals X 4 water sessions each); N = 24 during food satiation (4 animals X 6 water sessions each). Total heights of the bars represent values for ethanol. N = 8 during food deprivation; N = 12 during food satiation. Before completing the series of increasing FR's, responses and reinforcements during food satiation were 35.6 and 30.1% of their previous values, respectively. After completing the series, responses and reinforcements were 88.1 and 69% of their previous values, respectively.

Previously Aschkenasy-Lelu (1962a) found that following food satiation the ethanol drinking of rats systematically increased over a twenty-day period. The cause of increased ethanol intake during food satiation is not clear. Perhaps the increase represents acquisition of ethanol drinking under the new stimulus condition of food satiation.

Temporal distribution of responses and reinforcements. The distribution of reinforcements at FR 1 is illustrated for food deprivation in Figure 10 and for food satiation in Figure 11. All four animals exhibited similar patterns, and these patterns were not altered by food satiation. Water reinforcements were infrequent, and they did not occur in a pattern. During the first ten minutes of an experimental session, there was an initial phase of high ethanol intake. This phase was followed by an absense of intake, with some reinforcements being obtained toward the end of the session. Thus, drinking did not occur at a steady rate over the course of the six hour session. Since the behavioral effects of ethanol depend upon the rate of intake as well as the total quantity consumed, these results illustrate the necessity of time course data in the analysis of ethanol drinking (Meisch, 1969).

Figure 12 presents cumulative records of Rat 865's responses for ethanol taken from the initial part of food deprivation sessions. Figure 13 shows cumulative records of Rat 861's ethanol responding for entire food deprivation sessions. The fixed-ratio performance is similar to that of fixed-ratio responding maintained by other reinforcers. As the fixed-ratio value was increased, the reinforcements obtained at the beginning of the session became dispersed over longer time intervals, thus lowering the rate of ethanol intake. The number and pattern of ethanol responses and reinforcements changed in an orderly manner as a function of fixed-ratio size. This demon-

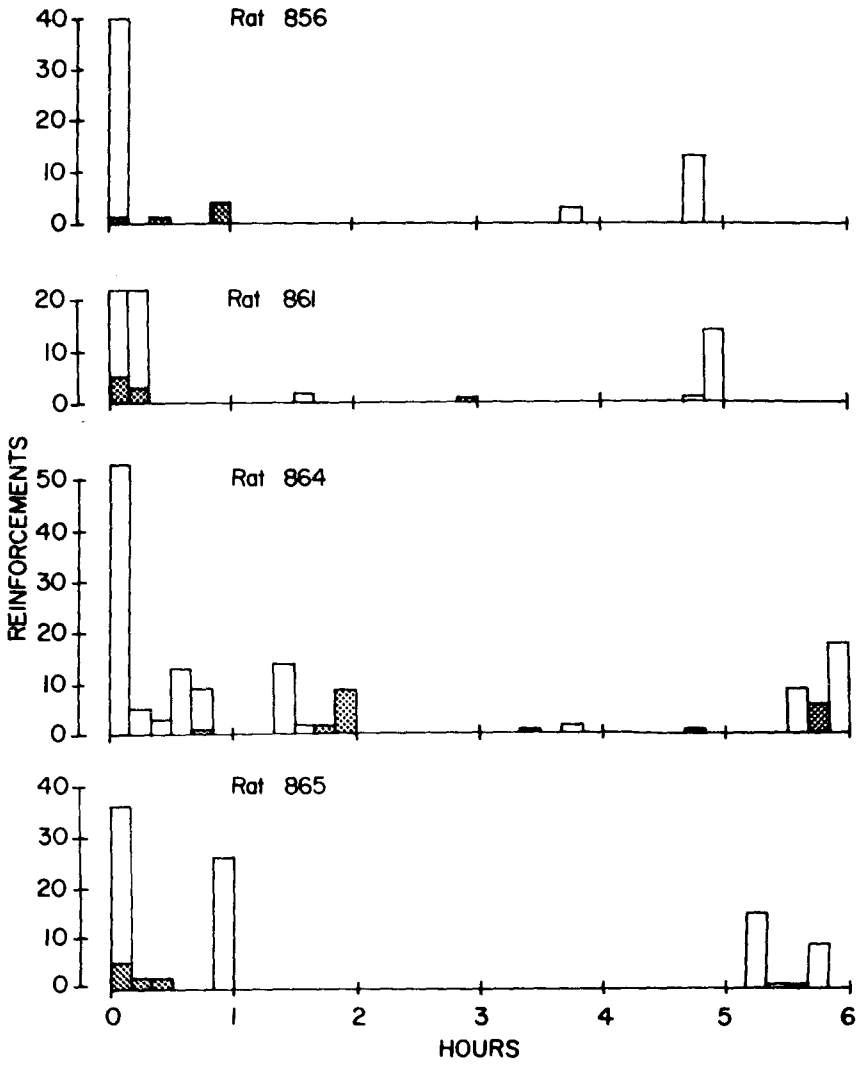

Figure 10. Temporal distribution of reinforcements during food deprivation. Data is from the first FR 1 session. Each bar represents the reinforcements obtained during a ten minute interval. Hatched portions represent the water reinforcements obtained on the preceding control day. Whenever ethanol reinforcements occurred, they exceeded the number of water reinforcements for the same interval.

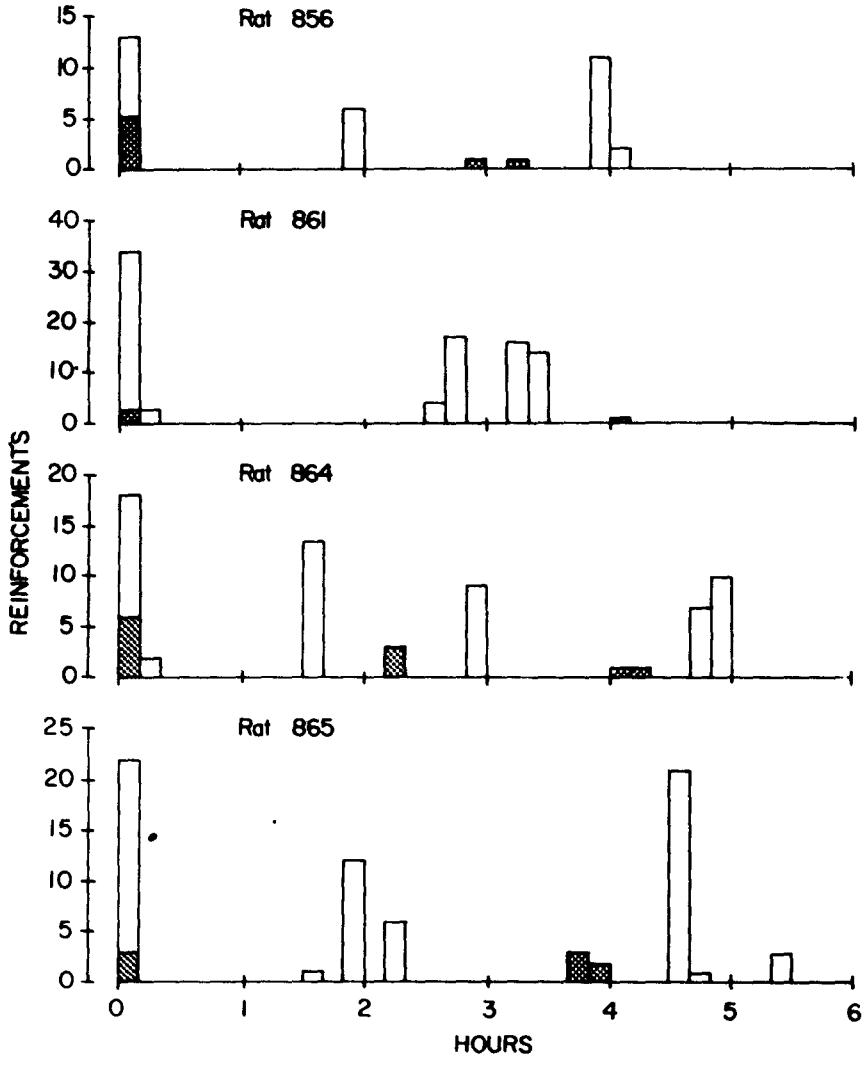

Figure 11. Temporal distribution of reinforcements during food satiation. Data is from the last FR 1 session. See Figure 10 legend for details.

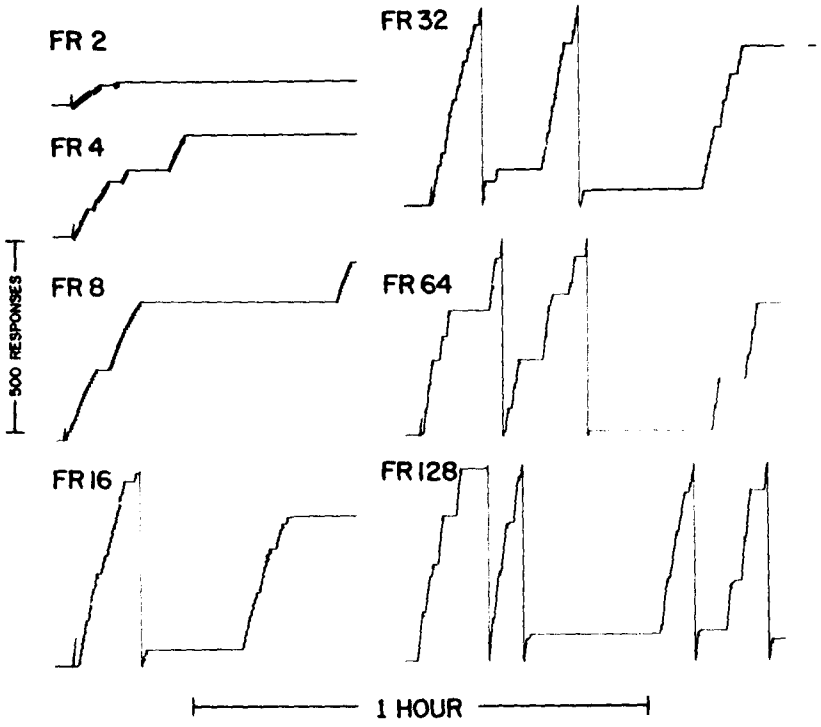

Figure 12. Cumulative records of fixed-ratio responding for ethanol by Rat 865. The records are from the beginning of the sessions.

strates that the schedule of reinforcement is an important variable affecting both total ethanol intake and the time course of intake.

One possible interpretation of why ethanol is consumed in greater volumes than water is that a pharmcodynamic effect of ethanol may be to increase liquid intake. For example, an intraperitoneal injection of ethanol might result in a rat drinking more water. Consequently, some individuals would conclude that ethanol cannot be considered to be a reinforcer in the previous experiment until such a possibility is ruled out. This reservation can be discounted. First, even if ethanol ingestion resulted in increased liquid intake, it would not follow that ethanol was not a reinforcer, for to state that something is a reinforcer is not to imply that it is pleasurable. Second, if ethanol ingestion resulted in increased liquid intake, this would not account for the initial intake. Moreover, one would expect to see a positively, not negatively, accelerated pattern of intake, and a negatively accelerated pattern is what is actually observed. Third, the initial intake of ethanol is not due to a tendency to consume small amounts of any liquid present, for it was shown earlier that the animals respond selectively in the presence of ethanol.

Volume and quantity of ethanol intake: Table 1 presents the volume and quantity of ethanol intake for the first ethanol session at fixed-ratio one during food deprivation and for the last ethanol session at fixed-ratio one during food satiation. The time course of intake for these sessions is illustrated in Figures 10 and 11. The rat's metabolic rate for ethanol is approximately 30 mg per 100 gm of body weight per hour (Segovia-Riguelme, et al., 1956), and as mentioned previously, it is reduced by 50 per cent in fasted rats (Le Breton, 1936; Owens and Marshall, 1955). Thus, during food deprivation the rate of drinking exceeded the rate of ethanol metabolism. During food satiation the rate of drinking, calculated on the basis

Table 1

Ethanol intake for the first session at FR 1 during food deprivation and for the last session at FR 1 during food satiation.

Rat Number	Food Condition	Volume Consumed	Weight	Ethanol Intake
856	Deprived	13 ml	510 g	34.0 [1]
	Satiated	8 ml	693 g	15.4
861	Deprived	11 ml	502 g	29.2
	Satiated	12 ml	744 g	21.5
864	Deprived	32 ml	527 g	81.3
	Satiated	15 ml	692 g	28.9
865	Deprived	18 ml	468 g	51.3
	Satiated	11 ml	653 g	22.5

[1] Milligrams per 100 grams of body weight per hour

of the volume consumed over a six hour period, did not exceed the rate of ethanol metabolism. However, the time course data demonstrate that a large portion of the drinking occurred during the first ten minutes of the session. Consequence, the rate of intake initially exceeded the rate of metabolism.

Water responses and reinforcements: Comparison of days preceding and succeeding ethanol days. Table 2 contains the number of water responses and reinforcements, cumulated across sessions, for days preceding and succeeding ethanol days. Responses and reinforcements were higher on days immediately following ethanol days, and this difference was greater when the animals were food satiated. The increased responding following ethanol days may be due to an extinction effect. Following repeated sessions with just ethanol solutions, the substitution of water results in a decreased responding that systematically declines to even lower values with subsequent sessions (Meisch and Thompson, unpublished observations).

Control responses. Control responses are responses made on the left lever; they had no programmed consequence. The control responses made by each animal during each session are tabulated in the Appendix. (Tables 1-8). Rats 856, 864, and 865 had modal values of zero control responses for both food conditions. Rat 861 had modal values of 3 and 1 during food deprivation and satiation, respectively. All four animals made fewer control responses per session when food satiated than when food deprived.

Conclusions: Ethanol serves as a reinforcer for rats and maintains fixed ratio behavior. Food deprivation increases ethanol but not water responding. Rats learn to discriminate ethanol solutions from water on the basis of odor, i.e. the odor of ethanol becomes a discriminative stimulus.

Table 2

Water responses and reinforcements: Comparison of days preceding and succeeding ethanol days

Rat Number	Number of Sessions	Food Condition	Water Responses		Water Reinforcements	
			Preceding	Succeeding	Preceding	Succeeding
856	32	Deprived	176 [1]	130	43	12
861	40	Deprived	314	467	93	104
864	36	Deprived	651	992	157	216
865	40	Deprived	121	120	41	38
		Subtotal	1262	1709	334	370
856	48	Satiated	203	271	64	94
861	60	Satiated	402	678	112	145
864	48	Satiated	451	523	96	175
865	48	Satiated	32	68	21	29
		Subtotal	1088	1540	293	443
		Grand Total	2350	3249	691	813

[1] Each number is a total cumulated across sessions.

Experiment II. Effect of ethanol concentration on ethanol intake.

With rats ethanol intake has been studied as a function of concentration. The procedure usually used is the two-bottle-choice method of Richter (1942-43), where one bottle contains an ethanol solution and the other contains water; different ethanol concentrations are sequentially presented. Using this procedure rats will drink ethanol concentrations up to 6% (W/V) in volumes that equal or exceed concurrent water intake (Richter and Campbell, 1940; Kehn and Stellar, 1960; Myers and Holman, 1967; Cicero and Myers, 1969; Cicero and Hill, 1970). Similar results occur when water and ethanol presentation are concurrently contingent upon a lever press (Myers and Carey, 1961). In contrast to the results of most studies 12% (W/V) ethanol was reported to be consumed in volumes exceeding water control (Dicker, 1958), and in another experiment rats drank concentrations up to 16% (W/V), again in volumes exceeding concurrent water intake, after having been repeatedly presented with an ascending series of ethanol concentrations (Veale and Myers, 1969).

In the present study presentation of water or an ethanol solution was response contingent and only one liquid was available during an experimental session. Instead of naive subjects, one was used with a past history of ethanol drinking. Since the time course of drinking within experimental sessions has not been reported, the temporal pattern of ethanol intake was recorded.

METHOD

Subject: The subject was a male albino Sprague-Dawley rat, #856, which had participated in the previous experiment. It was individually housed in a temperature-controlled (22.2° C.), constantly illuminated room. Water and

food, Purina Laboratory Rat Chow, were always available in the animal's home cage.

Apparatus: The apparatus was the same as that used in the previous experiment.

Procedure: The procedure was the same as that used in the previous experiment.

Experimental design. Concentrations of 2, 4, 8, 16 and 32% (W/V) were presented in an ascending order. Immediately preceding and succeeding each drug day was a water control day. Each concentration was presented twice except at 2 and 4% (W/V) where the first values deviated from the second values to the extent that three presentations were necessary.

RESULTS AND DISCUSSION

Figure 13 shows number of ethanol reinforcements as a function of ethanol concentration. As the concentration increased, the number of reinforcements decreased as did the volume consumed for there was a direct relation between the number of reinforcements and volume consumed. At all concentrations the number of reinforcements exceeded water control levels, thus demonstrating that ethanol serves as a reinforcer over a range of concentrations. These results suggest that it is possible to obtain self-administration of high ethanol concentrations in food satiated rats at levels exceeding water control values. Findings such as that the intake at 16 and 32% was 8 and 5 times greater, respectively, than water intake differ from earlier findings reported by other investigators where such concentrations are not consumed in volumes significantly exceeding water intake (Richter and Campbell,1940; Dicker, 1958; Kahn and Stellar, 1960; Myers and Carey, 1961; Myers and Holman, 1967; Veale and Myers, 1969; Cicero and Myers, 1969;

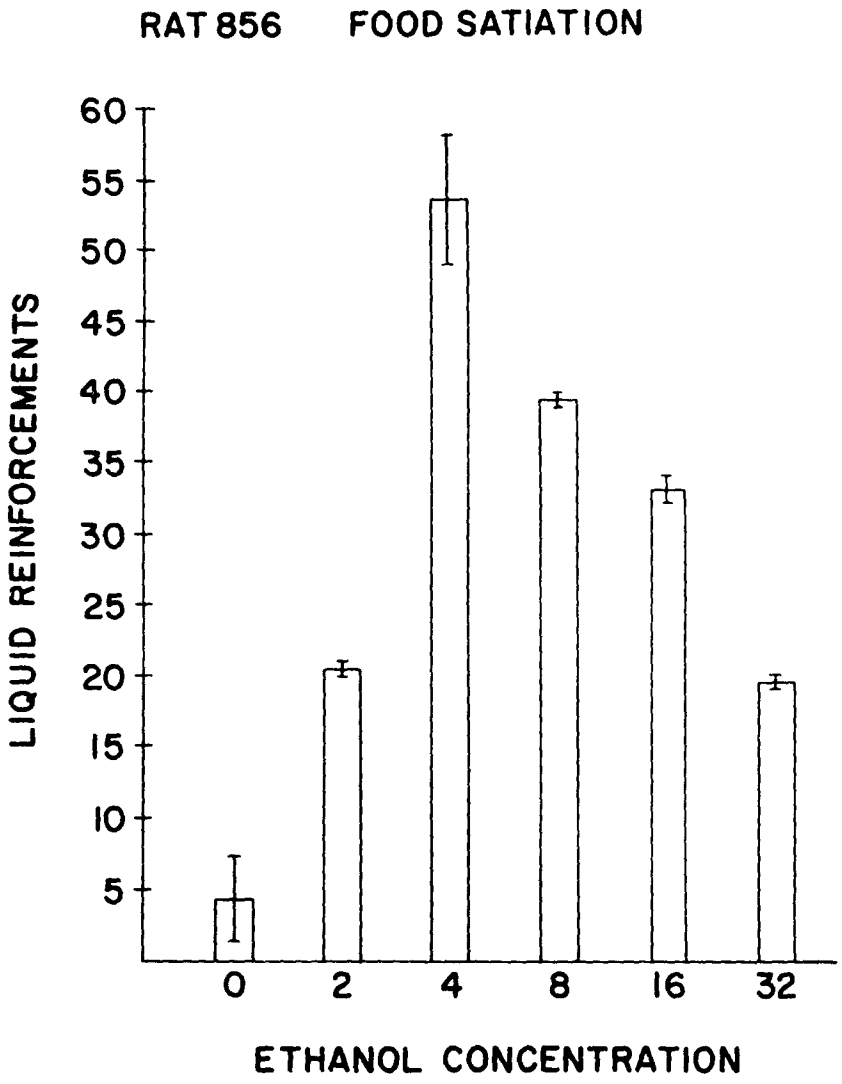

Figure 13. Reinforcements as a function of ethanol concentration. Values are for six hour sessions. Bar at zero per cent is the mean of 20 control sessions; brackets represents one standard deviation of the individual values. Bars at other concentrations are the mean of two sessions; brackets indicate the range.

Cicero and Hill, 1970). The decrease in reinforcements at a particular concentration was not to a level below one half the number obtained at the previous concentration. Consequently, the quantity of ethanol intake increased with increases in concentration. This relation is illustrated in Figure 14. The increase in ethanol intake with increasing concentration is consistent with results obtained during schedule-induced polydipsia and during extinction or absence of concurrent food reinforcement (Meisch, 1970); however, these results are contrary to those summarized in a recent review (Wallgren and Barry, 1970).

Figure 15 shows cumulative records taken from the first portion of experimental sessions. Paralleling the results for session totals the number of reinforcements obtained at the start of a session decreased with increases in the concentration. The temporal distribution of responding for entire sessions was similar to that observed in the previous experiment; maximum responding occurred at the beginning of a session, followed by a pause and then intermittent response bursts toward the middle and end of the session.

Conclusions: As ethanol concentration was increased, volume consumed decreased while quantity consumed increased. Ethanol served as a reinforcer for a food satiated rat at concentrations 2 through 32% (W/V).

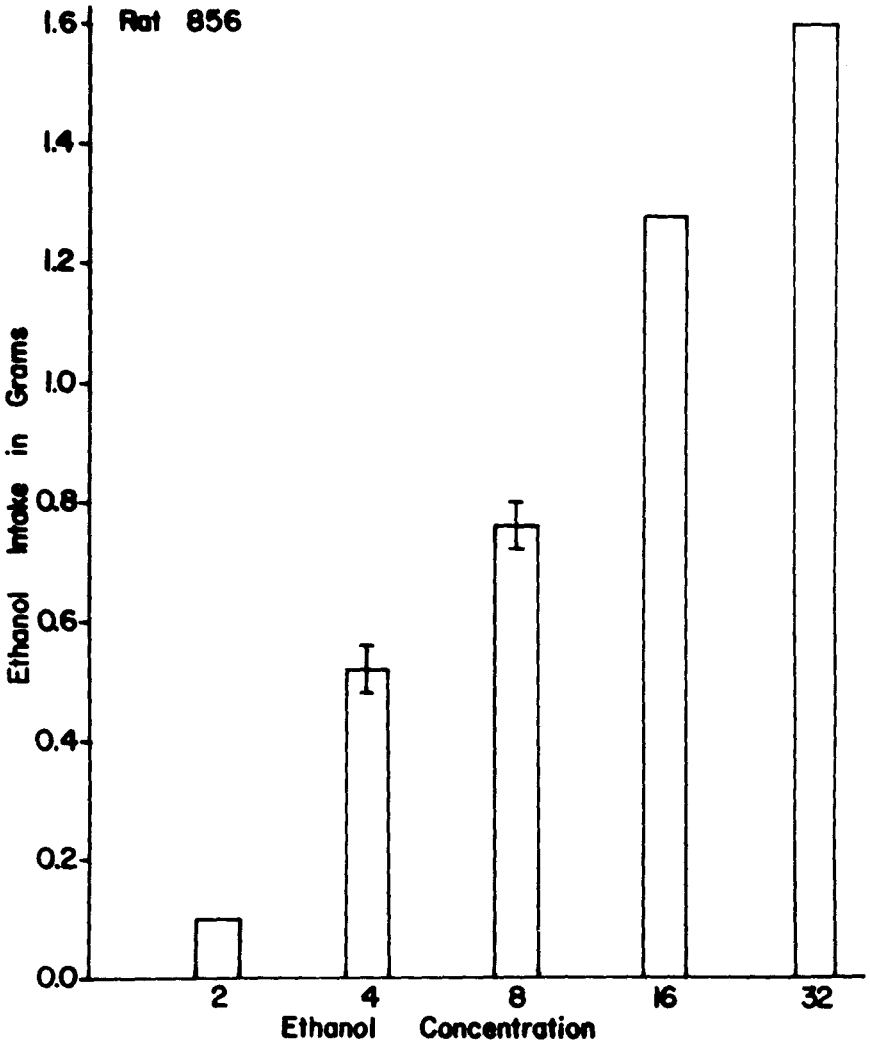

Figure 14. Quantity of ethanol intake as a function of concentration. Each bar represents the mean of 2 six hour sessions; brackets indicate the range.

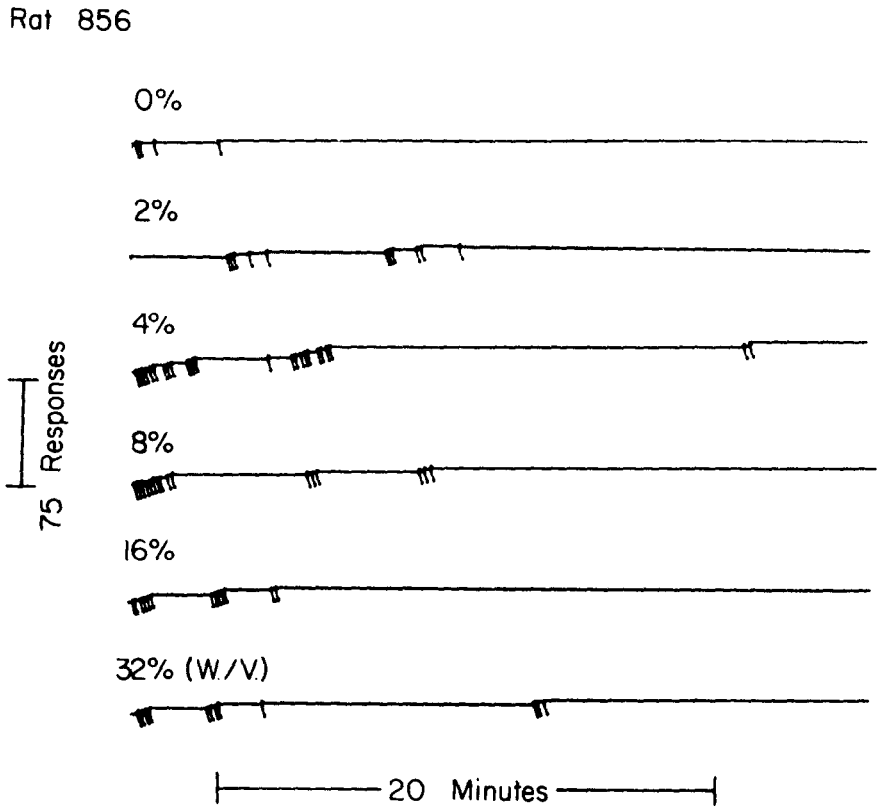

Figure 15. Cumulative records of responding at FR 1 for ethanol. The records are from the first 30 minutes of the sessions.

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APPENDIX

List of Tables

Table 1

FIXED RATIO PERFORMANCE BY RAT 856 DURING FOOD DEPRIVATION

FOR 8% (W/V) ETHANOL AND WATER

Data are listed chronologically with results from earlier sessions listed first. Data from sessions immediately following a change in FR (fixed ratio) value are omitted in cases where responding had not stabilized. Number of liquid reinforcements is not always an integral multiple of the number of liquid responses, for during reinforcement responding could occur which had no programmed consequence. Values for water sessions are from days immediately preceding and succeeding days when ethanol was available. "W" and "E" indicate water and ethanol sessions, respectively. The values given under "Weight" are the animal's weight immediately prior to the session. Control responses are responses on a second lever and had no programmed consequence.

Sess. Type	FR	Liquid Responses	Liquid Reinforcements	Volume Consumed (ml.)	Weight (grams)	FED (grams)	Control Responses
W	1	6	6	2	525	8	0
E	1	58	56	13	510	16	1
W	1	3	3	1	522	14	12
W	1	3	3	1	523	14	3
E	1	64	64	15	513	16	0
W	1	1	1	0	518	16	0
W	2	0	0	0	526	14	0
E	2	155	78	18	526	14	0
W	2	13	6	2	524	14	0
W	2	5	3	1	519	15	1
E	2	125	62	15	523	14	1
W	2	16	8	2	514	16	2
W	4	1	0	0	512	18	0
E	4	296	73	17	528	14	0
W	4	14	3	1	523	15	1
W	4	15	3	1	525	14	3
E	4	228	57	14	519	15	0
W	4	2	0	0	507	14	0

Table 1, Page 2

Sess. Type	FR	Liquid Responses	Liquid Reinforcements	Volume Consumed (ml.)	Weight (grams)	FED (grams)	Control Responses
W	8	4	0	0	518	18	3
E	8	523	63	15	536	15	1
W	8	30	3	1	529	15	1
W	8	24	3	1	523	11	0
E	8	409	51	12	529		2
W	8	10	1	0	522	16	0
W	16	1	0	0	516	17	0
E	16	570	33	8	517	17	8
W	16	2	0	0	526	15	1
W	16	85	5	1	525	15	9
E	16	675	40	10	523	15	16
W	16	2	0	0	528	18	0
W	32	2	0	0	518	18	0
E	32	364	11	3	525	14	2
W	32	2	0	0	521	15	0
W	32	5	0	0	501	16	1
E	32	495	15	4	515	18	1
W	32	0	0	0	524	14	0
W	64	0	0	0	519	17	1
E	64	38	0	0	523	15	1
W	64	0	0	0	514	17	0
W	64	0	0	0	518	17	0
E	64	34	0	0	500	19	1
W	64	0	0	0	529	15	0
W	1	9	9	2	516	16	0
E	1	63	63	14	512	18	8
W	1	26	20	3	516	18	3
W	1	16	11	2	520	17	0
E	1	64	62	14	522	16	4
W	1	9	9	2	524	++	0

Table 2

FIXED RATIO PERFORMANCE BY RAT 856 DURING FOOD SATIATION

FOR 8% (W/V) ETHANOL AND WATER

Sess. Type	FR	Liquid Responses	Liquid Reinforcements	Volume Consumed (ml.)	Weight (grams)	Control Responses
W	1	3	3	1	645	0
E	1	15	14	3	644	0
W	1	6	6	2	639	0
W	1	8	8	2	647	0
E	1	17	16	4	649	0
W	1	10	10	3	653	0
W	1	13	13	3	648	0
E	1	32	31	7	654	0
W	1	4	4	1	657	0
W	2	6	3	1	655	2
E	2	66	33	8	652	0
W	2	10	5	1	654	1
W	2	5	2	1	655	0
E	2	49	24	6	654	0
W	2	15	7	2	648	0
W	2	6	3	1	655	0
E	2	52	26	6	650	0
W	2	10	5	1	648	0
W	4	12	3	1	653	0
E	4	84	21	5	661	0
W	4	32	8	2	647	0
W	4	4	1	0	650	0
E	4	76	19	4	656	0
W	4	68	17	4	655	1
W	4	6	1	0	663	0
E	4	64	16	4	670	0
W	4	16	3	1	667	0

Table 2, Page 2

Sess. Type	FR	Liquid Responses	Liquid Reinforcements	Volume Consumed (ml.)	Weight (grams)	Control Responses
W	8	38	4	1	660	0
E	8	289	37	9	661	0
W	8	8	1	0	669	0
W	8	6	0	0	674	0
E	8	185	23	6	665	0
W	8	16	2	1	670	0
W	8	2	0	0	669	0
E	8	168	21	5	665	0
W	8	8	1	0	673	0
W	16	17	1	0	669	0
E	16	160	10	2	673	0
W	16	14	0	0	678	0
W	16	2	0	0	673	0
E	16	176	11	3	680	0
W	16	1	0	0	670	0
W	16	50	3	1	673	0
E	16	224	14	3	668	0
W	16	2	0	0	676	0
W	32	0	0	0	674	0
E	32	184	5	1	672	0
W	32	1	0	0	668	0
W	32	0	0	0	675	0
E	32	80	2	1	681	0
W	32	0	0	0	679	0
W	32	1	0	0	682	0
E	32	192	6	2	683	0
W	32	3	0	0	675	0
W	64	4	0	0	679	0
E	64	15	0	0	683	0
W	64	2	0	0	692	0

Table 2, Page 3

Sess. Type	FR	Liquid Responses	Liquid Reinforcements	Volume Consumed (ml.)	Weight (grams)	Control Responses
W	64	0	0	0	688	0
E	64	22	0	0	687	0
W	64	0	0	0	689	0
W	64	1	0	0	675	0
E	64	17	0	0	682	0
W	64	0	0	0	699	0
W	1	0	0	0	698	0
E	1	32	30	7	698	0
W	1	9	9	2	692	0
W	1	12	12	3	686	0
E	1	43	41	10	691	0
W	1	6	6	2	693	0
W	1	7	7	2	692	0
E	1	33	33	8	693	0
W	1	10	10	3	694	0

Table 3

FIXED RATIO PERFORMANCE BY RAT 861 DURING FOOD DEPRIVATION

FOR 8% (W/V) ETHANOL AND WATER

Sess. Type	FR	Liquid Responses	Liquid Reinforcements	Volume Consumed (ml.)	Weight (grams)	FED (grams)	Control Responses
W	1	12	9	2	505	15	36
E	1	69	61	11	502	16	12
W	1	15	11	3	505	15	11
W	1	15	12	3	503	16	20
E	1	67	48	12	503	15	8
W	1	17	13	3	503	16	6
W	2	9	4	1	507	15	3
E	2	148	71	17	507	14	4
W	2	18	7	2	504	16	7
W	2	19	9	2	505	16	10
E	2	119	59	15	507	15	1
W	2	35	12	3	504	16	21
W	4	7	1	0	522	12	8
E	4	339	81	19	496	16	18
W	4	38	8	2	497	17	16
W	4	12	2	0	497	18	11
E	4	341	82	19	502	18	3
W	4	31	7	2	508	15	10
W	8	33	3	1	498	17	19
E	8	586	71	16	507	15	5
W	8	49	5	1	500	16	18
W	8	20	2	0	506	16	10
E	8	555	63	15	501	17	2
W	8	14	1	0	510	17	10
W	16	5	0	0	511	16	5
E	16	1054	62	15	513	14	2
W	16	13	0	0	511	16	4

Table 3, Page 2

Sess. Type	FR	Liquid Responses	Liquid Reinforcements	Volume Consumed (ml.)	Weight (grams)	FED (grams)	Control Responses
W	16	10	0	0	511	15	8
E	16	1063	63	15	507	15	1
W	16	72	4	1	505	16	5
W	32	47	1	0	506	15	3
E	32	1766	54	13	508	16	0
W	32	41	1	0	506	15	4
W	32	7	0	0	511	15	8
E	32	1516	47	11	506	15	3
W	32	12	0	0	512	14	3
W	64	8	0	0	502	16	2
E	64	2584	40	10	503	16	0
W	64	14	0	0	505	16	3
W	64	14	0	0	506	16	3
E	64	2442	38	9	504	16	2
W	64	14	0	0	506	16	3
W	128	4	0	0	506	16	1
E	128	1802	14	3	509	15	20
W	128	5	0	0	510	15	14
W	128	7	0	0	507	16	4
E	128	897	7	2	498	17	10
W	128	1	0	0	505	15	6
W	256	10	0	0	503	16	3
E	256	72	0	0	510	14	8
W	256	12	0	0	504	15	8
W	256	10	0	0	501	16	2
E	256	518	2	1	508	15	2
W	256	21	0	0	504	16	4

Table 3, Page 3

Sess. Type	FR	Liquid Responses	Liquid Reinforcements	Volume Consumed (ml.)	Weight (grams)	FED (grams)	Control Responses
W	1	47	37	2	506	16	14
E	1	122	77	17	502	17	6
W	1	27	21	1	508	16	12
W	1	18	13	1	507	16	13
E	1	95	82	19	508	15	7
W	1	18	14	1	508	16	12

Table 4

FIXED RATIO PERFORMANCE BY RAT 861 DURING FOOD SATIATION

FOR 8% (W/V) ETHANOL AND WATER

Sess. Type	FR	Liquid Responses	Liquid Reinforcements	Volume Consumed (ml.)	Weight (grams)	Control Responses
W	1	11	8	2	577	8
E	1	72	33	7	580	1
W	1	28	18	5	586	3
W	1	6	4	1	589	0
E	1	36	27	7	597	3
W	1	16	9	2	599	2
W	1	16	12	2	605	0
E	1	32	20	4	615	2
W	1	12	11	2	615	1
W	2	40	15	3	637	5
E	2	132	50	11	630	1
W	2	24	9	2	628	3
W	2	42	16	4	634	0
E	2	161	58	12	638	5
W	2	63	25	5	632	10
W	2	29	14	2	637	6
E	2	117	44	11	643	2
W	2	46	18	3	636	5
W	4	18	4	1	642	2
E	4	179	36	9	647	5
W	4	25	4	1	647	4
W	4	33	6	1	644	3
E	4	134	28	7	644	1
W	4	27	5	1	642	3
W	4	23	5	1	656	3
E	4	188	38	9	649	1
W	4	25	5	1	651	3
W	8	31	3	1	656	5
E	8	434	46	11	653	10
W	8	43	5	1	659	6

Table 4, Page 2

Sess. Type	FR	Liquid Responses	Liquid Reinforcements	Volume Consumed (ml.)	Weight (grams)	Control Responses
W	8	6	0	0	655	3
E	8	497	55	13	666	4
W	8	100	10	2	670	8
W	8	46	5	1	669	5
E	8	624	61	14	666	3
W	8	16	2	0	673	6
W	16	7	0	0	682	10
E	16	859	48	12	680	5
W	16	71	4	1	667	4
W	16	18	1	0	675	5
E	16	955	54	14	680	0
W	16	2	0	0	680	0
W	16	1	0	0	675	2
E	16	821	47	11	677	7
W	16	14	0	0	677	4
W	32	10	0	0	683	3
E	32	632	19	5	686	5
W	32	13	0	0	686	5
W	32	1	0	0	694	4
E	32	563	17	4	700	7
W	32	1	0	0	699	0
W	32	1	0	0	705	1
E	32	656	20	4	705	8
W	32	45	1	0	703	2
W	64	6	0	0	704	0
E	64	713	11	3	713	1
W	64	19	0	0	709	0
W	64	1	0	0	714	1
E	64	1230	19	5	708	7
W	64	12	0	0	710	2
W	64	2	0	0	711	2
E	64	515	8	2	722	5
W	64	10	0	0	712	4

Table 4, Page 3

Sess. Type	FR	Liquid Responses	Liquid Reinforcements	Volume Consumed (ml.)	Weight (grams)	Control Responses
W	128	5	0	0	716	2
E	128	771	6	1	708	5
W	128	18	0	0	709	3
W	128	7	0	0	707	3
E	128	877	6	1	705	9
W	128	5	0	0	712	4
W	128	7	0	0	706	3
E	128	516	4	1	708	9
W	128	3	0	0	712	1
W	256	6	0	0	713	4
E	256	128	0	0	716	5
W	256	1	0	0	719	1
W	256	2	0	0	722	1
E	256	49	0	0	723	7
W	256	1	0	0	725	0
W	256	0	0	0	726	0
E	256	136	0	0	727	3
W	256	6	0	0	728	1
W	1	20	13	2	737	13
E	1	224	101	14	743	2
W	1	12	6	1	741	8
W	1	3	2	0	743	1
E	1	138	64	9	744	11
W	1	6	4	1	739	11
W	1	4	4	1	742	13
E	1	133	84	12	744	26
W	1	14	9	2	743	10

Table 5

FIXED RATIO PERFORMANCE BY RAT 864 DURING FOOD DEPRIVATION

FOR 8% (W/V) ETHANOL AND WATER

Sess. Type	FR	Liquid Responses	Liquid Reinforcements	Volume Consumed (ml.)	Weight (grams)	FED (grams)	Control Responses
W	1	24	20	5	520	19	14
E	1	139	128	32	527	18	0
W	1	37	27	7	532	16	35
W	1	15	15	4	520	18	3
E	1	167	149	37	526	17	0
W	1	68	50	7	533	16	118
W	2	55	26	7	525	17	39
E	2	203	95	23	518	18	1
W	2	125	53	11	532	17	102
W	2	97	33	8	525	18	52
E	2	170	80	20	527	18	0
W	2	41	16	4	530	18	23
W	4	64	15	4	524	19	14
E	4	449	110	27	546	15	0
W	4	3	0	0	540	15	1
W	4	54	13	3	532	18	9
E	4	387	95	22	543	16	0
W	4	66	14	4	529	17	14
W	8	54	6	2	525	17	7
E	8	487	60	14	528	16	0
W	8	14	1	0	535	15	1
W	8	3	0	0	528	16	1
E	8	672	78	19	533	15	0
W	8	170	20	5	534	15	6
W	16	209	12	3	533	15	17
E	16	1141	71	16	533	15	0
W	16	149	8	2	532	16	3

Table 5, Page 2

Sess. Type	FR	Liquid Responses	Liquid Reinforcements	Volume Consumed (ml.)	Weight (grams)	FED (grams)	Control Responses
W	16	17	1	0	524	19	1
E	16	1256	77	18	543	13	0
W	16	131	8	2	530	16	5
W	32	1	0	0	528	17	3
E	32	1256	39	9	527	17	0
W	32	161	5	1	527	17	0
W	32	5	0	0	526	18	2
E	32	1255	39	9	529	17	0
W	32	6	0	0	528	17	1
W	64	1	0	0	530	17	0
E	64	451	7	2	535	16	1
W	64	1	0	0	500	19	0
W	64	7	0	0	518	19	3
E	64	836	13	3	521	19	3
W	64	0	0	0	525	19	0
W	128	25	0	0	528	19	9
E	128	17	0	0	529	19	0
W	128	3	0	0	529	19	1
W	128	4	0	0	530	19	2
E	128	4	0	0	530	19	6
W	128	1	0	0	534	18	1
W	1	0	0	0	532	19	0
E	1	116	101	25	539	15	0
W	1	4	3	1	535	16	0
W	1	16	16	4	533	17	3
E	1	187	109	27	533	16	0
W	1	12	11	3	540	6	0

Table 6

FIXED RATIO PERFORMANCE BY RAT 864 DURING FOOD SATIATION

FOR 8% (W/V) ETHANOL AND WATER

Sess. Type	FR	Liquid Responses	Liquid Reinforcements	Volume Consumed (ml.)	Weight (grams)	Control Responses
W	1	5	5	1	618	0
E	1	66	40	10	627	0
W	1	23	22	5	633	0
W	1	18	17	4	627	1
E	1	38	32	8	645	0
W	1	14	13	3	658	0
W	1	2	2	0	657	0
E	1	27	24	6	657	0
W	1	19	19	5	649	0
W	2	4	2	0	657	0
E	2	91	41	10	655	0
W	2	22	9	2	655	0
W	2	11	5	1	659	0
E	2	109	48	12	653	1
W	2	7	3	1	663	0
W	2	4	2	0	660	1
E	2	49	23	6	662	0
W	2	13	6	2	660	0
W	4	36	8	2	663	2
E	4	179	43	11	665	0
W	4	27	6	1	666	0
W	4	7	1	0	671	0
E	4	184	43	11	670	0
W	4	54	12	3	676	0
W	4	17	4	1	678	0
E	4	215	49	12	672	2
W	4	58	13	4	670	0
W	8	98	11	3	675	0
E	8	417	50	13	672	0
W	8	125	15	4	672	1

Table 6, Page 2

Sess. Type	FR	Liquid Responses	Liquid Reinforcements	Volume Consumed (ml.)	Weight (grams)	Control Responses
W	8	89	10	3	672	0
E	8	228	27	7	672	0
W	8	34	4	1	672	0
W	8	41	5	1	673	0
E	8	361	42	10	673	0
W	8	44	5	1	666	0
W	16	52	3	1	670	0
E	16	242	14	3	675	2
W	16	0	0	0	671	0
W	16	5	0	0	672	0
E	16	302	18	4	677	0
W	16	4	0	0	671	0
W	16	14	0	0	674	0
E	16	133	7	2	675	1
W	16	3	0	0	677	0
W	32	0	0	0	676	1
E	32	223	6	2	669	0
W	32	13	0	0	675	0
W	32	0	0	0	677	0
E	32	188	5	1	675	0
W	32	5	0	0	682	0
W	32	7	0	0	677	0
E	32	153	4	1	675	1
W	32	1	0	0	680	0
W	64	2	0	0	677	0
E	64	10	0	0	675	1
W	64	1	0	0	677	0
W	64	9	0	0	689	0
E	64	22	0	0	684	0
W	64	1	0	0	679	0
W	64	9	0	0	688	0
E	64	11	0	0	688	0
W	64	0	0	0	681	2

Table 6, Page 3

Sess. Type	FR	Liquid Responses	Liquid Reinforcements	Volume Consumed (ml.)	Weight (grams)	Control Responses
W	1	2	2	0	696	0
E	1	107	68	17	684	0
W	1	13	11	3	682	2
W	1	8	8	2	686	1
E	1	82	63	16	681	0
W	1	31	26	5	682	0
W	1	11	11	3	687	0
E	1	63	60	15	692	0
W	1	11	11	3	693	0

Table 7

FIXED RATIO PERFORMANCE BY RAT 865 DURING FOOD DEPRIVATION

FOR 8% (W/V) ETHANOL AND WATER

Sess. Type	FR	Liquid Responses	Liquid Reinforcement	Volume Consumed (ml.)	Weight (grams)	FED (grams)	Control Responses
W	1	15	10	3	468	16	152
E	1	99	87	18	468	14	5
W	1	5	5	1	483	13	4
W	1	7	6	1	469	16	4
E	1	90	74	16	473	14	6
W	1	8	5	1	470	15	2
W	2	1	0	0	467	16	1
E	2	132	66	14	472	15	1
W	2	3	1	0	479	14	2
W	2	4	2	0	474	15	0
E	2	156	76	17	473	15	0
W	2	9	4	1	473	15	2
W	4	11	2	0	474	14	1
E	4	510	105	22	473	14	1
W	4	16	4	1	480	13	4
W	4	1	0	0	490	10	1
E	4	518	114	23	475	14	0
W	4	8	2	1	473	15	5
W	8	7	0	0	481	12	2
E	8	711	82	18	477	12	0
W	8	6	0	0	472	14	3
W	8	5	0	0	472	14	0
E	8	648	74	15	472	14	1
W	8	5	0	0	472	14	0
W	16	3	0	0	469	15	2
E	16	1790	107	23	472	14	1
W	16	1	0	0	475	13	1

Sess. Type	FR	Liquid Responses	Liquid Reinforcements	Volume Consumed (ml.)	Weight (grams)	FED (grams)	Control Responses
W	16	15	0	0	470	14	4
E	16	1947	106	23	469	14	0
W	16	1	0	0	476	13	1
W	32	2	0	0	468	16	1
E	32	2657	74	16	479	15	1
W	32	4	0	0	480	15	0
W	32	9	0	0	473	15	4
E	32	2961	83	17	474	15	0
W	32	1	0	0	473	15	0
W	64	0	0	0	475	14	2
E	64	4163	62	15	474	14	4
W	64	2	0	0	476	13	0
W	64	4	0	0	470	15	7
E	64	3896	57	14	475	13	2
W	64	7	0	0	471	15	3
W	128	7	0	0	470	15	4
E	128	897	7	2	473	14	10
W	128	1	0	0	473	14	6
W	128	2	0	0	473	13	0
E	128	904	7	2	472	13	8
W	128	2	0	0	470	14	8
W	256	2	0	0	471	14	10
E	256	624	2	0	468	15	4
W	256	12	0	0	474	14	17
W	256	5	0	0	475	13	15
E	256	964	3	1	470	14	4
W	256	7	0	0	473	13	4

Table 7, Page 3

Sess. Type	FR	Liquid Responses	Liquid Reinforcements	Volume Consumed (ml.)	Weight (grams)	FED (grams)	Control Responses
W	1	9	9	2	470	15	4
E	1	105	102	21	472	14	0
W	1	7	7	2	474	13	0
W	1	12	12	3	468	14	3
E	1	90	90	19	472	14	1
W	1	15	10	2	473	++	0

Table 8

FIXED RATIO PERFORMANCE BY RAT 865 DURING FOOD SATIATION

FOR 8% (W/V) ETHANOL AND WATER

Sess. Type	FR	Liquid Responses	Liquid Reinforcements	Volume Consumed (ml.)	Weight (grams)	Control Responses
W	1	2	2	0	520	1
E	1	21	20	5	527	1
W	1	1	1	0	545	0
W	1	2	2	0	544	1
E	1	25	25	6	558	0
W	1	0	0	0	562	0
W	1	4	4	1	550	0
E	1	21	20	5	573	0
W	1	4	4	1	576	0
W	2	0	0	0	595	0
E	2	54	26	6	604	3
W	2	1	0	0	606	0
W	2	2	1	0	601	0
E	2	93	46	11	601	0
W	2	5	2	0	605	1
W	2	1	0	0	614	0
E	2	52	26	6	613	0
W	2	2	1	0	611	1
W	4	2	0	0	606	1
E	4	135	26	6	605	0
W	4	6	1	0	604	0
W	4	0	0	0	604	0
E	4	118	25	6	607	1
W	4	7	1	0	611	0
W	4	1	0	0	610	0
E	4	134	27	7	612	0
W	4	2	0	0	615	0
W	8	0	0	0	614	1
E	8	263	28	7	612	0
W	8	0	0	0	617	0

Table 8, Page 2

Sess. Type	FR	Liquid Responses	Liquid Reinforcements	Volume Consumed (ml.)	Weight (grams)	Control Responses
W	8	0	0	0	618	0
E	8	193	20	5	612	0
W	8	8	1	0	615	3
W	8	0	0	0	614	0
E	8	243	26	6	615	0
W	8	0	0	0	615	0
W	16	0	0	0	620	0
E	16	262	16	4	618	0
W	16	2	0	0	621	0
W	16	0	0	0	621	0
E	16	146	9	2	620	0
W	16	1	0	0	621	0
W	16	0	0	0	625	0
E	16	171	10	2	630	1
W	16	4	0	0	624	2
W	32	3	0	0	633	1
E	32	237	7	2	635	1
W	32	0	0	0	640	0
W	32	0	0	0	632	0
E	32	295	9	2	639	0
W	32	0	0	0	652	0
W	32	1	0	0	648	0
E	32	137	4	1	648	0
W	32	4	0	0	638	0
W	64	1	0	0	645	0
E	64	3	0	0	649	2
W	64	1	0	0	644	1
W	64	0	0	0	638	0
E	64	2	0	0	650	1
W	64	0	0	0	647	3
W	64	0	0	0	647	0
E	64	1	0	0	650	0
W	64	0	0	0	648	0

Table 8, Page 3

Sess. Type	FR	Liquid Responses	Liquid Reinforcements	Volume Consumed (ml.)	Weight (grams)	Control Responses
W	1	1	1	0	654	0
E	1	61	59	12	645	0
W	1	4	4	1	651	0
W	1	3	3	1	651	0
E	1	51	49	8	645	0
W	1	4	4	1	646	0
W	1	9	8	2	649	1
E	1	90	66	11	653	2
W	1	12	10	3	649	0

Table 9

CONCENTRATION-RESPONSE DATA FOR RAT 856 DURING FOOD SATIATION

Sess. Type	Etoh. Conc.	Liquid Responses	Liquid Reinforcements	Volume Consumed (ml.)	Weight (grams)	Control Responses
W	0	3	3	1	688	0
E	2	23	21	5	687	1
W	0	1	1	0	690	0
W	0	0	0	0	692	0
E	2	20	20	5	694	6
W	0	3	3	1	687	0
W	0	2	2	0	689	0
E	4	58	58	14	684	0
W	0	11	11	3	686	0
W	0	5	5	1	686	0
E	4	49	49	12	687	0
W	0	4	4	1	690	0
W	0	7	6	1	685	0
E	8	40	39	9	689	0
W	0	2	1	0	687	0
W	0	6	5	1	683	0
E	8	41	40	10	689	0
W	0	13	13	3	687	0
W	0	8	8	2	689	0
E	16	32	32	8	684	0
W	0	9	6	1	694	0
W	0	5	4	1	697	0
E	16	34	34	8	696	0
W	0	4	4	1	689	0
W	0	2	2	0	699	0
E	32	24	20	5	690	0
W	0	4	4	1	696	0
W	0	3	3	0	698	0
E	32	19	19	5	696	0
W	0	6	6	1	694	0