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BRIEF COMMUNICATION

Schedule Induced Self Injections of Nicotine With Recovered Body Weight

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SINGER, G., F. SIMPSON AND W. J. LANG. *Schedule induced self injections of nicotine with recovered body weight.* PHARMAC. BIOCHEM. BEHAV. 9(3)387–389, 1978.—In a recent series of experiments we have shown that high rates of self injection of nicotine were acquired when rats are at 80% body weight on an FT-1 min food delivery schedule. This rate was significantly higher than that of rats at reduced or normal body weight without food delivery schedules or that of rats injecting saline under three parallel control conditions. In the present experiment naive rats were trained to acquire nicotine self injection at 80% body weight with an FT-1 min food delivery schedule. These rats maintained their self injection rates after they were allowed to regain free feeding body weight. The data indicate that once nicotine intake behavior is established it can be maintained with changing nutritional factors.

Nicotine Schedule induced Self-injection Recovery of body weight

IN a previous study we compared different methods of self-administration of nicotine by naive rats. It was found that larger quantities of nicotine were self-injected by rats at reduced body weight on an FT-1 min food delivery schedule than were self-injected without a schedule at either normal or reduced body weight [1]. This increased rate of self-injection of nicotine involves an interaction of pharmacological, environmental and nutritional factors. The purpose of the present experiment was to investigate whether the bar pressing behavior for nicotine injections would be maintained, if after its establishment body weight were returned to normal. In this way the influence of changing the nutritional factor may be determined.

Since the maintenance of behavior depends in part on the continuity of the environment, self-injections were from the acquisition phase continued during the period when the rats were recovering their reduced body weight. In order to throw some light on the role of pharmacological factors during body weight recovery, in one group of animals nicotine was available for self-injection throughout the experimental period whereas in another group saline was available.

METHOD

Animals

Twenty-eight naive Lister hooded rats weighing between 400 and 500 g were used. All animals were housed individually in a temperature controlled room with a 12 hr light/dark cycle. The animals were weighed and attended daily at 1:00 p.m.

Apparatus

The test chamber was a test box (35×32×32 cm) with a bar and food pellet dispensing unit attached to adjacent walls. The bar was situated 5 cm and the pellet dispensing unit 3 cm from the grid floor and located 10 cm from the corner. The bar operated a Sage infusion pump which delivered 83 μl of solution of nicotine or saline when triggered. A 5 sec time delay unit was incorporated into the drug delivery system so that any bar presses during the first 5 sec following the effective bar press did not trigger any further infusion. Cumulative recorders were used to measure the number of infusions during each 1 hour test session. Sixty 45 mg Noyes food pellets were delivered to the animal each test session on a Fixed-time 1 minute noncontingent pellet delivery (FT-1 min) schedule. Water was available at all times except during the test session.

Drugs

A solution of nicotine hydrogen tartrate (B.D.H. Ltd.) was prepared prior to each test session by dissolving it in 0.9% sterile saline. Each dose prepared was to the equivalent of 0.1 mg/kg.

TABLE 1

SELF ADMINISTRATION OF NICOTINE WITH BODY WEIGHT CHANGES

	Phase 1 Acquisition Period	Phase 2 Body Weight Recovery Period	Phase 3 Test Period
	Self-injection 80% B.W. FT-1 min Schedule 5 days	Self-injection FT-1 min Schedule 6 days	Self-injection 100% B.W. FT-1 min Schedule 5 days
Group 1	Saline	Food rations increased. Saline injections continued.	Saline
Group 2	Nicotine	Control animals maintained at 80% B.W. Nicotine injections continued.	Nicotine
Group 3	Nicotine	Food rations increased. Nicotine injections continued.	Nicotine
Group 4	Nicotine	Food rations increased. Nicotine injections replaced with Saline injections.	Nicotine

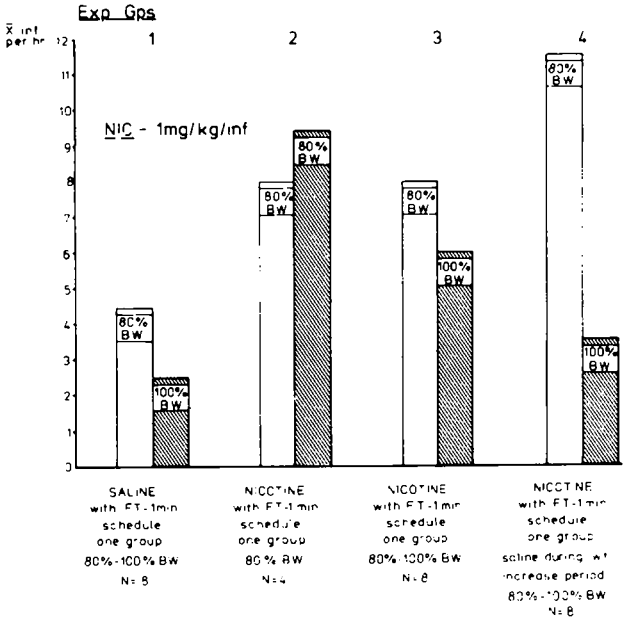

FIG. 1. Mean number of nicotine or saline infusions/hr self-injected by rats at reduced and free feeding body weights.

Procedure

All animals were reduced to 80% body weight (B.W.) by gradually restricting the daily ration of food over 10 days. Towards the end of the weight reduction period, intravenous cannulae were surgically implanted into the jugular vein of all animals using a mixture of methohexitone and amylobarbitone as an IP anaesthetic. All cannulae were maintained in position by jackets worn by each animal and which were connected to a flexible swivel system allowing each animal relatively free movement at all times. Two days following the insertion of the cannulae, the animals were allocated to four experimental groups and trained to self-inject for 1 hr/day for 6 days on an FT-1 min food delivery schedule. During the training period, nicotine or saline infusions were delivered to each animal via the implanted cannulae. Because this was a training period all animals received at least 3 infusions (either nicotine or saline) each day for the first 3 days. The experimental design is summarised in Table 1.

Phase 1. In phase one or the acquisition period, all animals in all groups were at 80% body weight and self-injected either nicotine or saline.

Phase 2. This phase was a 6 day body weight recovery period when animals in Groups 1, 3 and 4 were given ad lib food in their home cages. Group 2 was maintained at 80% body weight. During this time, animals were tested daily for 1 hr and self-injected either nicotine or saline infusions.

Phase 3. This was a final 5 day test period. Groups Nos. 1, 3 and 4 were at free feeding weights whilst Group 2 was maintained at the reduced body weight level. Animals were similarly tested daily as during Phases 1 and 2.

RESULTS AND DISCUSSION

The means and standard deviations for the 4 treatment groups for both Phase 1 and 3 are shown in Table 2 and Fig. 1.

A two factor ANOVA with repeated measures on one factor showed that the between groups effect was not significant, $F(3,24)=2.99$, $p>0.05$, and that the effect for the factor phase was significant, $F(1,24)=9.66$, $p<0.01$, as well as the interaction effect, $F(3,24)=5.32$, $p<0.01$. Since the interaction effect was significant two Scheffé post hoc analyses were carried out. The first one showed that the three nicotine groups were self-injecting at a significantly higher rate than the saline control groups, $F(3,48)=2.96$, $p<0.05$, for Phase 1. The second showed that the only significant difference between the phases was in Group 4; $F(3,24)=28.3$, $p<0.01$. There was no significant difference between the phases in Groups 1, 2 and 3, $F<2$, $p>0.05$.

These results need to be interpreted in conjunction with data reported from our laboratory [1]. In the earlier experi-

TABLE 2

MEAN INFUSION RATES/HR FOR RATS AT REDUCED AND RECOVERED BODY WEIGHT

Group No.			Phase 1		Phase 3	
			Mean	SD	Mean	SD
1	(n=8)	Saline	4.5	3.38	2.7	1.10
2	(n=4)	Nicotine	.0	5.52	9.4	3.04
3	(n=8)	Nicotine	8.0	4.06	6.0	3.30
4	(n=8)	Nicotine	11.6	5.03	3.5	2.09

ments it was shown that the highest rates of self-injection of nicotine are acquired when rats at 80% body weight were on an FT-1 min food delivery schedule. This rate was significantly higher than that of rats at reduced or normal body weight without food delivery schedules or that of rats with saline available under 3 parallel control conditions. The present data show that once this behavior is acquired it can be maintained after body weight has recovered to free feeding weight, since there is no significant difference between self-injection rates in phase 1 and 3 for Groups 1, 2 and 3. However, the maintenance of this behavior seems to be dependent on the continued availability of nicotine during the body weight recovery phase since Group 4 which had saline available during the recovery period shows a significant drop in nicotine self-injection rate from Phase 1 to Phase 3.

The results indicate that once nicotine intake behavior is established it can be maintained with changing nutritional factors. This may be of some significance to the understanding of nicotine intake (smoking behavior) in man.

ACKNOWLEDGEMENT

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REFERENCE

1. Lang, W. J., A. A. Latiff, A. McQueen and G. Singer. Self administration of nicotine with and without a food delivery schedule. *Pharmac. Biochem. Behav.* 7: 65–70, 1977.