Body weight loss as a measure of motivation in thirsty guinea pigs¹

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Guinea pigs deprived of water reduce their food intake and lose weight rapidly. Bar pressing for water over the course of this weight loss is a linear log log function of percent body weight loss. Experience was found to have no effect on body weight loss but to affect the rate of bar pressing.

Rats bar pressing (BP) for water under varying degrees of water restriction yield a linear increasing log function of log percent body weight loss (Collier, 1964; Collier & Knarr, 1966; Collier, 1967; Collier & Levitsky, 1967). The present experiment is concerned with examining this relation in the guinea pig.

Subjects

Twenty-three naive male Huntingdon Farms guinea pigs were used. The mean body weight at the start of the experiment was 806 g.

Apparatus

Testing cages were eight 9 x 12 x 10 in. Lincoln Incubator Co. cages. A 2 in. solid round bar was mounted 1 in. from the floor. It extended 1.75 in. into the cage. The top, bottom, and front of the cages were of 1/2 in. hardware cloth while the back and sides were sheet metal. The magazine was a 50 ml burette to which a 5 mm diameter glass drinking tube was annealed. It entered the cage above the bar through a 7/8 in. hole, 3 in. from the floor. The tube was moved by a motor driven cam. The duration of presentation was determined by electronic timers.

Procedure

The guinea pigs were first placed in the testing apparatus with the bars removed for five 1/2-h sessions in which the drinking tubes containing whole Carnation milk were continuously available. The Ss then received three 1/2-h magazine training sessions in which the tubes entered the cage for 15 sec on a VI-1 min schedule. Next the bar was placed in the cage and seven daily 1/2-h BP training sessions were given. A 1 min VI schedule and 5 sec tube-availability per reinforcement were used. Both food and water were continuously available to the animals in their home cages throughout the training sessions.

Five days following BP training, water was removed from the home cages immediately after the first 1/2-h BP session for water reinforcement. Food was available ad lib in home cages. Deprivation and BP for water were continued for 11 days. The only water available during this time was from BP. Following this deprivation cycle the animals were allowed 17 days to recover lost weight. The animals were again deprived of water in the home cage for the next 12 days which again was followed

by an 18 day recovery period. Next, the time allowed for reinforcement was decreased to 3 sec per reinforcement and a third water deprivation-BP cycle was introduced for nine days. Over the course of the experiment, three animals died and six others were discarded (see Fig. 1) showing definite signs of severe inanition, especially during the last deprivation cycle.

Results

Total water intake, food intake, and body weight during the BP deprivation and recovery periods are shown in Fig. 1. Water intake fell to approximately 20 ml from an average of 175 ml. On the days following the deprivation periods, water intake displayed a rapid recovery. The final level was no greater than mean intake for the entire recovery period.

Body weight showed an overall increase over the

Fig. 1. Body weight, food intake, and water intake during ad lib (AL) and water restriction (DEP) periods.

Fig. 2. Log bar presses during first, second, and third deprivation period as a function of percent body weight loss.

course of the experiment, with rapid drops during deprivation. The rate of body weight loss during the second deprivation cycle was identical to that of the first cycle. Body weight displayed a greater rate of decrease in the third, more severe deprivation cycle.

Food intake displayed a rapid and immediate decrease at the commencement of each deprivation period stabilizing at about the third day in the first and second deprivation cycles. Recovery of food intake following all cycles of deprivation was just as rapid as the declines, again stabilizing at about the third day.

Log total bar presses per session as a function of log body weight loss is presented for each deprivation cycle in Fig. 2. Both the first and second deprivation cycles yielded linear increasing functions, although the slope of the function for the second deprivation period was less and the intercept greater than those of the first deprivation period. The third deprivation period yielded a nonmonotonic function increasing linearly to about 20% body weight loss then dropping rapidly. Under this more severe schedule Ss appeared to be more physiologically distressed.

Discussion

Guinea pigs deprived of water lose weight. This weight loss is in part a result of an immediate reduction of food intake. In this respect the guinea pig is similar to the rat and it can be assumed that the guinea pig reflects the same mechanism, namely,

the defense of the ratio of body water to lean body mass (Collier & Knarr, 1966; Collier & Levitsky, 1967). Following deprivation, recovery of water and food intake is rapid and to the levels prevailing before deprivation. Recovery of body weight, at the level of deprivation used, is rapid and to the envelope of the growth curve.

Instrumental activity for water in water deprived guinea pigs again is similar to that for rats (Collier & Levitsky, 1967) in that it is a linear log function of log percent body weight loss. This relation appears to be a fundamental one in that it holds for a number of species and for a variety of methods of restricting water intake (Collier, 1967). The point of inanition, that is, the point at which BP starts to decline and the Ss become weak and show other signs of morbidity, appears to vary from species to species (Collier, 1967).

Successive experiences with total water deprivation appear to have a far greater effect psychologically than physiologically. Neither rate of body weight loss nor food intake during the second deprivation cycle differed from those of the prior deprivation cycle. The BP data, on the other hand, suggest that the initial deprivation experience or initial BP experience may have an effect on BP rate. It should be cautioned, however, that it is not clear from the present data whether it is the experience of deprivation alone, the experience of BP under deprivation, or a contrast effect which accounts for this difference in the proportionality constant of the rate of BP-percent body weight loss function. It is clear, however, that while the rate of BP at a given deprivation level is multiply determined, a significant component of this variance is that associated with body weight loss.

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Note

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