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Weight reduction and "free choice" polydipsic ethanol consumption

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In seeking to measure the effects of some independent variables on polydipsic ethanol consumption and/or ethanol selection of rats in a "free choice" situation, researchers commonly reduce the weight of all experimental subjects. Failure to control for the independent effects of this weight reduction may cause confounding of the treatment variables. The present study is an investigation of the effects of weight reduction on ethanol selection and ethanol consumption in a "free choice" polydipsic situation. Two groups of five rats were used; one group was reduced to 80% of their free-feeding weight and the other group was not reduced. The degree of ethanol selection and quantity of ethanol consumed by weight-reduced rats was significantly greater than the other group. Results were discussed in terms of their implications for future research.

A procedure involving the reduction of experimental subjects' weight to 80% of ad-lib feeding weight has been employed quite commonly in the study of polydipsic ethanol consumption (Falk, Samson, & Winger, 1972; Freed, 1971; Freed, Carpenter, & Hymowitz, 1970; Holman & Meyers, 1968; Keehn & Coulson, 1970). Using this procedure, researchers have found various factors which apparently affect polydipsic ethanol consumption in situations in which only ethanol is available. Variables studied include the temporal spacing of food portions in a polydipsic paradigm (Hawkins, Schrot, Githens, & Everett, 1972), and the manipulation of ethanol concentration in the experimental cages (Everett & King, 1970; Schrot, Hawkins, & Githens, 1971). Similar studies have also been performed on factors which affect the selection of ethanol in a "free choice" paradigm in which fluids other than ethanol have also been available (Keehn & Coulson, 1970, 1972).

However, the finding that polydipsic ethanol consumption is at least partially determined by caloric need (Freed, 1972, 1974; Freed & Lester, 1970) poses some problematic questions. The variables which past researchers have delineated as being important in determining polydipsic ethanol consumption have often been established by using rats reduced to 80% of their free-feeding weight. The effects of weight reduction per se on polydipsic ethanol consumption, or on the selection of ethanol in a "free choice" polydipsic paradigm, have neither been isolated nor controlled for in past research.

The present study was designed to investigate the effects of weight reduction per se on both the degree of ethanol selection in a "free choice" polydipsic paradigm and quantities of subjects' ethanol ingestion in such a situation.

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METHOD

Ten Holtzman rats with a mean free-feeding weight of 310 g were used as subjects. For each experimental period, rats were housed in Skinner boxes with attached feeders. The feeders were controlled by a series of switches on a console. Each time a switch was thrown, a single 45-mg food pellet was delivered into the foodcup of the corresponding Skinner box. During each experimental period, rats had free access to both tap water and a 10% (by volume) ethanol solution. Both fluids were available from 100-ml reservoirs.

Two groups of five rats each (Groups N and H) were formed from the original sample. Members of Group H (hungry) were reduced to 80% of their free-feeding weight and thereafter only received one-half the amount of food Group N (not hungry) received.

During the 2-h experimental period, Group H received two 45-mg food pellets every 2 min. Each rat had access to water as well as an ethanol solution. During the experimental period, Group N received four 45-mg food pellets every 2 min. Each rat in Group N had access to both water and an ethanol solution.

Rats were run in individual cages. Each group was run separately. The duration of the experiment was 15 days, each group undergoing one experimental period a day. Rats were given just enough food outside the experimental sessions to maintain their weight within the prescribed experimental parameters. Bottle position was randomized, ensuring against any response bias.

RESULTS AND DISCUSSION

A one-between one-within ANOVA was performed on the ethanol consumption data alone. A significant effect associated with the between groups variable was observed, $F(1,8) = 5.34$; $p < .05$. That is, Group H consumed significantly more ethanol than Group N. This outcome can be clearly seen in Figure 1. Although Group N consumed an overall larger quantity of liquid, $t(8) = 2.94$, $p < .02$, Group H consumed significantly more ethanol than did the other group. In fact, while Group N obviously preferred water to the ethanol solution, $t(4) = 8.89$, $p < .01$, no clear ethanol preference was established in Group H, $t(4) = .4003$, n.s. As can be seen in Figure 1, ethanol consumption for Group H was almost half of total fluid consumption.

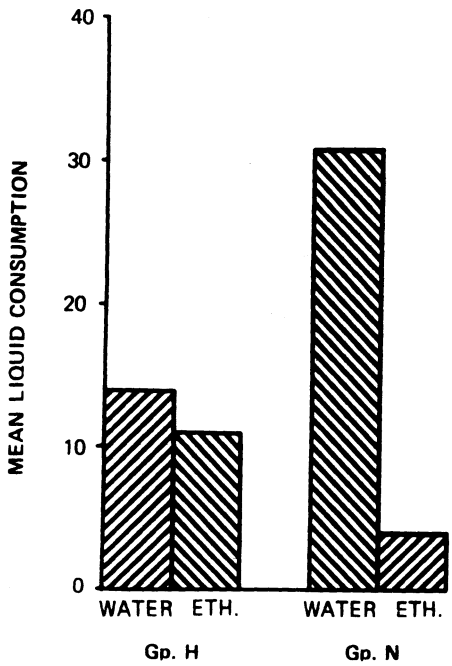

Figure 1. Mean consumption of water and ethanol solution per rat per day for the hungry group (Group H) and the not-hungry group (Group N). N = 5 rats per group, total time = 15 days.

A second one-between one-within ANOVA was done on the water consumption data alone. The observed significant effect, $F(1,8) = 14.55$, $p < .01$, is illustrated in Figure 1. Group N consumed water almost to the exclusion of ethanol.

Several conclusions can be drawn from these results. Since the total liquid consumption was significantly different for the two groups, it would seem that the outcomes of previous research utilizing differing amounts of food have been substantiated (Hawkins, Schrot, Githens, & Everett, 1972). That is, increased food portions seem to increase liquid consumption in a polydipsic situation.

Another conclusion is that weight reduction per se seems to have an effect on the selection of ethanol in a "free choice" polydipsic paradigm. In other words, although the not-hungry group consumed more fluid, presumably because of the larger amounts of food eaten, the weight-reduced group (Group H) showed an increased preference for ethanol relative to the other group. Presumably the weight reduction itself influenced the amount of ethanol consumed in a "free choice" situation.

These findings suggest several implications. Since weight reduction per se seems to have an effect on the selection of ethanol in a "free choice" polydipsic paradigm, the researchers should, perhaps, control for weight reduction if they wish to study the independent effects of other variables on ethanol selection. If experimenters do not control for weight reduction, then it would seem that the effects of the reduction in weight on ethanol selection might be confounded with the other experimental variables of interest, and the strength of the effects of these variables would remain in question.

A similar suggestion can be made for single-choice polydipsic ethanol ingestion studies. Researchers interested in variables which affect polydipsic ethanol consumption (for example, different levels of ethanol concentrations) should, perhaps, control for weight reduction. If the researchers reduce all the animals' weights and do not control for weight reduction, then they would seem to be making the assumption that the effects of weight reduction are absent or, at least, of equal effectiveness across all treatment conditions. This leaves the possibility of an interactive effect untested. There is no a priori reason to assume that weight reduction per se combines additively, rather than in some interactive way, across treatment conditions. On the other hand, if weight reduction were to be treated as a variable, researchers would be able to measure not only the effects of the treatment variables but also the independent and interactive effects of the weight reduction.

In summary, the data indicate two implications for future polydipsic research. In "free choice" studies in which the effects of experimental factors on ethanol selection are studied, researchers should be cautious of reducing the animals' weights. Reducing animals' weights, in and of itself, seems to influence ethanol selection. Similarly, in single-choice studies, weight reduction could possibly interact with the treatment variables so as to affect ethanol ingestion. In order to become aware of such possible interactions, researchers may wish to treat weight reduction as a systematic variable in polydipsic research.

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