Effect of alcohol on running-wheel activity in rats

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Groups of 10 rats were given either 15% w/v ethanol (ETOH) or water and ad lib food in activity wheels which were allowed to move freely or were fixed for a 21-day period. There was no overall difference in activity between the ETOH or water groups; however, a significant increase in activity was found in the ETOH group during the first 6 experimental days. This effect may have been due to a significant reduction in the amount of food and fluid consumed by the animals as well as to weight loss during the initial stage.

Examination of the literature has failed to reveal any source of information directly related to the influence of alcohol in moderate concentrations on running-wheel activity. Since our previous work (Barboriak & Wilson, 1966; Barboriak & Wilson, 1969) has studied the metabolic effect of ETOH on various feeding schedules and on growth and since activity is related to food deprivation (Routtenberg, 1968), it was of interest to see the effect of ETOH when activity was an additional variable. A further consideration was to examine whether ETOH, which is a central nervous system depressant, would have its depressive effect reflected in running-wheel activity of rats.

METHOD

Ss were 40 male Sprague-Dawley albino rats, weighing approximately 268 g. These animals were individually housed in standard activity wheels (Whaman), with a counter that recorded the number of revolutions of each wheel. All animals were given unlimited access to food (Purina rat chow) and fluid (water or ETOH–15% w/v). The wheels were kept in air-conditioned animal quarters, with controlled periods of 12 h of light and 12 h of darkness. All animals were placed in the activity wheels 24 h before the start of the 21-day experimental period.

In the activity condition, 10 animals were assigned randomly to the activity cages, with 5 animals given 15% ETOH and 5 water. In the nonactive condition, 10 animals were assigned to the same fluid arrangement as those in the activity condition, but in this case the wheels were immobilized by wire. These conditions were then replicated, producing a total of 10 animals in each of four beverage-activity groups.

During the experiment, recordings were taken every 24 h (9:00 a.m.) of food and fluid consumed during the preceding 24 h, and a reading on the activity-wheel counters was taken. Animals were weighed twice a week–on Tuesday and Friday.

RESULTS

The mean wheel revolutions in blocks of 3 days each were determined for the active ETOH and water groups (Fig. 1). A trend analysis of variance was performed and indicated no significant differences between the groups ($F = 0.91$, $df = 1/16$) over the 21-day period. Separate t tests subsequently determined that the ETOH group was significantly different ($p < .05$) on the first ($t = 2.82$, $df = 9$) and second ($t = 2.51$, $df = 9$) blocks of 3 days.

The patterns of solid food consumption in terms of mean daily grams per block of 3 days each are presented in Fig. 2. A trend analysis of these data indicated significant differences for fluid groups ($F = 58.6$, $df = 1/36$, $p < .01$), activity ($F = 4.41$, $df = 1/36$, $p < .05$), and days ($F = 17.8$, $df = 6/216$, $p < .01$), as well as for all within-group interactions. The ETOH groups show the lowest amounts of food consumption.

Figure 3 shows the average daily fluid consumption in 3-day blocks for each of the groups. There are significant differences in consumption between ETOH and water groups ($F = 137.9$, $df = 1/36$) and activity ($F = 6.67$, $df = 1/36$, $p < .05$). Both fluid and activity dimensions showed significant interactions with time.

Changes in body weight throughout the experiment for the different groups are shown in Fig. 4. There is a significant difference in growth between ETOH and water groups ($F = 7.54$, $df = 1/36$, $p < .01$). The ETOH groups are initially depressed but, by the third time block, all groups show an acceleration in growth (F for days = 47.0, $df = 6/216$, $p < .01$).

DISCUSSION

There is a significant early influence of ETOH on activity

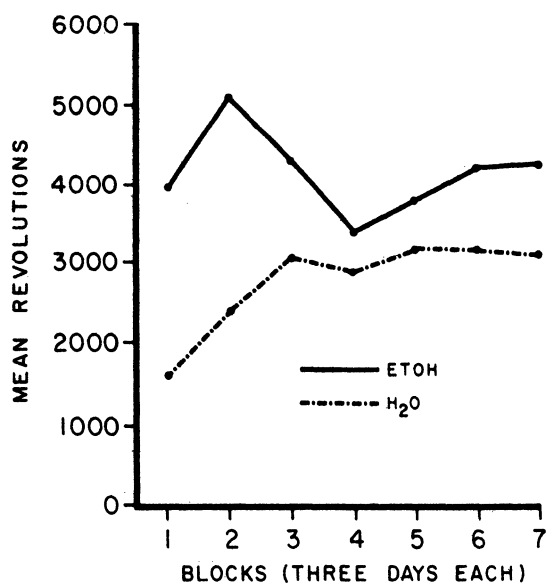

Fig. 1. Mean number of revolutions in 3-day blocks for active ethanol and water groups.

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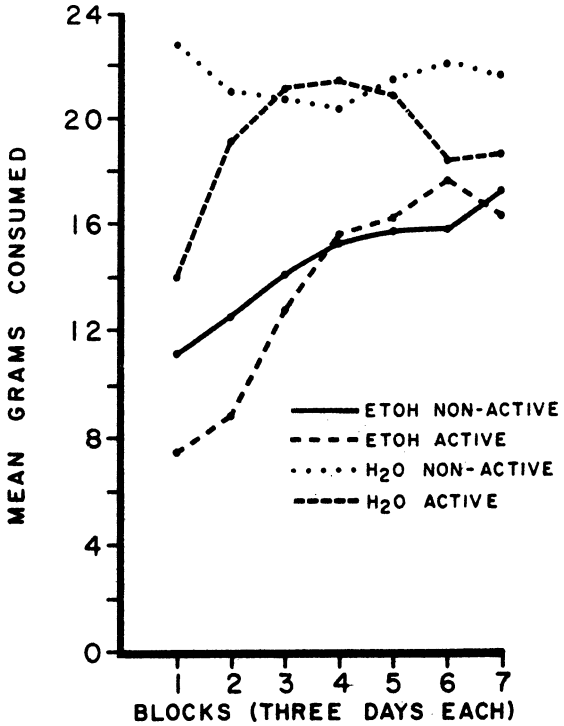

Fig. 2. Mean solid food consumption in grams per day for active and nonactive fluid groups.

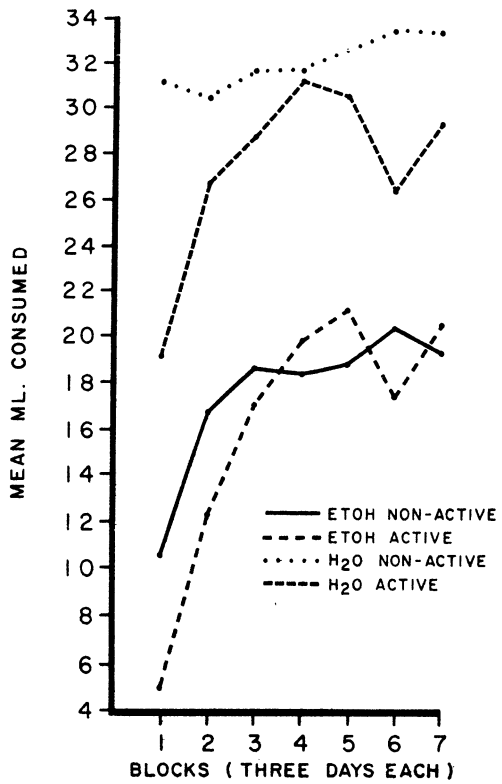

Fig. 3. Mean daily fluid consumption for active and nonactive fluid groups.

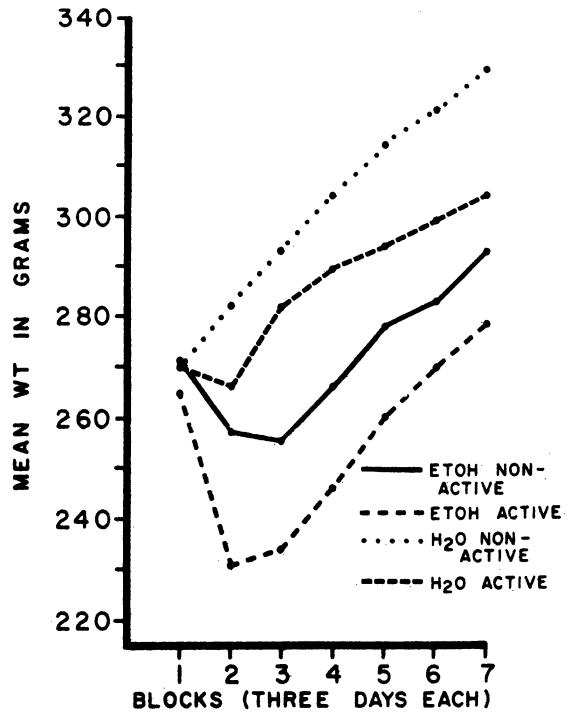

Fig. 4. Growth curves for ETOH and water-drinking rats under different activity conditions.

reflected in sharply elevated wheel running in the presence of ETOH during the first 6 experimental days. When ETOH is introduced as the sole drinking fluid, an initial reduction in amount of fluid consumed and in solid food eaten also occurs. This depression may result from the aversive properties of ETOH at this concentation (Lieber & Rubin, 1969). Consequently, these factors produce an initial weight loss. However, the animals adjust within about 6 days and begin to increase consumption of both ETOH and food. Previous research (Barboriak & Wilson, 1966) has presented similar evidence for this change. Since other data indicate that hungry animals run more in activity wheels than satiated animals (Routtenberg, 1968), the early high activity of the ETOH group is most likely due to deprivation factors. Over the entire 21-day experiment, however, this early effect of ETOH was not sufficient to produce an overall statistically meaningful change in the running-wheel activity. Furthermore, when animals gain weight, there is a tendency for their activity to decrease (Duda & Bolles, 1963), which can account for the resultant similarity in activity between the ETOH and water groups.

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