Evidence of Preference for a High-Concentration Sucrose Solution in Alcoholic Men

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Objective: The purpose of this study was to test in humans the finding from animal studies indicating an association between preference for more concentrated sweet solutions and excessive alcohol drinking. Method: The hedonic response to five different concentrations of sucrose solution was evaluated in 20 detoxified alcoholic and 37 nonalcoholic Caucasian men. All subjects repetitively tasted solutions with 0.05, 0.10, 0.21, 0.42, and 0.83 M sucrose concentrations and rated themselves on two scales measuring the intensity of sweetness and the likability of the solutions. Results: A bimodal distribution of responses to the sweet solutions occurred in the nonalcoholic comparison group, with peaks at 0.05 M and 0.42 M. In the alcoholic group, 65% of the subjects preferred the highest sucrose concentration (0.83 M), compared with only 16% of the nonalcoholic group. Conclusions: The results of this exploratory study support the hypothesis suggesting a positive association between the preference for stronger sweet solutions and alcohol dependence.

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Animal studies show a positive association between the consumption of sweet solutions and subsequent alcohol intake by both mice (1) and rats (2, 3). The high intake of sweet solutions might even predict a latent motivation to drink alcohol that may be transformed into actual alcohol intake only after extended exposure to alcohol (4). Recently, it was shown that the propensities to consume alcohol and to consume sweets may be regulated by the same gene(s) (5).

The high consumption of sweet solutions by alcohol-preferring animals has been attributed to two major characteristics. One is a tendency to consume sweet solutions far beyond the limits of normal daily fluid intake (4, 6); the other is the preference for more concentrated sweet solutions (3).

The purpose of the present study was to test for an association between preference for more concentrated sweet solutions and alcohol dependence in a comparison of human alcoholic and nonalcoholic subjects.

METHOD

The total study group consisted of 57 Caucasian men. The comparison group (N=37) consisted of men who had never been diagnosed as alcoholic (mean age=38.8 years, SD=11.3). The alcoholic subjects (N=20) (mean age=40.1 years, SD=10.1) received a DSM-III-R diagnosis of alcohol dependence based, in part, on information from the Structured Clinical Interview for DSM-III-R (SCID) (7). They had been detoxified from alcohol for at least 28 days. No alcoholic subject had evidence of substantial or serious medical illness, including cirrhosis and endocrinopathy. At the time of testing, several subjects exhibited mild elevations in serum γ-glutamyltransferase, ALT, or AST, compatible with a history of recent heavy drinking. None of the subjects received any medications for at least 5 days before the study. After a complete description of the study to the subjects, written informed consent was obtained.

To estimate each subject's response to sucrose, five concentrations of sucrose solution (0.05, 0.10, 0.21, 0.42, and 0.83 M) were presented five times in a random order (for comparison, Coca-Cola Classic is a 0.33 M sugar solution). Each subject was instructed to sip the solution, swish it around in his mouth, and spit it out. He was then asked to rinse his mouth with distilled water and to proceed to the next solution.

Each subject was asked to rate the intensity of the sweet taste on an analog scale, one extreme of which was labeled "not sweet at all" and the other labeled "extremely sweet." The subject was then asked to rate each solution's pleasurableness, answering the question, "How much do you like the taste?"; the two poles of this analog scale were "disliked very much" and "liked very much" (for details see reference 8).

The preferences for sweetness in the nonalcoholic subject group and the alcoholic group were compared by Fisher's exact test.

RESULTS

Both the alcoholic and the comparison groups were able to discriminate effectively between the different concentrations of sucrose, generating appropriate dose-response curves. In the comparison group, a bimodal distribution of responses to the sweet solutions occurred: 49% (N=18) of these subjects preferred low su-

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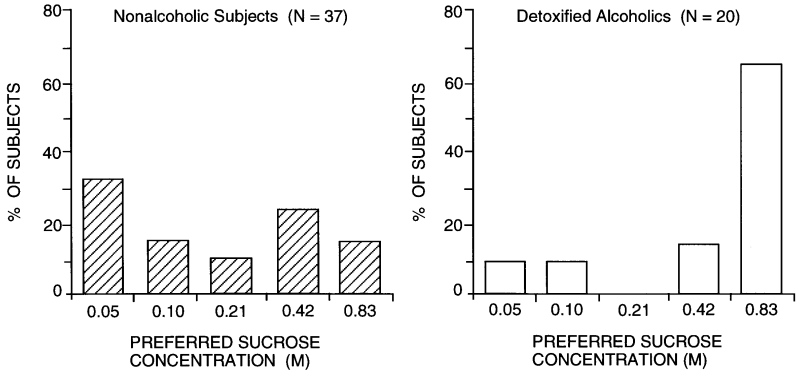
FIGURE 1. Preferences of Nonalcoholic Subjects and Detoxified Alcoholic Subjects for Solutions of Five Different Sucrose Concentrations



crose concentrations (0.05 and 0.10 M; "sweet dislikers"), and 41% (N=15) preferred high sucrose concentrations (0.42 and 0.83 M; "sweet likers") (figure 1). Among the alcoholics, the proportion of sweet dislikers was lower (20%, N=4) and the proportion of sweet likers was higher (80%, N=16) (figure 1) in comparison with the nonalcoholic subjects (p=0.03 and p=0.004, respectively, Fisher's exact test). Sixty-five percent (N= 13) of the alcoholics preferred the highest (0.83 M) sucrose concentration, compared with 16% (N=6) of the nonalcoholic group (p=0.0003, Fisher's exact test).

DISCUSSION

As with animal studies, a significant majority (80%) of the alcoholic patients in our study group were sweet likers, preferring the higher sucrose concentrations. Furthermore, unlike the sweet likers in the comparison group, who had a peak preference for the 0.42 M sucrose solution, the sweet-liking alcoholics preferred the highest offered sucrose concentration (0.83 M). This observation supports the hypothesis of Sinclair et al. (3) suggesting an association between preference for stronger sweet solutions and the propensity for excessive alcohol intake. The fact that 16% of the comparison group preferred the highest concentration of sweet solution suggests, not surprisingly, that preference for sweetness, in and of itself, is not always an indicator of alcoholism. Nevertheless, our finding suggests that sweet liking may identify a vulnerability to alcoholism that is manifestly expressed when associated with other factors such as, for example, personality traits. Further study is needed to test whether the selective pleasurable response to very strong sucrose concentrations is a general phenomenon among alcoholics or indicates a particular clinical subtype of alcoholism. It will also be necessary to determine whether the preference for stronger sweet solutions is a factor predisposing to alcoholism or is a consequence of heavy drinking that has altered taste sensitivity. Testing high-risk and low-risk populations would be one strategy for examining this issue.

The association between sweet perception/consumption and alcohol intake may be determined by a common mechanism mediating the rewarding properties of both sweets and ethanol, such as the brain opioid system. The literature suggests that sweets stimulate the endogenous opioid system in animals and humans by inducing a release of β endorphin (9, 10) and by increasing the binding affinity for opioids (11). Similarly, activation of the opioid system is known to be involved in the regulation of alcohol intake (12).

In summary, preference for stronger sweet solutions may represent a marker of alterations in brain systems that mediate rewarding responses to a variety of hedonic stimuli including sucrose and alcohol.

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